

## Carroll County

---

### GENERAL DESCRIPTION OF THE AREA.

Carroll county is situated in the third tier northwest of Indianapolis, in the northwestern part of Indiana. It comprises an area of about 376 square miles, or 240,640 acres. It is bounded on the north by White and Cass counties, on the east by Cass and Howard, on the south by Clinton and Tippecanoe, and on the west by Tippecanoe and White and the Tippecanoe River. The general outline of the county is rectangular, being about 22 miles from north to south, by about 20 miles from east to west, but lacking in the northeast corner, an area of about 3x8 miles, and in the southwest corner, an area of about 4x9 miles. The county is traversed by the Wabash and Tippecanoe Rivers, by Deer Creek, Wild creek and their tributaries.

Carroll county was organized as a corporate body in 1828, following an act of the Indiana Legislature. It was named in memory of Charles Carroll, a signer of the Declaration of Independence. The county seat was established at Delphi on May 24, 1828. According to the 1910 census, the county had a population of 17,970, of which 263 were of white foreign birth. This is a decrease, since the 1900 census shows a population of 19,933 and the 1890 census, one of 20,021.

There are thirteen townships in Carroll county: Adams, Burlington, Carrollton, Clay, Deer Creek, Democrat, Jackson, Jefferson, Madison, Monroe, Rock Creek, Tippecanoe and Washington. Delphi is the largest town, with a population of 2,161 in (1910). It is centrally situated at the junction of the Wabash Railroad and the Chicago, Indianapolis, and Louisville branch of the Monon. The Fort Wayne and Northern Indiana Traction Line also passes through Delphi. The county seat has several prospering industries, among them being a canning factory, paper mill, machine-shop and wagon works. There are several limestone quarries and lime kilns, which produce excellent material for road building and agricultural purposes. A new courthouse of Bedford limestone is under construction at a cost of about \$175,000. These industries furnish employment for from 400 to 500 men. Other important towns are Flora (1,386), Burling-

ton (789), Camden (557), Cutler, Ockley, Rockfield, Bringham, Burrows and Yeoman. Besides these there are settlements at Patton, Sleeth, Pittsburg, Owaseo, Walker, Radnor, Koro, Darwin, Carroll, Fisher, Tecoma, Hopedale and Lockport.

Most of the produce of Carroll county goes to Chicago although Indianapolis and eastern markets get a part.

Carroll county ranks well as regards improved roads. There are in the county  $43\frac{7}{8}$  miles of stone or macadam roads, and  $378\frac{5}{8}$  miles of gravel roads, all in good repair. There are 59.01 miles of steam railroads operated in Carroll county by the C. I. and L. branch of the Monon, the Vandalia and the Wabash Railroad. The Fort Wayne and Northern Indiana Traction Company operates 15.62 miles of electric line in the county.

Most of the drainage of the area is accomplished by natural means, although there are some six or eight hundred miles of open and tile drains.

#### CLIMATE.

The climatic conditions in Carroll county are typical of north Central Indiana. The year is divided almost equally by the average dates of the first killing frost in the fall and the last in the spring. The frosts and cold weather are usually limited to the time between September 30th and May 3rd, but have been known to occur several weeks earlier and later than these dates.

According to the Weather Bureau data recorded at Delphi, the winter mean temperature is 26 degrees Fahrenheit, but there are often great and sudden changes of weather so the season becomes a series of cold waves and thaws, with an average snowfall of 20 inches. The recorded maximum temperature of 70 degrees and a minimum of 26 degrees for January shows what extremes may occur. Other seasons show equal variability. While the summer mean is 72 degrees, the temperature may go above 100 degrees or drop to 40 degrees.

The following weather bureau data was recorded at Delphi and applies equally well to the whole county:

NORMAL MONTHLY, SEASONAL AND ANNUAL TEMPERATURE AND  
PRECIPITATION AT DELPHI, IND.

Month.	Temperature.			Precipitation.			Snow.
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1895).	Total amount for the wettest year (1907).	Average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December.....	29.7	64	—12	2.49	4.88	5.53	4.2
January.....	25.1	70	—26	2.64	2.64	7.00	8.8
February.....	25.5	67	—24	2.34	0.90	0.32	7.4
Winter.....	26.8	70	—26	7.47	8.42	12.85	20.4
March.....	37.5	85	— 3	3.18	1.06	3.93	5.2
April.....	49.9	93	13	3.17	1.97	1.91	0.5
May.....	60.9	97	25	4.60	1.06	2.87	.0
Spring.....	49.4	97	— 3	10.95	4.09	8.71	5.7
June.....	70.7	99	37	4.40	1.42	5.50	0
July.....	74.4	104	41	3.74	2.68	6.43	0
August.....	71.7	100	37	3.03	2.69	3.86	0
Summer.....	72.3	104	37	11.17	6.79	15.79	0
September.....	65.0	100	25	2.91	2.81	3.94	0
October.....	51.9	91	18	2.09	0.76	1.31	.....
November.....	39.0	77	0	3.23	4.30	2.31	1.9
Fall.....	52.0	100	0	8.23	7.87	7.56	1.9
Year.....	50.1	104	—26	37.82	27.17	44.91	28.0

## AGRICULTURE.

The land in Carroll county was first farmed by white settlers about the year 1825. Forests, which at this time covered almost the whole of Indiana, furnished much valuable timber, and were bountifully supplied with game, both for food and for trade. In the early days the Wabash and Erie Canal facilitated the exportation of produce and encouraged trade. Saw mills were common and the timber was used for boat building, houses and barns, vehicles and plow-manufacturing. The western side of the county borders on the "Grand Prairie," which remained marshy and uncultivated until the fifties. The prairie was drained by means of dug and scraper ditches, and cattle grazing was soon the dominant industry, being supplanted later, however, by crops of corn and oats. Dredge-ditching has, in recent years, reclaimed much marshy land, insuring better and larger crops.

Carroll county now has 2,239 farms embraced in 227,000 acres—an average of 101.7 acres to the farm. The farm property of the county is valued at \$27,321,614, showing an increase of \$13,995,045 over 1900. The average value of land per acre is \$93.69, and increase of \$52.39 since 1900. Corn growing is the more widely practiced industry, although live stock feeding and other grain growing types of farming are important. Corn leads all others as regards acreage planted, there being 69,009 (3,339,118 bushels) acres of this crop according to the census of 1910. Wheat is second to corn with an acreage of 34,076 (626,845 bushels). Then comes oats with 21,545 acres or (610,793 bushels). Buckwheat and rye are of some importance, about 338 acres being devoted to these two crops.

These grain crops are disposed of in various ways. The corn and wheat crops are a source of cash when sold to elevators. Corn is also utilized for feeding work stock. Straw is sold in town or used for bedding. The wasteful practice of burning straw and stubble has practically ceased. The total value of cereal grown in Carroll county is \$2,560,628.

Hay is an important crop of this area. According to the 1910 census there were 17,982 acres (24,533 tons) of "hay and forage" grown in the county. Of this, about 2,067 acres is marsh hay. Timothy leads all other hays in acreage with a total of 9,527 acres (12802 tons). Three thousand six hundred and forty-seven acres are devoted to timothy and clover mixed, while 2,610 tons of clover were obtained from 2,423 acres when it was planted



alone. One hundred and sixteen acres of alfalfa yielded exactly two tons to the acre in 1909. Although not a general crop, by any means, the acreage of alfalfa has been increased in recent years. Millett, Hungarian grass and a few other wild, salt, or prairie grasses are grown to a noticeable extent.

Sufficient vegetables are grown for home use by farmers and gardeners. Irish potatoes are the most important "special crop," there being 84,559 bushels raised from 841 acres in 1909, almost 100 bushels to the acre.

There are about 96,987 fruit trees in the county, producing 70,098 bushels a year. Apples, peaches, pears, plums, and cherries are grown for local use, as are grapes, strawberries, blackberries, raspberries and nuts.

The total value of domestic animals on the farms in Carroll county in 1909 was \$2,245,767. There were 16,870 cattle, 10,854 horses, 516 mules, 57,204 hogs, and 11,793 sheep at this time.

Dairy products, poultry, and bees constitute an important item of farm income. In 1909 there was \$87,848 worth of poultry, 1,248 colonies of bees valued at \$3,275, and \$134,453 worth of dairy products sold.

The local distribution of crops in this area indicates that the farmers recognize the adaptability to crops of the soils in Carroll county. Corn is grown on all types of soil, but best results are obtained from the well-drained black lands of the prairie and the deep Wabash valley. Good crops of corn are produced on the reclaimed marshes. Oats is adapted to the same soils and conditions as corn, and does well on even wetter lands. The prairie is well suited to grain farming, although the productiveness could be increased by the feeding of some live stock. Wheat is confined almost entirely to the light-colored soils.

Rye is usually grown on poor, thin ground where other crops would not thrive. It is valuable as a protection to slopes which might wash. It is the logical crop for the sandy portions of the county. Rye, however, in the sandy soils, is being replaced by cowpeas.

Carroll county farms are, for the most part, well up-to-date, with good equipment and intelligent farming methods. Comfortable farm homes, with conveniences of town, with the addition of the R. F. D. and the automobile, has made living in the country much more agreeable than in the past. Adequate barns for stock, cribs and granaries for crops for home consumption, are provided. Improved farming implements constitute \$591,143 of the farm values in 1909.

The system of farming in this area is typical of the surrounding country. Part of the corn land is broken to an average depth of about six inches in the fall, and the remainder in the spring during April or May, according to the weather. The clods are disced and harrowed down to a good seed bed and most of the crop is planted in May, by means of machines with fertilizer attachment which applies commerical fertilizer. The crop is laid by in July, after from three to five cultivations.

In the preparation for oats, the soil is broken or possibly only disced and harrowed if the weather is wet in the spring. It is seeded by drills in March at the rate of one and one-half to two bushels per acre. The oats crop is harveted about the time that the corn is laid by. Threshing begins as soon as the straw is dry.

Wheat may be drilled between corn rows in the fall or sown on stubble ground which has been broken and finely pulverized by discing and harrowing. It is harvested just before oats and in the same manner.

The hay crops are sown on oat or wheat ground early in the spring and occupy the land after the nurse crop is removed.

The fields may be pastured in the fall, and the hay crop cut the following season. Timothy is usually allowed to stand several years until it becomes thin. When timothy and clover are sown together, the first crop is largely clover, but it dies out and leaves only timothy for succeeding crops. Clover alone is cut for hay in June, and for seed in the fall if the growth warrants.

The most common rotation on the prairie land is corn and oats or corn, corn, oats. On the "clay" lands, corn, wheat and clover are often successful combinations. The growth of legumes is a vital necessity. Other rotations include timothy in place of clover.

Farmers in Carroll county depend on their manure and the feeding of stock to build up their land, and they use comparatively small amounts of commercial fertilizer. In 1909, 153 farms spent an average of \$29.00 for commercial fertilizers.

It is advantageous to the farmers to feed to their livestock as much of their corn as possible, since corn marketed as pork or beef brings much better prices. The principal profits derived from the feeding of cattle lie in the gains made by hogs following them, and in the improvement of soil.

Each year some sheep are pastured on stubble and finished with a little grain. They gain in value quickly and at the same time are valuable to clean orchards, fence corners, etc., of weeds.

Poultry is almost clear profit to the farmer, since most of their food is gleaned from the field, barnyard or near the granary.

Dairy products, sufficient for home consumption with an excess for the markets, are another source of revenue, over \$90,000 having been realized from their sale during the year 1909.

During recent years farm labor has become a large item of expense. The census of 1910 reports that 1,150 Carroll county farmers spent \$159,711 in cash and \$49,531 in rent and board, for farm labor in 1909. About \$1.00 per day, with board and room, is the average amount paid to farm hands. Work is sometimes exchanged between the farmers, especially during harvest times.

The following table indicates a few of the changes which have taken place in Carroll county during the last decade:

	1910	1900	% Increase.	% Increase.
Value of all farm property . . . . .	\$27,321,614	\$13,326,569	105.0	.....
Average value of land per acre. . . . .	\$93.69	\$41.3	57.0	.....
Farms operated by tenants. . . . .	857	832	.03	.....
Farms operated by owners . . . . .	1,366	1,558	.....	12.3
Population. . . . .	17,970	19,953	.....	9.9

### SOILS.

*Definition.* Soils consist of the broken and decomposed portions of rocks mixed with more or less organic matter in various stages of decomposition. To the agriculturist it is that portion of the earth's surface into which the roots of plants may penetrate and obtain nourishment.

*Soil and Subsoil.* No sharp distinction between the soil and subsoil has yet been generally accepted. A change of color from the darker surface layer (due to the presence of humus or ferric hydroxide) to the lighter subsoil layer has generally been regarded as the basis of separation, but this distinction breaks down in the arid region where the humus content is scanty or is wholly lacking.

Of the distinction to be noted between the soil and subsoil, the most important is the presence of humus in the former. The

depth to which humus is found varies to some extent with the kind of plant growth. It is often found to extend in notable quantities to the lower limit of the growth of the roots of annual plants. Variation in the root habit of plants, therefore, causes a variation in the depth of the soil as determined by the humus content. Fertilization tends to change the structure, chemical composition and degree of compactness of the soil. In swamps and marshes the humus tint may reach to such depths as to invalidate the distinction between soil and subsoil based on humus content.

Since the humus is porous and has a high water absorbing and retaining capacity, and since the surface layer may be composed of much finer particles, it is clear that the water content of the soil and subsoil may vary both in time of drought and in wet weather. Aeration is also more perfect in the surface soil, thus bringing about many chemical changes and tending to make available the necessary plant food.

Another difference between soil and subsoil is the clay content. Usually the subsoil is more clayey than the surface soil, making the former more impervious and more retentive of moisture and plant food than the latter. The subsoil should tend to accumulate a larger potential supply of plant food because the finer particles are the richest in plant food. This is due to the tendency of the descending water to carry the finer particles with it into the subsoil. This tendency to deplete the soil is counteracted between rains when the ascending capillary water brings the soluble salts towards the surface where they are left upon the evaporation of the water. Thus the soil is periodically enriched. In an arid region this causes such a large accumulation of salts as to be injurious to the plants.

The subsoil is usually more calcareous than the upper soil and this difference is so great in some cases that the surface soil may require an application of lime while the subsoil still contains a large amount of lime. This accumulation of lime in the subsoil may be so great as to produce a solid subsoil condition or hardpan. It is noteworthy that the subsoil is in a less weathered condition, consisting more or less of unweathered particles of rock. This condition is due largely to the absence of humus and the associated carbonic acid and other acids. In the arid region, this difference between the soil and subsoil largely disappears. This is due, partly, to the fact that the plant remains oxidized so rapidly that they are in some cases completely "burned up," and partly to the fact that the plant roots penetrate so deeply into the subsoil in quest of water and plant food that the soil is only slightly enriched.

*Effect of Clay.* It takes only a very small percent of clay to materially add to the tilth or give open texture to a soil largely composed of sand because of its binding properties. This is well shown in the following table from Hilgard:

Very fine soil.....	0.5% to 3% clay.
Ordinary sandy loam....	3% to 10% "
Sandy loams.....	10% to 15% "
Clay loams.....	15% to 25% "
Clay soils.....	25% to 35% "
Heavy clay soils.....	35% to 45% "

While pure clay does not contain any thing of value as a food for the growing plant yet it does contain within its mass the necessary minerals in easily soluble form. Among these are the highly important substances potash, lime, soda, etc.

The importance of the clay as a plant food carrier is shown in the following table given by Bowman:

RELATION OF SOLUBLE MATTER TO SOIL CLASS

Conventional Name	Clay.	Finest Silt.	Fine Silt.	Medium Silt.	Coarse Silt.
Per cent in Soil	21.64%	23.56%	12.58%	13.67%	13.11%
Diameter of Particles.....	?	mm. .005 = .011	mm. .013 = .016	mm. .002 = .027	mm. .033 = .038
Constituents....	%	%	%	%	%
Insoluble residue.....	15.96	73.17	87.96	94.13	96.52
Soluble silica....	33.10	9.95	4.27	2.35	.....
Potash (K <sub>2</sub> O)....	1.47	0.53	0.29	0.12	.....
Soda (Na <sub>2</sub> O)....	1.70	0.24	0.28	0.21	.....
Lime (Ca O)....	0.09	0.13	0.18	0.09	.....
Magnesia (Mg O).....	1.33	0.46	0.26	0.10	.....
Iron sesquioxide (Fe <sub>2</sub> O <sub>3</sub> ).....	18.76	4.76	2.34	1.03	.....
Manganese (Mn O <sub>2</sub> ).....	0.30	0.00	0.00	0.00	.....
Alumina (Al <sub>2</sub> O <sub>3</sub> )	18.19	4.32	2.64	1.21	.....
Phosphoric acid (P <sub>2</sub> O <sub>5</sub> ).....	0.18	0.11	0.03	0.02	.....
Sulphuric acid (S O <sub>3</sub> ).....	0.06	0.02	0.03	0.03	.....
Volatile matter...	9.00	5.61	1.72	0.92	.....
Totals.....	100.14	99.30	100.00	100.21	.....
Total soluble matter...	75.18	20.52	10.32	5.16	.....



*Physical Properties.* In former years, it was thought that the chemical analysis of a soil was of the most importance, but since the subject has been better understood, the physical side has gained in emphasis. A factor of prime importance to the agriculturist is the absorbing capacity of a soil and its ability to retain and furnish moisture to the growing plant as needed. In fact the ability of a soil to furnish an adequate amount of water to the growing crop is of far more importance than its chemical ingredients. Pure sand holds water poorly so that sand ordinarily is a dry soil. At the other extreme, clay holds moisture very tenaciously, so that a pure clay soil is usually soggy and apt to be very wet. A mixture of the two, forming a loam is not subject to either objection and is an ideal soil. A loam in the humid region always has a very luxuriant growth of vegetation where it has an adequate supply of water.

One of the effects of the presence of humus is to produce granules, forming a mellow, easily worked soil. Where a soil is cultivated without adding to the supply of humus, the soil becomes more compact and run together, producing decreasing crops, and reducing the moisture retaining capacity. Cultivation loosens the soil promoting aeration, and increases the amount of available plant food.

*Chemical Properties.* A chemical analysis of a soil will show the amounts of the different plant foods such as nitrogen, phosphorous, potassium, calcium, etc.; but the difficulty is that it does not give even a hint as to the form in which the elements occur in the soil. The analysis shows correctly the total organic carbon, but as a rule, this represents about one-half the organic matter; so that 20,000 pounds of organic carbon in the upper six inches of an acre represents 20 tons of organic matter. But this 20 tons is largely in the form of old organic residues that have accumulated during the centuries because they were so resistant to decay; so 2 tons of clover plowed under as a green manure would have greater power to liberate plant food for a growing crop than all the 20 tons of old residue of old organic remains. This is true of other chemicals as well.

*Liberation of plant food.* Ground limestone and decaying organic matter are the principle materials which the farmer can utilize most profitably to bring about the liberation of plant food. The ground limestone corrects the acidity of the soil and thus encouraged not only the nitrogen gathering bacteria which lives



in the nodules found on the roots of the growing plants of clovers, cow-peas, alfalfa and other leguminous plants, but also the nitrifying bacteria in the soil which have the power to make into plant food the insoluble and unavailable organic products. At the same time the products of this decomposition also make available the insoluble minerals found in the soil, such as the potassium and magnesium as well as the insoluble limestones and phosphates which can be applied by the agriculturist in a very low priced form.

One of the chief sources of loss of organic matter in the corn belt is the burning of corn stalks. If farmers would only realize the loss they incur they certainly would discontinue the practice. Probably no form of organic matter acts to form good tilth better than the plowing under of corn stalks. It is true they decay slowly but that only prolongs the desired conditions of the soil. The nitrogen in a ton of stalks is  $1\frac{1}{2}$  times that of a ton of manure, while a ton of dry stalks when ultimately incorporated with the soil is equal to four times that amount of average farm manure, but when they are burned the humus making element and nitrogen are both gone and lost to the soil.

*Upland Soils.* The upland soils of Carroll County are mapped in 3 series; namely: Clyde, Miami and Shelby types, and in addition, the miscellaneous type known as muck. These types are all due to a difference in soil content and color and to surface conditions resulting from erosion. The Miami and Clyde series occur side by side, perhaps coming from a similar glacial till but those areas having better natural drainage and smaller amount of organic remains for humus become the light colored clay land or Miami series while the depressed areas with poor drainage or no drainage in swamp or marsh conditions, become the black or brown areas known as the Clyde series; or where there was a great abundance of partly decomposed organic matter they became muck. While some of the Miami series near the streams which was badly dissected by valley and gully heads on account of the erosive work of running water is placed in the Shelby series, from the standpoint of physical composition, it is identical with the Miami series.

*Alluvial Soils.* The alluvial soils of Carroll county are the sediments deposited in the stream valleys by flood waters. The sediments came from the uplands adjacent to the valleys of the different streams, and a certain kind of upland gave rise to a

definite type of alluvial soil. The darker colored soils are classed in the Wabash series, while the lighter colored alluvial soil is placed in the Genesee series. The Fox series consists of terrace soils, deposited perhaps by the glacial waters which were a great deal more abundant than the waters of the present time. The meadow land has not been mapped but much of the land along the smaller streams, classed as Genesee, belongs in this type.

#### MIAMI SILT LOAM.

*Characteristics.* The following characteristics of the Miami silt loam are given by the publications of the United States Bureau of Soils:

"The Miami silt loam consists normally of a dark gray or light brown, friable, silty clay loam having an average depth of about 10 inches. The surface soil is usually somewhat deeper over level or depressed areas and shallower on steep slopes and over the crests of ridges. When moist the surface color is almost a uniformly grayish or yellowish brown, but when thoroughly dry it becomes a light ashy gray.

"The immediate subsoil to a depth varying from 20 to 30 inches is a yellow or yellowish-brown silty clay loam. This is underlain by a yellowish brown, or brown gritty or sandy clay, usually containing an appreciable amount of coarse sand, gravel and boulders. As a rule this stony material consists chiefly of limestone, although crystalline erratics of various kinds form a part of the coarse grained material."

The different soil areas mapped as the Miami silt loam will vary from the above type description in one or more particulars but will agree in the main. The Miami silt loam has a level to undulating or rolling surface and occurs throughout the county, with the Clyde series occurring in the depressions. It forms about half of the total area of the county and is also known as the Miami silty clay loam.

*Origin.* The Miami silt loam in common with other members of the Miami series is due to the glaciation of the region in which it occurs. The retreating ice left the till with a very uneven surface composed of numerous ridges and valleys or depressions. During the process of erosion and weathering since that time, the ridges have tended to become lower, thus filling the depressions with the organic remains and the finer sediments from the higher land. The better natural drainage and lack of a large amount of

humus would produce a light colored soil with a high clay and silt content. This condition is well shown along the larger water courses where the surplus water rapidly drains away producing a wide strip of the Miami series on either side without any or with very few areas of the Clyde series even in the largest depressions.

*Drainage.* The fine texture and uniform structure causes ground water to move slowly and makes natural drainage inadequate in the Miami silt loam. This condition can be remedied by the use of tile drainage but care should be exercised by not using too small tile as lateral lines. The drains not only remove the surplus water in the wet weather thus lowering the ground water table, but also help to aerate the soil in the dry weather. In most cultivated soils, the pore space is from 25 to 50% of the volume and this is the maximum water capacity or saturation capacity. The amount of this space occupied by water for the maximum development of most plants is from 40 to 50% of the pore space which leaves one half or more to be occupied by air. The presence of a large amount of oxygen in the soil is essential to the best growth of the plant crops as well as the liberation of the necessary plant food.

*Tilth.* It is well to bear in mind that aside from fertility, drainage, and tillage, one of the main factors of a good soil is good physical condition or tilth. The Miami silt loam is in good tilth but since it has a small per cent of sand is very fine grained and easily injured by the tramping of live stock in the spring and fall on the stalk or stubble ground and by plowing or working the ground when too wet. Clods will result from these practices and it usually requires considerable time and work to put the soil in good tilth again. An occasional application of ground limestone followed by a crop of clover or some soiling crop will produce good tilth. In fact good physical condition depends to a large extent upon the amount of humus present in the soil.

*Crops.* Corn, wheat, oats, clover and timothy do well on the Miami silt loam. It is not as good corn land as the Clyde, but it produces good crops where the soil is well cared for. To do the best a field should not be in corn two years in succession. Wheat and oats do well, in fact the Miami silt loam is better for wheat and oats than any member of the Clyde series as it is apt to grow too rank and fall down when grown on the latter soils. Clover and timothy do well, but it is better not to grow the timothy alone as it has a strong tendency to deplete the fertility of

the soil. Some potatoes are grown on the Miami silt loam but it does not give a high yield. Some orchards are grown on this type and seem to give good results. The more hilly or rolling ground should be selected for orchard land.

*Improvement.* As has been stated before, the Miami silt loam should be kept in good tilth by proper drainage, cultivation, and the growing of crops for soiling purposes. All the manure produced on the farm should be carefully taken care of and spread over the land where it is most needed. It is well to follow a rotation with the corn planted on clover sod. The number of crops and kinds used in the rotation will depend on the size of the farm and the type of farming practiced but should include one (two would be better) year of clover. Where the ground seems to be "clover sick" only an application of ground lime is needed to insure a change. Commercial fertilizers may be resorted to under some conditions but we believe that they should not be constantly used with all crops.

#### MIAMI LOAM.

*Properties.* The Miami loam is a transition between the silt loam and the sandy loam and the boundary between them is usually arbitrary. It has a higher per cent of sand and has perhaps a little darker color than the silt loam.

The subsoil of the Miami loam has a higher per cent of sand and fine gravel than the silt loam and is variable in color and texture. On the one hand it grades into the silt loam type while on the other it may be sandy, grading into the sandy loam. One of the chief characteristics is the high per cent of sand in the top soil.

The difference in the character of the till as left by the glacier and the removal of the silt by weathering and eroding agents are probably responsible for the present structure of the Miami loam. The topography is similar to that of the Miami silt loam.

*Drainage.* The drainage of the Miami loam is usually good, on account of the open porous structure of the soil and the large amount of sand and gravel present in the subsoil. In some cases, however, the subsoil is hard and compact producing a poor natural drainage. In such cases artificial drainage would be beneficial and greatly increase the producing capacity of the soil.

*Crops grown.* The crops grown on this type are similar to those of the Miami silt loam and they yield as good crops. Owing

to the presence of sand it can be more readily kept in a state of good tilth, but it quickly responds to good farming methods. The same farming methods will apply equally well to the Miami loam and the silt loam types.

*Location.* The Miami loam is not so extensive as the Miami silt loam and occurs largely as the upland type along the borders of the streams. Owing to its location it is not, perhaps, valued as high as the Miami silt loam.

#### MIAMI FINE SANDY LOAM.

*Characteristics.* The upper 6 to 8 inches of the Miami fine sandy loam consists of a grayish-brown fine sandy loam, or fine loamy sand. The subsoil is a yellowish-brown heavy loam grading at about 18 inches into a sticky, fine sandy loam or clay loam. The most extensive area occurs in Deer Creek township while small areas are found in Adams and Tippecanoe townships. The topography is level to gently undulating with an occasional ravine where a small stream has formed a V-shaped valley.

*Drainage.* The drainage of the Miami fine sandy loam is good and is apt to be somewhat droughty in more sandy areas. It absorbs water readily and the soil water moves easily.

*Crops grown.* This type produces good yields of corn, oats, wheat, clover and potatoes. Apples, pears, peaches, grapes and small fruits should do well in this type of soil.

The fine sandy loam is easily cultivated and requires less labor to secure a good seed bed than the other upland soils. The yields are slightly below those of the heavier types.

The application of barnyard manure and green manures is very important. Clover and other leguminous crops should be grown for green manure.

#### CLYDE SILTY CLAY LOAM—HEAVY PHASE.

*Characteristics.* The United States Bureau of Soils gives the following description of Clyde silty clay loam:

"The surface soil of the Clyde silty clay loam to an average depth of 10 inches is a dark-brown to black sticky, silty clay loam. When wet it is a dull black in color and decidedly plastic and clay like. Upon becoming partially dried it assumes a lighter brown or gray or grayish brown color and usually develops a granulated or crumb-like structure. Nearer the margins of the areas of this



type the color is usually a lighter brown, the surface soil may have a depth of only 5 or 6 inches, and the admixture of coarse grained material sometimes renders it rather more loamy than the typical area.

"The subsoil to a depth ranging from 15 to 20 inches is most frequently a dark brown or almost black silty clay loam which becomes gradually lighter colored with depth and at about 2 feet grades into a drab or dark blue sticky clay loam. This is most frequently underlain by a yellow or mottled yellow and gray plastic clay loam."

The Clyde silty clay loam grades on the one hand into the peat and muck series while on the other hand it merges into the surrounding Miami soils.

The topography is naturally level with perhaps an occasional slight elevation on the surface.

*Origin.* The Clyde silty clay loam in common with the Clyde series is due to depressions in the surface after the retreat of the glacier. The depressions had very poor natural drainage and became marshes and swamps in the case of the Carroll County soils. The areas are connected in most cases by long narrow, usually parallel lines where the water slowly drained from the higher swamps to the lower ones and finally reached the smaller tributaries of the streams. The swamps slowly filled with organic remains from the surrounding higher land in addition to the rank vegetation that flourished in the swamps themselves. The organic matter settled to the bottom where it decayed and became mixed with the fine clay sediment that was washed in to the depressions. The poor drainage produced the heavy phase while the better and more free drainage gave rise to the silt loam with a bright yellow to reddish subsoil at a depth of two feet.

*Drainage.* The Clyde series of soil types requires artificial drainage to lower the water level below the surface of the soil. In fact, when the country was first settled, the black land was all under water, but after thorough drainage it was considered the best soil type.

The Clyde silty clay loam contains a very high per cent of humus which united with the clay forms a porous friable, soil which absorbs moisture readily and is easily cultivated.

*Crops grown.* The Clyde soil is the leading corn land of the country. It yields 50 to 75 and sometimes 80 to 90 bushels per acre. Timothy is a good crop to grow on the more chaffy phases



where other crops have a tendency to dry up. Oats yield well and wheat does good but both crops tend to produce too rank a growth of straw and consequently to lodge. Wet, open winters are bad for wheat. The open, loose, texture admits water freely and freezing heaves the soil pulling the wheat out of the ground. A relatively dry winter season with a few inches of snow for protection, is followed by good results.

The Clyde silty clay loam or silty loam as it is sometimes called occurs typically in Democrat, Burlington and Jefferson townships with some areas in other parts of the county. It occupies a large part of the county. The muck is always associated with or surrounded by this soil type.

#### CLYDE SILTY CLAY LOAM.

*Properties.* The Clyde silty clay loam is a grayish brown to brownish-black soil with an average depth of about 10 inches. The subsoil is grayish brown in color, increasing in clay content as it descends and at about 18 inches to 2 feet grading into a mottled bright yellow material sometimes streaked with a reddish color but not with the steel gray. This characteristic difference between it and the flat phase is due to better drainage. The decidedly lighter steel gray mottling of the flat phase is due to stagnant or very poor drainage. This type occurs in shallower depressions than the heavy phase, and the surface soils are not so dark; in some cases the color is almost midway between the surrounding gray Miami soils and the dark Clyde silty clay loam.

*Crops grown.* The Clyde silty clay loam is well adapted to the growing of corn, clover, wheat, oats and timothy. It is first and last a corn soil, in fact in some parts of the county that crop seems to be the only one grown.

A crop rotation should be practiced including a crop of clover or some leguminous crop every 4 or 5 years to enrich the soil. The farmers are planting the soy bean in the corn rows and also as separate crops. This will help to improve the soil.

*Location.* The Clyde silt loam is developed throughout the county but more particularly in Washington, Monroe and Madison townships and comprises about  $\frac{1}{8}$  of the county.

## CLYDE LOAM.

*Characteristics.* The Clyde loam is a black loam of variable texture and about 10 inches deep. It ranges from the silt type to the sandy type. The subsoil at about 18 inches grades into a mottled gray or yellowish material sometimes with a reddish tinge and usually containing a varying amount of fine sand.

*Crops grown.* The drainage conditions are the same for the loam as for the silty clay types, and artificial drainage is required. The crops produced are similar to those grown on the other types of the Clyde series and the yield is not materially different. The methods of farming are similar also to those for the Clyde series in general.

## GENESEE FINE SANDY LOAM.

*Characteristics.* The Genesee fine sandy loam has been described in the United State Bureau of soils publications as follows:

"The soil consists of a light-brown to dark brown moderately heavy fine sandy loam from 10 to 20 inches deep. The subsoil has about the same texture as the soil, but is usually slightly lighter in color. There are in places slight variations from the typical soil, owing to local erosion and to deposition of sand and silt over small areas by overflow waters. Streaks of sand and silty material are sometimes encountered in the soil mass. Most of the type is subject to annual or frequent overflow."

The Genesee series form the flood plains of the smaller streams and to some extent of the Wabash and Tippecanoe rivers. Some of the areas mapped as Genesee are the same as those usually called meadow land. The two were not separated. The boundary between the Clyde series and the Genesee series is not distinct. Since the Genesee fine sandy loam is an alluvial soil, it varies in short distances owing to the variation in the currents of the streams at various flood stages. Near the streams and across the sharper bends where the currents were swift, the coarser particles were deposited; and in many cases the soil has a large proportion of coarse sand. Near the larger bends or where the water found settling basins, or where the water was less turbulent, the finer material was deposited, giving rise to the heavier and more silty type, usually of a darker color. Mixture of the fine clay or silty materials with the right proportion of sand is the basis of the Genesee fine sandy loam.

*Agricultural conditions.* The bottoms are flooded annually or oftener and in places are cut by smaller branches and creeks tributary to the main stream. The drainage is usually good and the land dries rapidly after a rain. It is a soil that is friable, easy to till, and where protected from overflow is admirably adapted to corn, oats, clover or timothy. A great deal of the rougher land is in pasture.

The fertility of the Genesee fine sandy loam is renewed each time it is flooded by high water making the growing leguminous crops of less importance. Thorough cultivation is necessary to keep down the large number of weeds springing up from the seed brought in by high water.

#### GENESEE LOAM.

*Properties.* This soil consists of a light-brown loam to sandy or silty loam. The subsoil is very similar in texture to the soil but is usually lighter brown in color. Below 18 to 20 inches, the substratum is frequently made up of horizontal beds of sand and clay.

The Genesee loam is an alluvial soil and its variation in structure is due to the same causes as in the case of the sandy loams. It has a level to somewhat broken topography and occurs along the course of the streams.

*Agricultural conditions.* The Genesee loam is used for the growing of grain crops, particularly corn. It is productive, easily cultivated, and readily kept in good tilth. A great deal of the land is used for pasture purposes.

The drainage is usually good but it does not stand dry weather so well as soils with a very high clay content.

#### FOX FINE SANDY LOAM.

*Characteristics.* "The surface soil of the Fox fine sandy loam is known to be gray in color, a fine sandy loam in texture, and in places somewhat sticky when wet. The subsoil is lighter in color than the soil and at the top has the same texture, becoming heavier with depth. At 24 inches it is a fine sandy clay, below which it becomes lighter, a bed of fine sand often being encountered within the three foot sections. There is always a substructure of gravel containing at least 25 per cent of limestone pebbles. This type may occur as a glacial outwash plain or a glacial stream terrace. the surface is level or pitted, and sometimes slightly rolling owing to erosion."

This is the type description of this soil as given by the publication of the U. S. Bureau of Soils.

The Fox sandy loam occurs as a terrace soil along the Tippecanoe and Wabash rivers where in some instances it resembles long sandy ridges. Some areas grade into almost pure sand. The surface is level to gently undulating on account of the effects of erosion.

*Agricultural conditions.* The natural drainage is good with a tendency in places to drought in long dry spells.

#### WABASH LOAM.

*Properties.* The following type description of the Wabash loam is given by the U. S. Bureau of Soils:

"Owing to its wide distribution and its alluvial origin from the wash of soils of different textures, this type shows a wide local variation. It is generally a brown loam about 10 inches deep, often containing small quantities of sand and in local areas some gravel. The subsoil is usually a heavy brownish-yellow loam 20 to 40 inches deep, overlying a gravelly loam. The type occurs as first bottoms along the streams and small rivers and much of it is subject to periodical overflow. It is a first class corn soil, producing 35 to 60 bushels per acre. This type could be used more extensively for the production of canning crops, such as sugar corn, green peas, tomatoes," etc.

The surface of the Wabash loam is level to slightly undulating. It occurs along the Wabash river, forming part of the flood plain.

The natural drainage is good only requiring artificial drains to conduct the water from the uplands to the river.

*Crop conditions.* This type of soil is very highly prized for farming purposes. It is friable, easily cultivated and responds readily to good farming methods. Very little is for sale and brings \$200 per acre when sold, if close to market.

#### WABASH SILT LOAM.

*Properties.* The wabash silt loam is described by the U. S. Bureau of Soils as follows:

"The type includes a dark-brown to black silt loam about 12 inches deep, underlain by a heavy silt loam of lighter color. Sometimes, however, the dark color extends to three feet or more. The soil is of alluvial origin. It occupies stream bottoms subject

to overflow, and is often poorly drained. When well drained it produces heavy crops of corn and grass and fair yields of small grain."

Having a small amount of sand, the Wabash silt loam retains moisture well but will readily form clods when stirred too wet. It will not form a good tilth readily when cloddy on account of the presence of a large amount of silt or clay.

*Agricultural conditions.* Where well drained, corn does well on the Wabash silt loam, but it is not always a good practice to pasture the stalks especially when the ground is not frozen.

#### WABASH FINE SANDY LOAM.

*Properties.* The Wabash fine sandy loam is similar to the other types of the Wabash series of soils occurring in Carroll County, except that the sandy loam contains more sand. In places it becomes very sandy.

The natural drainage of this type is very good. The soil absorbs moisture rapidly and it dries very quickly after a rain. This is due to the porous condition of the subsoil.

*Crops grown.* The crops grown on this are similar to those of the other Wabash soils and the yields are not materially different.

The agricultural practices are similar to those in vogue in the other types of Wabash soils and it requires the same kind of treatment.

Almost all of the Wabash fine sandy loam is in cultivation and is highly valued as farm land.

#### SHELBY SILT LOAM.

*Characteristics.* In physical composition, the Shelby silt loam is the same as the Miami silt loam but the basis of separation is a difference of surface conditions. It is rather broken and deeply dissected by stream erosion. It occurs near the streams mainly in Adams township. This type should be left in forest growth as much as possible to prevent erosion and stream etching. This type of soil would be good for orchards. The crops grown on the Shelby silt loam are similar to those of the Miami silt loam and do not give materially different crop yields from those of the Miami soils.

### MUCK.

*Characteristics.* Muck is a dark-brown to black mixture composed of the organic remains of swamp vegetation in various stages of oxidation, mixed with varying quantities of sand, clay and silt. It ranges from two or three feet to many feet in thickness. On the outer margins, the muck merges into the Clyde series.

Most muck is too chaffy for farm crops. Corn many times grows nicely until it becomes knee high when it turns yellow and dies, and the smaller grains grow too rank and lodge badly. Timothy does well on muck soil. It is well adapted to the growth of onions, celery, cabbage, Irish potatoes, beets, turnips, cauliflower, and other vegetables. The agricultural condition may be improved by the liberal use of barnyard manure and potash salts.

### MEADOW.

Meadow represents the variable soil conditions encountered in the narrow, trough like valleys of the creeks. It consists of alluvial material varying from almost pure sand to silt or clay and is usually subject to overflow with every high water. Part of it is in cultivation but most of it is in pasture, trees, underbrush and weeds. This type is not shown separately on the map but is included with the Genesee series.

### SUMMARY.

Fourteen soil types are recognized and mapped in Carrol county. The Miami, Clyde, Muck and Shelby soils occur on the uplands, the Fox, upon the terraces, and the Genesee and Wabash in the first, or overflow bottoms.

Three types of the Miami soils are mapped, the silt loam, loam and fine sandy loam. They are best adapted to wheat and oats.

The Clyde series includes the silty clay loam, the silty clay loam, heavy phase and the loam. This is the corn land, but the smaller grains and hay also do well.

The Fox fine sandy loam occurs on the higher terraces. It is well drained.

The Genesee is represented by the loam and fine sandy loam, alluvial soils that are subject to frequent overflow. They are well suited to corn.

The Muck is of small extent and unimportant.

The Wabash series has three representatives, the loam, silt loam and fine sandy loam. They are well drained and suited to corn and the small grains.