

Soil Survey of Howard County.

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DESCRIPTION OF THE AREA.

Howard County lies 96 miles north of Indianapolis and is situated in the central part of Indiana. It is bounded on the north by Cass and Miami, on the east by Grant, on the south by Tipton and Clinton, and on the west by Clinton and Carroll counties. It comprises an area of $295\frac{1}{2}$ square miles, or 189,120 acres. It is approximately a rectangle 27 miles east and west by 11 miles north and south.

The surface is level to rolling. The rolling land lies in a connected district, forming a strip from two to four miles on each side of the large stream that extends almost the entire length of the county. At Phlox, a small country village in the southeast part of the county, the width of the undulating area is no more than a mile, and from this place it gradually widens to two miles at Greentown; while at Kokomo the rolling land of Little Wild Cat Creek extends to that of the principal stream, making the entire area almost seven miles wide. The width increases on going westward by the addition of new streams and new tributaries with their accompanying rolling areas, until the entire distance north and south is greater than that of the county. Thus the county is divided by this wedge into three regions, that one lying to the north being broad flats and very low swells, presenting great similarity to prairie topography, except about Cassville, where a small stream flows out of the county. Fully seven square miles in that vicinity are steeply rolling and hilly.

The southern division has a topography similar to the northern district, but it lies in detached areas east of Hemlock, southeast of Kokomo, and south and east of Russiaville. The surface about Fairfield is very gently undulating, and the extent of broad, flat areas of dark colored soil is very limited.

The northern and southern division contain the prized "corn lands" of Howard County. The soil is black, loose and often mucky, lying in low, broad flats interpolated by very gentle, dark gray swells.

The part of the county lying in and about Russiaville and New

London shows the work of erosion greater than any other. The steep slopes, gullies and deep, narrow ravines are evidences of the great work that it is able to do.

Reclamation becomes a serious and difficult task. The rougher portions are left to the ravages of weathering, to become covered by shrubs, trees and native grasses, or are planted in orchards and small fruit that are proving good investments. Large tracts of blue grass pastures cover many of the slopes that are too steep for the cultivation of tillage crops.

POPULATION.

The number of people in Howard County has steadily increased since 1890. The movement has been a continuous flocking of the laboring class to the large factory center at Kokomo. Every township has decreased in population with the exception of Center. The increase in Center Township is due to the growth of Kokomo city.

TABLE OF POPULATION ESTIMATES.

	1914.	1910.	1900.	1890.
Center Township, including Kokomo.....	22,500	19,600	12,796	10,388
Kokomo city	20,000	17,010	10,609	8,261
Clay Township	1,000	1,050	1,268	1,466
Ervin Township	1,690	1,706	2,055	2,169
Harrison Township	950	958	1,067	1,110
Alta	50	.....	.....	.....
West Middleton	200	.....	.....	.....
Honey Creek Township	1,130	1,137	1,240	1,210
Russiaville	500	.....	.....	.....
Howard Township	1,050	1,084	1,323	1,324
Cassville	50	.....	.....	.....
Jackson Township	900	909	1,197	1,370
Sycamore	70	.....	.....	.....
Liberty Township	2,700	2,843	3,219	2,432
Greentown	1,100	1,166	1,289	721
Pleona	40	.....	.....	.....
Monroe Township	950	959	1,052	1,135
New London	250	.....	.....	.....
Taylor Township	1,800	1,832	1,919	2,090
Center	350	.....	.....	.....
Hemlock	150	.....	.....	.....
Fairfield	60	.....	.....	.....
Union Township	1,040	1,099	1,439	1,492
Jerome	45	.....	.....	.....
West Liberty	30	.....	.....	.....
Phlox	65	.....	.....	.....
Howard County	35,810	33,177	28,575	26,186

EARLY HISTORY.

Howard County was organized in 1844. For three years it was known as Richardville County in memory of the Miami Indian Chief, Richardville.

The county was formed wholly out of the Miami Indian Reserve. Erwin, Monroe and Honey Creek townships were part of the seven-mile strip sold off of the west side of the reserve and given by the government to the State of Indiana to use the proceeds of the sale of these lands for the completion of the Wabash and Erie Canal. After Indiana had sold this strip, Erwin and Monroe townships had been annexed to Carroll County, which had been organized in 1828, and Honey Creek had been annexed to Clinton County, which had been organized about 1830. The remainder of the county was formed from the final sale of the "Reserve" in 1840. The county was covered with forests of giant poplar, walnut, ash, oak and maple. The first settlements were made along the streams, where water power was used in turning the mills and saws.

In 1847 the name was changed by an act of the Legislature to Howard.

KOKOMO.

The location of early Kokomo was donated by Daniel Foster, and at that time the swampy lands were rated at only \$2.00 per acre. This donation forms the heart of the city of Kokomo as it is today. Large, three, five and seven-story buildings cover the lots, and splendid paved streets cover the early muddy roadways.

The development of Kokomo dates from 1866, when the first successful gas well was drilled. This caused a flock of various classes of men to Kokomo. The first came for exploitation and drilling; the speculator, for investment in land; and the manufacturer for the utilization of the cheap fuel. From that time on, Kokomo has been a manufacturing city of wide reputation. The recent exhibition staged at the city parks affirms, without doubt, that the manufactured products stand high in the estimation of the consumers.

The following is a complete list of the factories, many of which are among the best known establishments of their sort throughout the State:

Apperson Auto Company.

Armstrong-Landon Milling Company.

Bornique Glass Company.

Buck Handle Company.
 Central Closet Manufacturing Company.
 Central Indiana Fence and Wire Company.
 Chandler Machine Company.
 Cloverleaf Creamery Company.
 Globe Stove Range Company.
 Great Western Pottery Company.
 Haynes Auto Company.
 Jenkins Glass Company.
 Knerr Board and Paper Company.
 Kokomo Bale Tie Company.
 Kokomo Brass Works.
 Kokomo Canning Company.
 Kokomo Hoop and Lumber Company.
 Kokomo Nail and Brad Company.
 Kokomo Paper Company.
 Kokomo Rubber Company.
 Kokomo Sanitary Manufacturing Company.
 Kokomo Sanitary Milk and Ice Cream Company.
 Kokomo Steel and Wire Company.
 Kokomo Stone Company.
 Kokomo Trunk Company.
 J. M. Leach Brick Company.
 National Mitten Company.
 Opalescent Glass Company.
 Pittsburg Plate Glass Company.
 Rockford Bit Company.
 Sailors Packing Company.
 Superior Machine Tool Company.
 Ulrich Manufacturing Company.
 Worth Wire Works.

The school system of Kokomo is one of the best in central Indiana. The completion of the high school building in 1915 will give ample facilities for the higher subjects of the public school work. A new grade building was completed in 1914 in the north part of the city. The several grade buildings are conveniently located in various parts of the city and are known locally by the following names: Central, Willard, Lincoln, Columbia, Meridian, Palmer, Washington, Douglas and St. Francis. Kokomo has some of the largest church buildings in northern Indiana. The splendid stone or brick structures add much to the beauty of the city.

The Kokomo City Park, lying just beyond the corporation limits, on the southwest, is a beautiful place, with streams, ponds, springs, artesian wells, drives, flower and zoological gardens. A part is improved especially for children, and another for games and entertainments. The city golf links and tennis courts lie adjacent.

The Kokomo, Marion and Western Traction Company owns and operates the street railways.

Continuous public improvements are being made, and many new additions have been plotted and added to the city within the last few years. Many people of moderate means have found that Kokomo property is a good investment and that the city is a desirable place to live.

Passenger and shipping facilities over the railways are all that could be desired.

GREENTOWN.

Greentown is eight miles east of Kokomo and is connected with it by the main line of the Cloverleaf and the Kokomo, Marion and Western Traction. It has hourly passenger service over the Traction Company's lines, both to the east and west. It has a population of about 1,100. The decrease is due to the shifting of the business that was formerly done at Greentown to the city of Kokomo.

In 1914 the first brick street was laid.

A new graded school building was constructed in 1913, and facilities were added to give instruction in the vocational courses.

The Traction Company furnishes electric service for street and home lighting.

Other industries are: An ice factory, public water works, canning factory, grain elevator and flour mills. Greentown has a bank and several good retail stores and shops.

One mile west and one-half mile north of Greentown is one of the remaining gas pumping stations. A few houses have been built near, for the employes. The pumps are constantly in motion, but the gas pressure is so very low that the company may discontinue most any time.

PLEVNA.

Plevna is a small village four miles north of Greentown. It was an early trading post and furnished many supplies to the people of the vicinity before the roads were improved, and travel had assumed its modern aspect. It has a population of about forty.

SYCAMORE.

Sycamore is one mile north and two miles west of Greentown. It is a railroad village and furnishes a market for the products of a portion of the best farming land in the county. A grain elevator and general store are the principal mercantile establishments.

The town is electrically lighted by the I. E. L. and R. R. Co.

JEROME.

Jerome is an old trading center, founded in 1847. It is one and one-half miles east, and two miles south of Greentown. An old dam across Wild Cat Creek marks the place of an early "grist mill" and saw mill. The buildings are mostly of the early styles and many are now empty. A few shops and retail stores constitute its commercial life.

WEST LIBERTY.

West Liberty is three and one-half miles east, and three and one-half miles south of Greentown. At present it is a cluster of a little over a dozen houses, including a small retail store. In 1849 a water mill was built near this place, which was of great service to the early settlers. After the beginning of the clearing of the land, the stream became so low that the mill had to be abandoned. The stream at present is intermittent and cannot be depended upon to furnish water for the stock that pasture along its banks.

PHLOX.

Phlox is another early trade center developed for the convenience of the people. At present there is a population of about sixty-five. It has two churches and a school building. The retail stores furnish the people ready access for provisional supplies.

HEMLOCK.

Hemlock is a small railroad town lying on the west edge of a fine farming district. It furnishes a good market for the farm products, over the Pittsburg, Cincinnati, Chicago and St. Louis Railroad. It is six miles southeast of Kokomo. Its business industries can be listed as: Grain elevator, coal yards, and general mercantile shops. It has a population of about one hundred and fifty.

CENTER.

Center is five miles southeast of Kokomo on the Pittsburg, Cincinnati, Chicago and St. Louis Railroad. Many people who live here are retired farmers who prefer a small town for a home.

A few stores and shops make up its retail portion. A grain elevator offers accommodations to the farmers for shipping of the corn, wheat and oats. The farmland about Center is gently rolling and the Miami series predominates.

FAIRFIELD.

The Union Traction Company of Indiana and the Lake Erie and Western Railway pass through this village. Many of its people do the majority of their shopping at Kokomo because of the hourly service offered by the electric company.

The industries of Fairfield include a grain elevator, machine shops and retail stores.

This town was laid out in 1849 by John Stephen in anticipation of the building of the railroad from Indianapolis to Peru.

It has a population of approximately sixty. Most of its people are owners of and laborers on the farms.

CASSVILLE.

Cassville is four miles north of Kokomo. The prospects of the building of what is now the L. E. & W. Railroad gave impetus to its early growth.

A grain elevator and a few retail stores form the list of its business enterprises.

A splendid country home with aquarium and park is located at Cassville.

ALTO.

Alto is one mile west and three and one-half miles south of Kokomo, on the banks of Little Wild Cat Creek. It is an old trading post that was not favored with a railroad. A cluster of two dozen houses occupied by retired farmers and farm laborers makes up its population. A single store and shop are its only business enterprises.

The local church is a live institution. A new school building was completed in 1914.

Electricity is furnished by the I. E. L. and R. R. Co.

WEST MIDDLETON.

West Middleton is a small town located five and one-half miles southwest of Kokomo. The Kokomo, Marion and Western Traction Company gives hourly service over its lines through this place to Kokomo, or to Frankfort, in Clinton County. One of the officials of the company has a beautiful country home near here, locally known as "Sunny Brook Farm".

West Middleton has a new addition plotted, intended to be sold to those who desire to live in a country town and take advantage of the electric service in going to and from their business interests elsewhere.

The school system is in good condition, though the building is not fully modern.

It has electric lighting service from the I. E. L. and R. R. Company.

RUSSIAVILLE.

Russiaville is eight miles southwest of Kokomo. The K. M. & W., or Indiana Electric Light and Railway Company's lines, and the Cloverleaf pass through it.

The Howard County fair grounds are located here. The Fair Association is a live institution, and racing forms the chief annual attraction. The building of the electric line has stimulated permanent building and public improvement. Many people with business interest elsewhere make their home at Russiaville. The electric service for the town is furnished by the I. E. L. and R. R. Company. The town has its own public water system. The streets are heavily macadamized.

NEW LONDON.

New London is one and one-half miles north of Russiaville. It is one of the oldest settlements of Howard County. Its early industries were a water-power flour mill, and sawmill. The stream is not large enough now, throughout the year, to give such services.

There is a splendid graded school building here that was constructed only a few years ago, and ample stable room is furnished for the horses of the students who take advantage of the high school courses.

The retail stores and shops are the principal business enterprises.

The electric service for lighting is furnished by the Indiana Electric Light and Railway Company.

Other Commercial Enterprises.—Approximately one and one-half miles west of New London is located a large tile factory. All sizes of tile and various kinds of porous brick are made from the clay beds near by. The clay beds are under the Miami type of soil, which is the predominant one in this locality. Nearly all of the output is used by local consumers.

Four and one-half miles east of Kokomo on the Toledo, St. Louis and Western Railroad (Cloverleaf) is a large elevator and a few houses. This place is called Vermont, and is one of the large grain shipping stations in eastern Howard County. The old trading station of Vermont was a short distance south and east of the present location. After the construction of the railroad the retail business was moved elsewhere, and the grain elevator erected near the railway took the name of the old settlement.

TRANSPORTATION.

The Early Roads.—The first state road located in the county was the Burlington and Marion. The report on this was made to the commission in June, 1845. The road was one and one-half miles in Carroll County, twenty-nine and one-fourth miles in Richardville (Howard) County, and eleven miles in Grant County. This was a winding road, changing its course sixty-four times in crossing Howard County. In passing through Kokomo it enters at the west end of Sycamore street and passes out at the east end of this street.

The second road was built in 1845 and was known as the Kokomo, Michigantown road. It began at the southwest corner of the square and ran south on Buckeye street to the Wild Cat Bluffs, thence southwesterly to the north banks of Wild Cat Creek, crossing at the rapids and zigzagging back and forth, finally reaching Michigantown.

The third was the Peru and Canton (Tipton) state road, and the fourth the Logansport state road.

The first gravel roads were toll roads. The Kokomo and New London road was the first under the toll law. It was built in 1867—ten miles long, and cost \$27,000. It passed through Alto, West Middleton and New London.

The Kokomo-Greentown road was built in 1867. It extended from Kokomo running along the north side of Wild Cat Creek through old Vermont to Greentown and thence to Jerome.

The Petes Run gravel road, built in 1869, left Kokomo at West Jefferson street and forms the principal thoroughfare to the west-

ern part of the county. The Sycamore street pike begins at the west end of Sycamore street and runs west along Wild Cat Creek for ten miles.

The Deer Creek road runs north to the Miami County line. The Albright runs south on Home avenue to one mile east of Fairfield. These were completed in 1878.

With these early improved highways Kokomo soon became the center of the commercial life of the county. Road after road has since been improved in the county, so that only a few miles of the six hundred, remain unpaved with gravel or stone.

Lake Erie and Western Railroad.—This road was one of the first to be completed, and was constructed under the name of the Indianapolis and Peru Railway. It crosses the county from north to south, passing through Cassville, Kokomo and Fairfield. Cassville and Fairfield (Oakford) were laid out in anticipation of the building of the railroad. Excellent local passenger service is furnished by the company, and the Indianapolis market is made easy of access.

Pittsburgh, Cincinnati, Chicago and Indianapolis.—The line of this railway company passes through the towns of Kokomo, Center and Hemlock. It makes the Chicago markets available to local shippers. The passenger service over this line is splendid, especially the through trains. This company also gives passenger service over the Lake Erie and Western Railroad from Kokomo to Indianapolis.

The Toledo, St. Louis and Western.—This line, better known as the "Cloverleaf" has more mileage in Howard County than any other. It is the main line of this company from St. Louis to Toledo. The through passenger service is excellent, and the local trains make all stops in the towns through which the line passes. In Howard County the towns along this road are, from west to east: Russiaville, West Middleton, Kokomo, Vermont, Greentown and Sycamore.

Union Traction Company of Indiana.—This electric railway parallels the Lake Erie and Western railroad throughout its entire extent in the county, passing through Cassville, Kokomo and Fairfield. At Kokomo a branch of the electric company parallels the Pittsburgh, Cincinnati, Chicago and St. Louis Railway leading to Logansport. Hourly passenger service is given over the electric line in both directions during the day. The passenger cars carry express. Daily freight service is given between Indianapolis, Logansport and Peru.

Indiana Electric Light and Railway Company.—This company's line passes through Russiaville, West Middleton, Kokomo, Greentown and Sycamore. It parallels the Cloverleaf on the north side of the railroad from Russiaville to West Middleton. One-half mile west of West Middleton, at the "Sunny Brook Farm" the electric car passes under the railroad and from thence it parallels the latter on the south side to Kokomo. From Kokomo to Greentown the electric railway follows the township line, and from Greentown to the Howard County line the Clover Leaf is paralleled, first on the south side as far as Sycamore, then on the north side to the county line.

This company, also known as the Kokomo, Marion and Western, gives hourly passenger service from Frankfort to Marion. The company furnishes the electric power to the following towns and cities in Howard County: Sycamore, Greentown, Kokomo, Alto, West Middleton, Russiaville and New London. Numerous electric cables run to farm communities and give them the accommodations of light and power that are available within a corporation.

AGRICULTURAL NOTES.

Howard County is an agricultural county and produces in abundance wheat, oats, corn, potatoes, rye and hay. Corn is the leading crop. The deep black soil and the abundant rainfall during the growing season is the right combination for a splendid yield. The various grasses furnish abundant hay and pasture. The rolling lands along the streams are excellent grazing areas, and the live stock industry is in most cases limited to that district.

In the pioneer days hard wood forest covered almost the entire county. Native timbers and lumber were used in all buildings and fencing. The oak, poplar, walnut, maple and hickory are almost gone. Only a few small wood lots mark the places where once stood the great forests. The high prices of native timber has compelled the use of pine and cheaper materials. Local sawmills are gone and with them the revenue formerly obtained by lumber shipping. And today there is little waste land on the farms where some years ago much of it was unused.

Howard County has over 95 per cent. of its area in farms. In 1900 there were 2,680 and this number has decreased to 2,461 in 1910 and is still decreasing. The farms are becoming larger and the country population less dense. The greatest number of farms contain from 50 to 100 acres, there being 770. This is the usual

size of the average farm. Only one in the county is over 500 acres, and ten less than three acres.

The crop reports for 1910 show the following interesting data:

Corn	acres, 60,158.....	bushels, 3,115,338
Oats	acres, 22,776.....	bushels, 782,924
Wheat	acres, 23,355.....	bushels, 424,458
Barley	acres, 16.....	bushels, 430
Rye	acres, 296.....	bushels, 4,950
Clover seed		bushels, 371
Potatoes	acres, 884.....	bushels, 94,609
Timothy	acres, 9,634.....	tons, 14,210
Clover	acres, 1,471.....	tons, 1,791

CLIMATE, DRAINAGE AND CROP NOTES.

Table of Climatological Changes, for a Period of Sixteen Years.

MONTHS.	Mean Monthly Precipitation.	Mean Temperature Fahr'ht°	Maximum Temperature F.°	Minimum Temperature F.°	Average Depth of Snow, Inches.	Average Number of Rainy Days.	Average Date of Killing Frost.	Earliest and Latest Killing Frost.
January.....	2.6	27.1	68	-17	7.2	9		
February.....	2.03	25.4	65	-20	7.6	9		
March.....	3.28	40.1	84	-1	5.2	11	Last	
April.....	3.2	50.9	92	17	0.5	10	in spring	
May.....	4.1	62.7	97	29	Trace.	11	April 26.	Latest
June.....	3.99	70.8	101	37		9		June 7.
July.....	3.39	74.9	104	41		9		
August.....	3.25	72.3	101	40		7		
September.....	2.55	66.1	98	30	Trace.	7	First in	Earliest
October.....	2.09	63.1	88	18	Trace.	6	autumn	September
November.....	2.96	40.2	75	4	1.3	8	October 1.	14.
December.....	2.41	30.8	64	-9	4.6	9		
Annual...	35.85	50.9	104	-20	26.4	105		

The recording station at Kokomo is 840 feet above sea level.

The growing season from the average time of killing frost in the spring to the average time of killing frost in the fall is ample for the maturing and harvesting of the staple crops of corn, wheat and oats.

The distribution of the precipitation during the growing season is a vital factor in crop production.

The definiteness of the time of the seeding of corn is governed by the variability of the season and moisture changes. The first or second week in May is the usual time, though later seeding often brings good returns.

Winter wheat is sown from the sixth to the fifteenth of September; however, during a late fall, wheat sown during the last few weeks in September or the first week in October will get sufficient growth to withstand the freezes. In either case a killing

frost should visit the wheat land before the sprouts appear above the ground. This would prevent the injury to the growing wheat that is usually done by the noxious insects.

Vetch or some other legume should be sown on the land after the corn is "laid by" in the spring and plowed under as a green manure during the preparation of the seed bed.

Oats are usually sown during the early spring months, as soon as the freeze is out of the ground and the soil becomes sufficiently dry to till. The oats harvest follows the wheat harvest in close succession during the month of July.

DRAINAGE.

The natural surface drainage is good. Wild Cat Creek flows through the entire county from the east to the west. On the south side, Kokomo, Little Wild Cat and Honey creeks flow into Wild Cat Creek and afford outlets for drains for the southern part of the county. On the north side, Lilly, Pipe and Deer Creek drain and afford outlets for drains in that part.

In the early days, Howard County was wet and swampy. The natural drainage depressions were obstructed by fallen timbers and decaying vegetation. These were difficult to keep open so that adequate drainage for crop tillage was possible. Later, large public drain ditches were constructed. They meandered through the farms and rendered not a little land waste. Many of them have since had one or more rows of tile laid within and covered up, so that farm operations are now carried on over them. The soil is black and deep, and the most fertile types in the county. There are no marshy lands so low that they cannot be drained, and, in fact, the county may be said to be without untillable marshes or bogs.

The major part of this black, fertile soil lies in Clay, Howard, Liberty, Jackson and Taylor townships, and is classed as the Clyde and Muck lands.

Drainage has yet another purpose than to remove the surplus surface water. We notice on close examination of the soils practically everywhere they are mottled, at a depth of ten to thirty inches, by brown and whitish colorations. The soil that is in the best of condition will not show such characteristics. It is an indication that the soil has become "heavy", compact, and as a result, "sour". Tiling is an important factor in obtaining the needful soil ventilation, in bringing the oxygen into the ground

and giving the soil the proper temperature. The more drains placed in the "sour" land, with the idea of aeration in mind, the more productive and fertile the old soils will become. It is not necessary that a tile drain carry water. Much of the upland, though it has a rolling topography, would be benefited by permitting the passage of air through the drains and assist in removing the coldness and compactness of the soil and bring about that condition of deep porosity and pulverization, which enables the plant roots to pierce deeper and reach abundant food before the acidity of the soil kills the growing root tips, and a steady growth would then be insured during the summer months, notwithstanding the presence of insufficient rain.

VETCH AND ITS USES.

Vetch is attracting considerable attention, yet its value as a legume is practically unknown to the majority of people. It has been known and cultivated in Indiana for the last decade. The "Sand or Winter Vetch" has become more popular, as its value as a soiling, green-manuring crop is learned. It is especially recommended for poor soils, upon which it thrives luxuriantly. It improves the soil by adding nitrogen and makes phosphoric and potassium compounds available.

As a soil restorer, vetch has few equals. It prevents washing and leaching during the winter months, and makes a rank growth for plowing under in the early spring.

The winter vetch will grow on almost any kind of soil that has reasonably good drainage. No soil should be left uncovered during the winter, and the writer knows of no other plant that can be used at such a great advantage as this one. As a fertilizer, the Department of Agriculture at Washington, D. C., has compared its value as equal to putting into the ground twenty to forty dollars' worth of commercial fertilizer per acre. It is surprising in what a short time the poorest lands can be restored and made to produce crops equal to the best.

Vetch can be sown after every wheat crop and in every maturing corn crop. Then it gives a good coating of green manure to be turned under for the next season. The land, if well drained, will not become sour, nor does it become dry or stunt the growing plants, on turning under the heavy foliage of the vetch.

It makes an excellent hay when grown with rye or wheat to hold it up, but its rank growth and vining habits unfit it for a hay

crop alone. Its greatest value is as a pasture, and green manure crop in adding humus to the soil.

The vetch belongs to the same family as the cow-pea and clover, and it resembles the former in growth and general appearance. It grows about three feet high ordinarily, although occasionally on good soil it reaches a height of five or six feet. The greatest drawback at present is the scarcity and high price of the seed, but a small plot will furnish enough seed for several acres. The harvesting of the seed is done in the same way as the harvesting of the cow-pea.

The time has come when a legume must be grown for the benefit of the soil as well as for commercial purposes, and we believe vetch to be one of the greatest soil builders ever discovered. Its roots are the home of nitrogen-gathering bacteria, which bring the nitrogen from the air into the soil and make it into compounds which the growing plants can use. It has the advantage in being grown upon the soil at times when the soil would otherwise be bare. Seeing that it is necessary to add plant food to the soil if we continue to expect crop returns, we are forced to consider the fertility of the soil as a bank account that must be replenished in order that our drafts will be honored, or else we shall find ourselves facing the proposition of reclaiming "abandoned farms".

RYE AND ITS USES TO RESTORE FERTILITY.

Within the central area of Indiana there is perhaps no one who is at all acquainted with the growing farm crops, that does not know the characteristic features of a matured plant of rye. This plant is one of the family of grasses that lives for only two years, and during that period brings within the soil in which it grows abundance of nitrogen and nitrogenous compounds. In utilizing the rye plant for soil fertilization, this is one of the chief factors that makes it profitable.

The seeding of rye is done in the month of September about the same time as the seeding of wheat. The growth obtained in the fall and in the spring, until the time for breaking the ground for corn, should be left untouched and turned under in order to add humus to the soil. The ventilation and friability will be increased also.

By some who have used this method of soil rejuvenation, it is said that if the growth of rye is plowed under about May 1st, the money value added to the soil is from ten to thirty dollars per acre, at an expense of three dollars an acre. Others say that the

increased fertility is equal to that produced by the addition of forty loads of good stable manure; yet even if this estimate is considerably too high, we are convinced that the easy method and small expense of producing a growth of rye over large areas would make it a desirable plant for soiling purposes. In addition to this advantage, it is grown at the time of year when much of the soil is unoccupied by other crops.

In order to gain the best results from the rye, for soil fertilization, we believe that the entire crop should be turned under at the spring plowing; yet, in many cases, the occupant of the farm, if the farm is small, would find that he could not care for his stock throughout the period of production of the tillage crop that followed the rye, so we must not fail to emphasize the pasturing advantage of rye in the fall. In all such cases, however, the advantage of the compromise should be made in favor of the soil, so that the hopes of maintaining it in a better state of productivity for an indefinite number of years would be insured.

ARTESIAN WELLS.

Originally, artesian wells and flowing wells were synonymous; but any notably deep well is now called artesian. The artesian well, which does not flow, does not differ greatly from common wells in principle, while the flowing well is really a gushing spring, the opening of which is made by man.

Flowing wells depend upon certain relations of rock structure, water supply, and elevation. Generally speaking, a flowing well is possible in any place underlain by any considerable bed of porous rock, if this rock outcrops at a sufficiently higher level in a region of adequate rainfall and is covered by a layer or bed of impervious, or relatively impervious rock. The porous rock is the reservoir of the flowing wells. It is usually a stratum of sand or sandstone, and of gravel or conglomerate. The impervious layer must be unbroken and continuous except at the point of catchment, or the place of the outcropping of the water-bearing stratum. This maintains the water head and gives the pressure to the flow from the well.

Many of the deep gas wells of Howard County have passed through conditions favorable to flowing wells. The light, gaseous substance that lay upon the surface of the underground water, that was below the impervious strata, has been removed and now the same openings have become flowing wells of good water.

The majority of the wells that are flowing at present are located in the vicinity of Kokomo and Fairfield. From some, the water is similar to that of the common wells and is quite useful for farm purposes, while from others the mineral constituents are so abundant as to give the water a pungent odor and disagreeable taste. Iron sulphide, hydrogen sulphide, calcium carbonate, calcium sulphate, magnesium sulphate, and included quantities of natural gas are the principal compounds that give that "peculiar" taste to the artesian water of Howard County.

One well-known and often visited flowing well is located in the city park of Kokomo. The water here is strongly sulphuretted, has a pungent odor, and to many people it is a curiosity that has but little fascination.

The continuous flow from the many wells in Howard County has without doubt lessened the water head. The pressure is much less now than it was several years ago, and it may be only a few years until the wells will cease to flow.

LIME AND ITS USES.

Lime has long been recognized as a valuable agent in promoting crop production. The earliest forms used as fertilizers were marls, gathered from their native deposits and applied to the soil by sowing broadcast upon the plowed surface and harrowing in. If lime is desired as a fertilizer it makes little difference what sort is used—marl, ground limestone, slacked lime well mixed with dirt or some other filler. Burned lime or caustic lime should not be used until well air or water slacked. Then it would serve the purpose better by using a good filler.

Lime, with a little phosphate or phosphoric acid, usually causes a complete change in the poorest of soils, so that for a time cultivated crops do well. The acidity of the soil is neutralized by the application of lime, and the crop immediately following will be better than the previous ones; yet the depletion of the soil by the chemical action that results does not approve of the continuation of such applications. It is well to use the lime for neutralization of the acid and then further enrichment should be done by growing some legume, as cow-peas, soy-beans, clover, alfalfa, winter vetch or hungarian.

The lime has a tendency to decompose the humus and liberates and reduces the amount of plant food stored in the soil. Because of this property, it can be used to an advantage upon peaty deposits in order to hasten the process of decay.

In choosing a limestone for use in liming soils, the magnesium limestone should be rejected. A method of differentiating it from the purer limestone may be made by noting the fact that it is heavier than the calcium carbonate and will not effervesce vigorously when cold hydrochloric (muriatic) acid is dropped upon its surface, while the effervescence of pure calcium carbonate (limestone) is extremely vigorous.

As a general rule, from one-half to one and one-half tons of lime per acre is sufficient to change the acid soils, but heavier application of two tons would be advisable in case of very acid soils, which are to be seeded to grass and left for several years in pasture or meadow. The practice of applying small amounts of lime at somewhat frequent intervals is being generally accepted as preferable to the use of large amounts at rare intervals. The frequency of the application depends upon the character of the soil, the number of years involved in crop rotation, the kind of plants grown for cropping, and the kind grown for soiling purposes.

Limestone in the form of ground limestone or marl can be applied in the spring or at any season of the year, but autumn is always the safest time to apply the slacked caustic lime. It is generally considered best to apply the lime to the soil immediately after plowing and then harrow in thoroughly. Lime which is already slacked may be spread upon the soil directly from wagons or by the use of a lime spreader or fertilizer attachment. Lime alone should not be depended upon to maintain the fertility of the soil, for all of the ingredients which plants need must be present in the soil to insure a profitable crop production and consequently must be returned by the addition of humus, as suggested elsewhere in this paper.

The commercial fertilizers may be used as a stimulant to the soil, in starting a crop, but we believe that its constant use with all crops must never be resorted to under any condition. A much better method of restoring worn soils is by growing nitrogenous plants as vetch, rye and cow-peas and giving back to the soil the entire growth between the harvesting and seeding of tillage crops.

SOILS.

MIAMI SERIES.

<i>Types:</i>	<i>Area.</i>
Miami Silt Loam.....	131 square miles.
Miami Silt Loam—Flat Phase.....	36 square miles.
Miami Gravel Loam.....	2½ square miles.
Miami Loam	2 square miles.

The soils of the Miami series are the most predominant of all the types, and include the various divisions given in the table above. Throughout the county they form the clay uplands or "white lands", as they are often locally known. Everywhere the surface stratum consists of a very fine silt or silty clay varying in depth from a few inches to a foot or more. This thin layer is continuous over the Clyde types also, but is not so distinguishable. On steeper slopes along the streams it has suffered partial, and in places complete erosion, exposing the underlying till.

In structure the upper stratum consists of very fine soil particles and feels like flour. There is little doubt but that this is a wind deposit similar to loess, yet during the process of tillage it has become intermixed with the coarser layer below, so that a great deal of the original characteristics have been lost. In this condition we classify it as a silt loam. The percentage of clay is usually low save where the layer is so thin that the clay from the stratum below has been mingled with it. Usually it does not become sticky when wet or hard when dry, except in those districts affected greatly in composition by the clay.

All the Miami types were once heavily forested, but the topographical condition did not usually permit the accumulation of very great quantities of organic matter. The little humus that existed in the soil from the decay of vegetation has, on the more rolling surface, been leached out and washed away, leaving the soil whiter, less friable, more compact and more difficult to till. The mineral foods are dissolved and carried away, making the problem of restoration troublesome and expensive.

MIAMI SILT LOAM.

The Miami silt loam is the dominant type throughout the county, covering about forty-five per cent. of the total area. It has a rolling topography and within the vicinity of the streams it often is quite hilly. The stream erosion in Howard County is young, geologically speaking, which is shown by the steep bluffs of the upland that form the banks of Wild Cat and its tributaries, and the approximate levelness of the surface that extends back from these bluffs. The hilly district is narrow, seldom more than a mile wide on either side of the larger creek. Even though many small level areas lie in this division, the majority is given over to meadow and pasture land, except on small farms.

The cultivated soil is light gray to brownish gray. Any clods upon the surface are easily crumbled to a fine powder. The fine

structure and texture makes under drainage inadequate. Artificial drainage of numerous tiled ditches paralleling each other only a few rods apart would remove the stagnant water that causes the sour, "soggy" condition, and would assist in a more thorough ventilation and oxidation of the soil, which would make the mineral food available and bring about a more favorable temperature in the soil for plant growth.

The removal of the excess of ground water would make earlier cultivation possible and give a better control over the moisture conditions in the time of drouth, as well as in times of excessive rainfall. Liming the land is an immediate remedy for "sour soils"; however, it does not measurably increase the amount of mineral plant food.

The hay produced upon this type of soil is mostly a mixture of timothy and clover. Timothy alone is very hard upon the soil. A field that has been in timothy meadow for several years and then prepared for a crop of corn, will grow stunted, yellowish-green plants, showing that some of the important foods are not present; but a field where a good sod of clover and timothy is plowed under usually produces a reasonably good tillage crop. The clover tends to balance the condition that the timothy alone brings out, and leaves the soil almost the same condition as it was when the meadow was seeded.

At present this soil cannot be called a first-class "corn soil", but in its virgin state it produced excellent crops of either corn, wheat or oats. Its fertility can be restored and its life prolonged indefinitely by a carefully selected system of crop rotation. A process of crop management that is used by a few farmers of the county is given here, and the results that they have obtained are surely sufficient argument in its favor.

The first year in the process of soil restoration of the Miami type, which will serve for practically any of the others, were as follows: A crop of sugar corn was put in after the soil had been thoroughly ditched, was marketed at the local factory. The ground was kept clean and well cultivated.

Early in August vetch or rye was sown between the rows of corn, vetch being preferred. Under no circumstances were the stalks pastured. They were left for plowing under with the vetch, which was done about the first of May with a double disc plow. The vetch was not pastured in the spring.

The field was planted in corn and the yield was amazingly increased. Vetch was sown in the corn as before and left to be

plowed under for the next tillage crop. The second corn crop, produced in this method of rotation, was followed by a crop of wheat and clover, then back to corn, as before.

With this method, soils that formerly produced from ten to twenty-five bushels of corn are increased in fertility so that in two seasons they produce from fifty to one hundred bushels.

If alfalfa is wished to be sown, the vetch can be plowed under before it ripens, and thus keep cultivating the ground until about the middle of July or the first of August, at which time it can be seeded. The vetch will inoculate the soil and a good stand of alfalfa is insured. The first clippings of the alfalfa, when it is about five or six inches high, are left on the ground, and if the growth is considerable before winter it is clipped again.

The greater the amount of organic matter introduced, the greater will be its ability to retain moisture. There should be no fear that the introduction of such large amounts of green vegetation would make the soil sour; on the contrary, a remarkable degree of fertility has resulted from all the experiments, and a fertile soil is not a sour soil.

The value of this type varies greatly, as to the care it has received in cultivation and the condition of its improvements. In 1913 it was selling for \$50 to \$75 an acre in the worn condition, and \$100 to \$150 for the better improved. The price varies also as to its location, being valued at \$200 to \$250 per acre wherever it lay within a few miles of Kokomo. Truck farming and dairying are the principal occupations of the people in such a district, and the products are marketed in that city.

MECHANICAL ANALYSIS MIAMI SILT LOAM.

(S. $\frac{1}{2}$ Sec. 34, Howard Tp.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
2.03	2.21	Fine gravel, per cent.
2.07	1.20	Coarse sand, per cent.
15.01	4.37	Medium sand, per cent.
13.37	8.32	Fine sand, per cent.
12.27	11.14	Very fine sand, per cent.
55.25	72.76	Silt and clay, per cent.

THE SUBSOIL OF THE MIAMI SILT LOAM.

Below and in contact to the silty stratum, the subsoil contains a great deal of loess, but as the depth increases the clay content becomes higher. Its structure is more compact, its drainage is poor, and its mottled coloration usually noticeable. At a depth of

thirty inches and quite often at a depth of four feet, the compactness of the subsoil becomes a distinguishing character. It is not absolutely impervious to water, however, the movement is so slow that most people who are acquainted with this condition call the layer "hard pan". At varying depths the "hard pan" underlies the major portion of the Miami silt loam, and in places it lies under the Clyde types, usually at a greater depth.

When this partially impervious stratum is deeper than five or six feet, good soil drainage is obtained in the more open subsoil above, naturally and artificially, but whenever it comes near the surface—that is, within eight to twenty inches—the possibility of obtaining good drainage even by tiling is difficult. Only very small areas were noticed, where surface drainage and shallow tile ditches were removing the excess of water. The surface soils in such localities are always "sour", the crops are generally unproductive and the plants seldom reach their customary size.

The process described in a preceding paper for soil reclamation will bring about a marked degree in the increase in fertility within a period of two years that will pay the expense of the necessary labor and time.

MIAMI SILT-LOAM, FLAT PHASE.

In the localities where the Clyde series is the predominant type, we find very gently raised portions that are of a lighter color. Upon these slight elevations are, in most cases, built the farm homes. They are high enough to cause good surface drainage and make excellent locations for buildings and orchards. The surrounding types are dark colored and make the lighter types conspicuous.

This type, the Miami Silt Loam, Flat Phase, is designated on the maps by vertical broken lines. The larger districts in which it lies are in Clay, Howard, Jackson and Taylor townships.

The soil is from eight to fourteen inches deep and of a dark gray to a light gray color, grading to a dark brown near the boundaries, where it grades into the brownish black or black soils of the Clyde type. The clay constituent is not so great as in the Miami Silt Loam, yet wherever a condition of poor farming exists, the flat phase assumes a compact nature similar to other Miami types. A high per cent. of humus gives the darker color to this Miami type and makes it loose, friable and easy to till. Underdrainage should be used to increase the aeration and control the temperature conditions. Water moves rather slowly through the heavy clay

loam subsoil. At the depth of twenty to thirty inches the subsoil is locally heavy and mottled, friable and gravelly; thus the natural underdrainage is assisted.

The "hard pan", spoken of under subsoil of the Miami Silt Loam, was frequently found to lie within thirty inches of the surface.

The crops of corn, wheat, oats, clover and forage do excellently well, wherever the proper care of replacing the plant food in the soil has been done by either clover or some other legume. The corn produces from thirty-five to fifty bushels per acre, according to the care given to the soil before and during cultivation. This range of production may seem rather low to owners of the land; however, there are very few fields of thirty to forty acres that consist wholly of this type. The Clyde soils that lie adjacent have a greater yield and raise the average of the field.

When the fertility is increased by the application of refuse from the stables or by turning under repeatedly legume crops of clover, or vetch, the yield in all crops is greater accordingly. Under such conditions corn seldom produces less than fifty bushels per acre and often produces seventy-five bushels. Wheat produces from twenty to thirty-five bushels per acre under the same conditions.

The price of this land is influenced by the types among which it lies, being from \$150 to \$200 per acre. Its location in reference to the city of Kokomo causes some variation in the sale price also.

MECHANICAL ANALYSIS MIAMI SILT LOAM, FLAT PHASE.

(Center of East $\frac{1}{2}$ Sec. 23; 1 mile north of Sycamore.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
2.47	1.73	Fine gravel, per cent.
2.86	1.94	Coarse sand, per cent.
14.20	8.92	Medium sand, per cent.
17.03	8.22	Fine sand, per cent.
10.11	14.61	Very fine sand, per cent.
53.33	64.48	Silt and clay, per cent.

MIAMI GRAVEL LOAM.

The Miami gravel loam includes such a small area that its influence on crop production is very small. The two and one-half square miles of this type lies in narrow strips along the streams, especially along Wild Cat, west of Kokomo. The soil is of a light brown to a yellowish gravel-loam containing considerable silt. The

silt is derived from the surface wash of the Miami silt loam that lies adjacent.

The gravel loam lies upon the slopes and terrace formations. It is derived from the weathering of the glacial till and is a heavier soil than the other Miami types, containing more clay and less humus.

Cultivation is often difficult where the gravel is too close to the surface and the topography is rough and broken.

Native forests once covered this type of soil, but since it has been cleared, blue grass pastures protect it from washing and leaching. In places where cultivation is followed and tillage crops are raised, extensive gullyng becomes a characteristic feature.

The Miami gravel loam is splendidly adapted to fruit raising. Orchards grow well upon the slopes too steep for advantageous tilling. Clover makes the best orchard sod where it is possible to get it started. It will lessen the surface wash and be a benefit to the soil.

Where large areas are owned by one farmer, pasturing is perhaps the most profitable, especially on the hilly portions. In such districts dairying has become a profitable industry. This is, indeed, true when it lies within a few miles of Kokomo.

The price of the land ranges from \$40 to \$70 per acre, according to its condition and the amount of surface gullyng. Plots that have received little or no care sell for a price less than stated above.

MECHANICAL ANALYSIS MIAMI GRAVEL LOAM.

(S. E. $\frac{1}{4}$ of N. E. $\frac{1}{4}$ Sec.-3, Center Tp.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
3.52	2.10	Fine gravel, per cent.
3.84	3.46	Coarse sand, per cent.
11.61	7.41	Medium sand, per cent.
18.63	8.94	Fine sand, per cent.
20.73	16.43	Very fine sand, per cent.
41.67	61.66	Silt and clay, per cent.

MIAMI LOAM.

The Miami loam is a variable type since it is influenced by the adjacent types. It lies upon the terraces of the stream, but it is not derived from alluvial deposits. The surface wash from the Miami silt loam and the Miami gravel loam is left upon the Miami loam phase and make a silty loam near those types. Uniformity in texture and structure is not to be expected. The deep subsoil is

usually of a coarse texture and permits the free passage of ground water. The upper subsoil is generally a silty loam, moderately compact, but possesses good capillarity. Brownish or yellowish tints are the characteristic colors of this substratum. The lower part of the subsoil is brown or reddish brown, caused by the relatively high degree of oxidation of the iron contents that characterizes the upper part of the glacial till. The subsoil is usually high in moisture and the soil becomes seldom dry, due to the rise of the water by capillary attraction. It is this property, combined with good drainage, that enables this type to withstand seasonal extremes so well.

This phase is more silty than the Miami gravel loam and not so easily differentiated from the other silty phase of the Miami series. Quite often fine sand is found in appreciable amounts through the soil locally. Usually this type averages twelve inches deep and is a fine, sandy loam, but on inclinations the finer portion is removed by surface wash, leaving the coarser gravelly subsoil so near exposed that it eventually becomes mixed with the remaining surface soil. On account of the open structure of the soil and the shallow depth at which the glacial till lies, the entire soil type has good drainage and aeration. The small amount of Miami loam in Howard County lies in separated areas along the principal stream. The area being so small and of such unimportance in considering the whole county, it can hardly be said that it has a commercial value of its own. In regard to its position among other types it has a market value of \$60 to \$80 per acre. The adjacent types are either rolling or hilly and mostly used for pasture lands, and this is a determining factor in the use of the Miami loam. This soil itself has a high agricultural value and can be made into excellent farming land, because of its good conditions of underground water and the loose texture and structure of the surface, yet the isolated areas are so small that very little attention has ever been given to the improvement of them.

MECHANICAL ANALYSIS MIAMI LOAM.

(N. E. $\frac{1}{4}$ of S. E. $\frac{1}{4}$ Sec. 34, Howard Tp.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
8.47	1.31	Fine gravel, per cent.
4.03	1.02	Coarse sand, per cent.
18.96	7.46	Medium sand, per cent.
23.41	3.51	Fine sand, per cent.
13.04	11.01	Very fine sand, per cent.
32.08	75.69	Silt and clay, per cent.

CLYDE SERIES.

Clyde Silt Loam.....	.55 square miles.
Clyde Loam .....	.2½ square miles.

In the type list as given in the legend, the next series is the Clyde. This includes the black lands in Clay, Howard, Jackson and Taylor, where large tracts are found, as well as the small irregular patches scattered promiscuously throughout the county.

The topography is generally flat to very gently rolling, and occupies the depressions that exist upon the upland.

CLYDE SILT LOAM.

The Clyde silt loam or Clyde silty clay loam, as it is sometimes known, is a black, silty clay loam. The per cent. of organic matter is high and imparts the dark brown to black color to this soil. It is friable and has a loose structure, especially in areas that are well tilled.

The subsoil is usually of a lighter color and containing a greater amount of clay. Quite often the clay constituent is so great that the subsoil is very compact, and apparently impervious, yet dry portions show a remarked tendency to break up in small cubical particles that even present within themselves a porous condition. At greater depth of twenty to thirty inches the subsoil becomes mottled with white streaks and reddish-yellow iron stains. This, when wet, has a plastic, sticky nature, but its tenacity is lost as soon as the material becomes dry, and crumbles freely.

The Clyde silty clay loam that lies in narrow connected or isolated areas has similar subsoil to the Miami phases which surrounds them. The glacial drift lies at about three or four feet below the surface. The drift often contains beds of gravel that lie beneath the silty clay subsoil. These small areas contain less organic matter and are not so dark colored. As a rule they are chocolate brown to brownish black. Some of the strips of this type that lie in the depressions in the upland are seldom more than a few hundred feet across. The surface wash has in many such limited areas silted in until the productive quality and physical appearance are scarcely different from the upland phases. The majority of the smaller areas of the Clyde silt loam are in the southern and western part of the county. They are in depressions that often present a meandering appearance as if they had been old beds of small streams. It is not likely that a stream ever flowed for a very long period in the depressions, but more that they have been irreg-

ularly formed lakes that wound about the uplands and were filled with swamp plants and marsh grasses that grew up, fell down and decayed under water. The partial decay of the plants in that condition left the black carbon unoxidized, which even yet gives the color that to most people means a rich soil.

The larger areas, as are found in Jackson and Clay townships, have been old lake bogs. The color of the soil is very dark brown to black, and is usually several feet deep, lying upon the lighter subsoil. The organic material is very abundant, though we do not believe that the black, partially oxidized organic matter enriches the soil; we, however, believe that the condition of texture and structure brought about by its presence tends to lighten the otherwise heavy clay soil and make it better adapted to plant growth, and gives it its present great agricultural value.

The Clyde silty clay loam is the leading corn soil of the county. It yields from fifty to seventy-five bushels per acre and often eighty to ninety. Seasonal extremes of wet and dry conditions do not measurably affect this type that is well drained. The smaller areas do show some effect of a dry season, especially during the growing months.

Wheat yields from twenty to thirty bushels per acre on the Clyde soil and it withstands the freezing of winter with remarkable persistence on the well drained areas. Wet, "open" winters are very injurious to the winter wheat on the Clyde silt loam, more so than on the Miami phases. The open, loose structure admits water freely, and during the periods of freezing, the wheat plants are lifted out of the soil. A relatively dry season during the winter months, with a few inches of snow protection is generally followed by a good yield. Clover, timothy, and alfalfa do well on well drained areas of this type. Oats usually grow so rank that before harvest they lodge badly.

In preparing this soil for alfalfa, good drainage that would lower the water table to at least five or six feet is necessary. Then before the sowing of the alfalfa, a crop of some good legume should be raised upon the soil—winter vetch preferred. If this is grown and turned under in the spring before the seeding of the ground to alfalfa in July or August, there will be no need of further inoculation. Commercial fertilizers are seldom if ever used upon this soil, and a good system of crop rotation with some good legume, and a little addition of phosphate and lime will, as a rule procure the desired results.

The Clyde silt loam commands the highest price of any farm

land in the county, especially when the necessary drainage and improvements for cultivation have been made. There is very little that is not under cultivation, and that which is not, is able to be drained and improved. The present price varies from \$150 to \$200 per acre. The more desirably located farms are marketed at even a higher price.

The black soils that lie within a few miles of Kokomo are gardened and trucked. Tomatoes, sweet corn and peas are raised and delivered to the local canning factories. In this vicinity it is not unusual for land to sell for \$250 or \$275 per acre.

MECHANICAL ANALYSIS CLYDE SILTY CLAY LOAM.

(Center of W. $\frac{1}{2}$ of Sec. 25.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
.12	.02	Fine gravel, per cent.
.31	.06	Coarse sand, per cent.
.47	.27	Medium sand, per cent.
.08	1.21	Fine sand, per cent.
2.02	1.76	Very fine sand, per cent.
97.1	96.68	Silt and clay, per cent.

CLYDE LOAM.

The soil of the Clyde loam is a deep sandy loam containing a very high per cent. of organic matter. It varies in depth from ten to sixteen inches. When dry the surface is very loose, crumbling to fine particles and having a very dark gray to brownish-black color. The organic humus keeps the soil from packing or crusting. When it is wet the color is intensely black. In the region of this soil that lies in the central portion of Clay Township there are limited areas that contain a medium fine sand, mixed with the fine carbonaceous granules, so that the whole presents the appearance of being composed of very dark to black sand. It is loose to a depth of a foot or more, and yields readily, even to the shuffling by one's foot.

The upper subsoil contains much clay, and is usually a bluish-black in color. It is plastic when wet, and when it lies close to the surface and is struck by the breaking plow it yields only after heavy pulling. It is called "gumbo" by the farmers, and is quite often considered a worthless soil. It contains considerable sand, crumbles to small, hard granules often cubical, and apparently infertile. The "gumbo" area, when well drained, reacts to the application of stable manure. However, the strength of the fertilization seems to last for only one year or two at the most. The corn on

such soils sprouts and begins its growth in splendid condition, being of a very dark green color until reaches about six or eight inches high. Then the lower leaves begin to turn yellowish-green, the edges of them begin to roll and dry up completely. The stalk of corn grows very slowly, becomes a pale, yellowish-green, with the lower leaves dead and withered away. It may reach a height of four five feet, but the joints of the stalks are short and the tassel stunted, whitish and without much pollen. The stalks are easily blown awry and become crooked. A "shoot" appears, but it seldom if ever matures into a sound ear. The plant is easily pulled from the ground at any stage of its growth or after maturity. The "spike" roots are dead, being eaten off by some chemical. Only the surface roots are supporting the growth and weight of the plant. These prove insufficient, the plant is stunted and we have, what is well known as "chaffy" corn.

The improvement of this soil has been suggested by many different people to be brought about in many different ways, and it is the purpose here to give the experiences of people who have been endeavoring to make the soil yield more favorably to cultivation. This "gumbo" is what might be termed a "water-logged" soil. It is dead to plant life and contains a high percentage of various forms of alkali.

The process of reclamation is begun by a thorough tiling. In this case, it would mean that a large tile should be laid through the lower part of the area and tributaries leading from it to all parts. The smaller tile-drains should be only a few rods apart and at a depth not greater than twenty to twenty-four inches, in order to lie out of reach of the breaking plow, yet above the heavy blue clay stratum as much as possible. The drainage system would induce aeration and remove the stagnant ground water. The frequent rains would wash the soil free from the injurious chemicals that destroyed the roots, and it would be carried out by the drains.

Deep and frequent cultivation should be used when a tillage crop is raised. Organic substance should be introduced into the soil as soon as possible and in large amounts.

Winter vetch should be sown in the fall and plowed under in the spring as late as possible before the planting of corn. This should be repeated for several years. A coating of ground limestone flour, about three to four tons to the acre, and a quantity of commercial phosphoric acid or phosphate will in some cases be found a necessity, to supply those mineral plant foods and remove objectionable acid compounds in the soil. The benefit derived by

this method has been found paying to the investor and profitable to the soil. The fertility is increased, and quite often permanently, at least the former "gumbo" nature is destroyed and the soil becomes similar to the remaining portions of the Clyde loam.

There is little soil of this kind in the county, only a few acres here and there in isolated plots throughout the Clyde series. The value of this land ranges, after in a good condition, from \$125 to \$150 per acre, being influenced greatly by the surrounding Clyde silty clay loam.

MECHANICAL ANALYSIS CLYDE LOAM.

(S. $\frac{1}{2}$ of Sec. 22, Howard Tp.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
1.41	.05	Fine gravel, per cent.
3.36	4.10	Coarse sand, per cent.
15.41	18.62	Medium sand, per cent.
13.62	20.31	Fine sand, per cent.
11.98	19.49	Very fine sand, per cent.
64.22	37.43	Silt and clay, per cent.

GENESEE SERIES.

Genesee Sandy Loam	16 square miles.
Genesee Sand	1 square mile.
Genesee Loam	7 square miles.

The Genesee series of soils are all of alluvial or of partly alluvial derivation and lie next to the stream beds throughout their entire course. These soils along the smaller streams lie in very narrow strips and owe a great many of their characteristics to the surface wash from the upland types. West of Kokomo the bottom lands widen and maintain a reasonable width to the west county line. In this district the Genesee soils have a tillage value and the standard crops of corn, wheat and oats are raised, as well as a great many tracts being used in truck farming, producing, tomatoes, sugar corn, melons and peas.

GENESEE SANDY LOAM.

The Genesee sandy loam is a fine sandy loam of light brown to reddish brown color, and ranges from six to fourteen inches deep. The percent. of humus is usually low. The sand constituent makes tillage easy, and splendid seed beds can be prepared under almost any sort of weather conditions. The soil never packs or crusts after a heavy rain, though the soil particles are sufficiently small to retain ample ground water for tillage crops.

This soil is an ideal one for melon culture, and other truck crops that are adapted to loose, sandy soils do well.

The higher ridges often show effects of drouth, especially if the period of insufficient rainfall is prolonged.

The subsoil cannot be definitely separated from the soil stratum. The soil particles become coarser with depth and contain a considerable amount of very coarse sand and gravel. Natural drainage is generally sufficient only in the heavier silty areas.

The Genesee sandy loams occupy the first bottom along the streams and are composed of reworked glacial till and material of local origin. The occasional inundations assist in building up this type by spreading a layer of silt over the area.

The matter of cultivation is made more difficult by the reason of the overflows, as they act as carriers of weed seed, and the task of keeping the tillage crops clean becomes arduous.

The topography is generally level. The narrow areas east of Kokomo are gently rolling and they are used for pasture lands. Timothy does well either for pasture or for hay, since it is not so easily damaged by the overflows that bury it for a few hours.

MECHANICAL ANALYSIS GENESEE SANDY LOAM.

(Center of Sec. 4, in Harrison Tp.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
1.51	0.0	Fine gravel, per cent.
3.43	1.29	Coarse sand, per cent.
14.96	12.18	Medium sand, per cent.
19.17	19.18	Fine sand, per cent.
22.92	40.26	Very fine, per cent.
18.01	29.09	Silt and clay, per cent.

GENESEE SAND.

In the larger areas of the Genesee soils, there was differentiated a type of coarse to fine sand as the Genesee sand. It lies in the inner side of the meander of Wild Cat west of Kokomo. The entire type scarcely covers more than a square mile.

The surface is a sand deposited by the currents of the stream during freshets and quite often is not covered with vegetation. The wind shifts the sand in the unprotected area. Recent fresh water shells and organic remains shows the recency of the deposit.

The depth for two or three feet seldom changes in texture or structure, save that the clay that has been carried in suspension by the receding inundations has sunken into the sand and causes portions of it to become packed and sticky to the touch, when wet.

Gravel is found underlying this sand at varying depths of four to five feet, or the sand becomes so coarse that the movement of ground water is quite free.

The agricultural value of the sand deposits is practically nothing. The moisture conditions fluctuate with the amount of precipitation and the humus contents is so low that there is no real firmness to the type sufficient for seed germination and growth.

GENESEE LOAM.

Along the small tributaries the bottom lands are very narrow, ranging from one-twelfth to one-tenth mile wide. The streams are young and shallow, and any heavy rain raises them above the shallow bed over the first bottom and quite often the water spreads back to the Miami types. The silt carried from these freshets is deposited upon the first bottom and makes up the greater per cent. of the Genesee loam, making it a silty alluvial deposit.

This soil is eight to ten inches deep and of a light brown to a chocolate brown color. Throughout the soil there is much coarse gravel and even pebbles. The organic matter forms a low per cent. of composition. The sand and gravel makes the soil friable and easily tilled. Generally the drainage is poor and parts of the area are semi-swampy during a part of the year.

The subsoil is a heavy silt loam containing a high per cent. of sand and gravel near the base. It is mottled with whitish, black and reddish spots, showing that aeration and oxidation has been impeded by the excess of ground water and the variable compactness of the structure.

In areas that have sufficient drainage the soil is productive and yields good crops of corn and wheat. Clover and grass do well and make excellent pasture lands. The contiguousness of the ground water induces growth during the entire spring and summer season, and when pastures are short elsewhere these bottom areas furnish abundant feed.

The type produces from thirty to fifty bushels of corn per acre, to sixty or seventy on the better improved. In areas that are sufficiently large to command a separate market value, the price ranges from \$60 to \$80 per acre. Usually the selling price is governed by the adjacent types, since no farm includes more than a few acres of the Genesee loam.

MECHANICAL ANALYSIS GENESEE LOAM.

(Center of Sec. 16, in Taylor Tp.)

<i>Subsoil.</i>	<i>Soil.</i>	<i>Description.</i>
6.01	3.01	Fine gravel, per cent.
5.62	3.05	Coarse sand, per cent.
13.41	2.74	Medium sand, per cent.
14.93	10.93	Fine sand, per cent.
10.11	20.64	Very fine, per cent.
49.91	69.63	Silt and clay, per cent.

MEADOW.

The recent alluvial deposits along upper Wild Cat and along the small streams in the northwest part of the county have been mapped as meadow. This is a condition of a soil rather than a soil type, and may include more than one phase. These areas are narrow bottom lands that are frequently overflowed by the streams. The soil is a brown silty clay loam containing considerable "grit". As a rule it is wet, poorly drained and covered with coarse marsh grass. Some portions are drained sufficiently for cultivation. Corn makes a fairly good crop, yielding forty to fifty bushels per acre.

The small area of Clyde silt loam lies in the depressions that lead to the meadow land. Many of the short tributaries of the streams that drain the Clyde have cut narrow gullies and this washed material is the chief source of building up the low bottom lands where the water runs more sluggish.

There is not sufficient area of this land to give it an individual value; however, as a pasture land it has proven to be good, especially during the summer months of July and August when the rainfall is at a minimum.

MUCK AND PEAT.

Old peaty bogs that have been drained are the best examples of mucky land. The soil is black, woody and deep. It is loose, easily pulverized at any time of the year, whether wet or dry, except when frozen. Remains of old decayed tree-trunks, leaves, roots and smaller vegetation makes up the bulk of the soil. In places, no limit to depth was found or no change in the composition, save only that the surface contained a little more silt that washed from the surrounding soils. Where a subsoil lies within three or four feet of the surface it is principally a bluish-drab silty clay and has every appearance of the clays that form the bottom of the present-day swamps.

In Section 22 of Howard Township is an area of peaty muck that resembles peat more than muck. It is of a reddish-yellow soil that is almost wholly composed of decayed organic material. In quantities taken from the field, the woody structure of tree trunks was easily made out. The area is not yet under cultivation, even though it is fairly well drained and quite level. On this land were growing many ferns in clusters of more than a foot in diameter, and they reached a height of three to four feet. Even though the year 1914 was an extremely dry one, these plants grew luxuriantly without shade or without water, other than that obtained from the ground.

Other areas of muck lie in Clay and Jackson townships, but they are smaller areas and have been under cultivation for several years.

Muck land has a value ranging from \$150 to \$250 per acre. It is a splendid corn land, yielding from seventy to ninety bushels per acre. Wheat and oats do not do well. The soil is so loose that the wheat freezes out, and the oats grow so rank that they usually lodge.

No fertilizer has yet been used on this type; however, a good legume would be well to place in the circle of crop rotations in order to secure an indefinite fertility.

EXPLANATIONS AND DIRECTIONS FOR THE USE OF THE SOIL MAP.

The map has been prepared with especial care, so that all information can be used by anyone. And the following gives the method of getting the description of any tract of land in the county:

First, the farm must be located on a civil map, according to the part of the section in which it lies. Then one could find the same area on the Soil Map and trace a lead pencil around its approximate boundaries.

Let us choose the N. E. $\frac{1}{4}$ of the S. E. $\frac{1}{4}$ of Section 21, Range 4 East and Township 24 North. This forty acres lies $2\frac{1}{2}$ miles east and $\frac{1}{2}$ mile north of the northeast corner of Kokomo. The house stands on the northeast corner of the forty, being represented by a small square dot.

Now in applying the classification below to the areas marked

the same way, we find that the north edge of the forty is Miami Silt Loam, Flat Phase; south of this is a strip of Clyde Silt Loam, and next an area of Muck that resembles closely the Clyde Loam. South of this are small tracts of Clyde Silt Loam and Miami Silt Loam, Flat Phase, that would lie in the forty acres.

Now, having found the names of the types, the accompanying paper gives a detailed discussion of each, listed under soils.