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A Soil Survey of Clark, Floyd and Harrison Counties

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DESCRIPTION OF THE AREA.

The territory under consideration in this report embraces the counties of Clark, Floyd and Harrison. These counties all border on the Ohio River. They are bounded on the north by the counties of Jefferson, Scott and Washington. Washington County also forms the western boundary of Clark County, while Crawford County lies west of Harrison. The area comprises about 1,000 square miles, being approximately 50 miles in length and 20 in breadth, lying with its greater extension in a northeast-southwest direction. The Ohio River courses along its southeastern boundary, a distance of 30 miles above the Falls and 55 miles below the Falls, and its central portion is nearly opposite Louisville, Ky. A brief statement of facts concerning the surface features, the settlement, the industrial facilities, etc., is given for each county, as follows:

Clark County.—The population of Clark County in 1900 was about 32,000, being an average of 85 people to the square mile. The population is largely white, but a considerable percentage of colored population exists in the larger towns. The county embraces most of the tract known as "Clark's Grant," this being the portion of land assigned to Capt. George Rogers Clark in recognition of his services against the British in the Revolutionary War.*

The first settlements were made in 1787, and the settlers came from Pennsylvania, from Virginia, from North Carolina, from Maryland and from New York. Development was slow till after the Civil War, when its progress became very rapid.

*Clark's Grant comprises an area about 15 miles square and it is laid off in 500-acre tracts numbered successively from 1 to 298. The lines of these tracts do not run in north-south and east-west directions but approximately parallel or at right angles to the Ohio river a few miles above the Falls. One line runs about north 30° west, the other, north 60° east. Most of the roads follow the directions of these lines, but some of them follow irregular courses between towns, without reference to section lines or points of the compass.

Jeffersonville, the county seat, has a population of 11,000, and is situated on the Ohio River in the extreme southern portion of the county. It is a prosperous manufacturing town and railroad center. The State Industrial and Reform School for Boys is located here. The city is closely connected with Louisville, Ky., and New Albany by river, railroad and electric lines. Three railroad lines and one interurban system traverse the county and furnish ready means of communication with the county seat, and its river traffic is large.

Charlestown and Sellersburg are next in size, each having a population of about 1,000. They are easily accessible by railroad and electric lines. Charlestown was formerly the county seat, while Sellersburg is the center of extensive cement manufactories.

Shipment of produce is done mostly by rail, but to some parts the Ohio River furnishes an ample and more convenient means of shipment. The principal ports aside from Jeffersonville are Bethlehem and Utica. Many small "landings," also, are points where much freight is taken aboard the steamers. The country roads in many places have been macadamized, and these furnish good communication between towns, giving the farmer easy access to market. While the county has, in the past, been a little backward in extending its "free gravel roads," there is awaking a more general interest in the matter. The antiquated toll system of pikes has been done away with altogether in this county.

Many northern farmers, seeing the opportunities for future development of the country, are coming in, and these add new life and wealth to the county.

The surface of the county presents a variety of types. The eastern and larger portion is moderately level but slopes in general toward Silver Creek. This surface is cut by many small valleys leading either to Silver Creek Valley or the Ohio River Valley. There are extensive areas, uncut by drainage systems, which present a surface about as level as a floor, upon which rainwater will stand for many days—until it is evaporated or is slowly absorbed by the almost impervious soil. The main topographic features of the area are resultant from the nature and position of the underlying geological formations. These formations, from the Niagara of the Silurian to the Knobstone shales of the Carboniferous, are not folded but have a gentle westward dip, the massive limestone beds of the Niagara forming the high escarpment along the eastern edge of the county, while the channel of Silver Creek lies at the

foot of a somewhat similar escarpment of the Knobstone formation in the western part. The stream valleys, where they cut a limestone formation, are narrow and deep, but where the streams traverse a formation of softer material—as the New Albany black shale —the valleys widen out. Such a variation of conditions occurs along the course of Silver Creek. Streams emerging from the southeastern border approach the Ohio Valley between limestone walls 200 to 300 feet high.

As viewed from the Knobstone hills at the west, the surface of the county to the east appears quite level and nearly forest-covered. The area covered with trees is, however, comparatively small, being probably not more than 10 per cent. This timber, the remnants of the once universal forest in this region, comprises, mainly, beech and oak, with some poplar, some gum and some sugar maple. As a rule, the maple occurs on the limestone slopes; the beech on the flat, wet areas; the oak, sometimes interspersed with the beech, on the more broken areas. The Knobstone hills are nearly covered with timber, the lower slopes with oak and hickory, the higher parts with chestnut, oak and jack pine.

The region known as the "Knobs" embraces most of the county west of Silver Creek. It is a region formed from the dissection of the soft shales of the Knobstone group, whose firm upper layers have resisted erosion and so have tended to preserve the original height of the surface while it was being deeply trenched by weathering processes. The surface is almost wholly broken, and many portions exist as outlying knobs. The western arm of the county includes the valley of Muddy Fork, with the accompanying broken country lying adjacent.

Floyd County.—The Knobstone range of hills continuing south extends through the central part of Floyd County, giving that county as a whole a rather hilly surface. Floyd County occupies a position between Clark and Harrison counties. It is bordered for 10 miles on the southeast by the Ohio River, and it touches Washington County at the north. Being a small county with a large town within its borders, its population per square mile is over 200.

The county was settled about 1800. A few scattering settlers had come in before that time. Among the pioneers who took an active part in the early development of the county were David Lewis, Leonard Leach, Joseph Smith, Howell Wells, Louis Mann, John Barnett, Martin Very, Israel Moore, John Baumann, August Genung and Jacob Korb. These settlers occupied lands in

the vicinity of New Albany. The county at that time was an almost unbroken forest, consisting of oak, beech, hickory, chestnut, walnut, ash, poplar, gum and sugar maple.

The largest city and the county seat is New Albany. It has a population of 21,000, and extends two miles along the Ohio River. It is situated mainly on the upper terrace of the river, some 60 feet above ordinary low water, but a portion of the business section is on a second terrace 15 or 20 feet lower, lying along the river front. High water in the Ohio sometimes floods the lower part of town, but does not extend to the upper terrace. The city has a fine court house and government building. It has also a creditable city library and many commodious churches. Steel works and other important industries make this one of the most important commercial cities in the southern part of the State. The city is connected with Louisville, Kentucky, by several lines of railroad and an electric line. The Southern, the Chicago, Indianapolis & Louisville, the Baltimore & Ohio Southwestern, and the Pennsylvania Lines give ample facilities for freight and passenger traffic, in addition to which is electric road connection with Indianapolis. The river traffic is very large. New Albany is one of the leading markets of the region for a farming and truck-raising area 20 miles in radius.

Georgetown, on the Southern Railway, and Greenville, on the Paoli pike, are two of the larger inland towns of the county, each with a population of about 350.

Practically the whole county is hilly. To the east of the main divide the surface descends rather abruptly to the level of the Ohio River bottom. Most of the streams are short and are dry much of the time. The western slope is more gentle and the headwaters of Indian Creek have broad valleys. The stream channels are frequently shallow and have rock or gravel beds, which are often traveled as roads. The larger of these streams are seldom without water, which, when not in flood, flows clear and fresh over pebbly bottoms or percolates slowly through beds of sand. While the valleys are broad the amount of bottom land along the streams is limited, since the gradient of the streams is steep and the downward erosion is rapid. There is, however, a greater relative amount of alluvial deposits from the town of Crandall up stream than from there down stream. In the eastern part of the county there is a large area of comparatively low land lying between the Knobs and Silver Creek, from St. Joseph to New Albany. This was formerly base leveled, part of it being made up largely of the original shales.

but there also being extensive tracts of loess-like deposit. The general surface is that of a plain, partly trenched by young valleys, lying 100 feet or so above the Ohio River. The Ohio River, from New Albany south, has a bottom land averaging probably half a mile wide till in the vicinity of Bridgeport. This is low enough to be covered with water when the river is at its highest stage.

Owing to the irregularity of surface the roads do not closely follow the section lines. Floyd County roads are, however, well improved, many of them being graveled with the soft gravel that comes from the Knobstone formation. The Paoli-New Albany pike is here a toll road and is one of the chief channels of trade between New Albany and a wide territory untapped by any railroad.

Harrison County.—The early settlement of Harrison County, like that of Clark and Floyd, began about the first of the nineteenth century. Ephraim Fleshman came to Harrison County in 1807 and settled in Heth Township, on what is known as the John Frank land. John Ripperdan and wife, from Danville, Kentucky, settled in 1807, in the valley that has since borne his name. Daniel Boone's brother, Squire Boone, with his sons, in 1802 settled in "Grassy Valley," about six miles back from the Ohio River. John Hudson came from the Shenandoah Valley, Virginia, in 1798, and settled in Harrison County. There was at that time only one house on the site of New Albany. The county was organized in 1809, having been named after General William Henry Harrison, who had entered government land known as the Wilson Mills property, in 1806. General Harrison built a grist mill on Blue River in the southern part of Spencer Township, the foundation of which is still in use.

The population of Harrison County is about 22,000, being only 47 to the square mile. There are no large towns, but many villages. Corydon, the county seat, has a population of 1,700, and is the metropolis. Corydon has many features of historical interest, which can barely be mentioned. It received its name from General W. H. Harrison. The State government was constructed here and the original State house still stands, in the center of the town. Morgan's raid reached to Corydon, and the Battle of Corydon is one in the official list of battles of the Civil War. The town is a prosperous one in the center of the county, without saloons. Extensive canning factories are established here, and the Corydon wagon works have more than local renown. The town is provided with electric light and ice plants. It is the southern terminus of the Louisville, New Albany & Corydon Railway. This road provides an outlet for a large part of the county's produce. The Southern

Railway runs through the northern half of the county and gives a good market for farmers of that region, with Louisville, Kentucky, less than 30 miles away. The southern part of the county depends largely on river traffic. New Amsterdam, Mauckport, Evans' Landing, Rosewood and many other landings, make convenient points for shipping. The Paoli pike cuts the extreme northern end of the county and provides a good communication with New Albany by team.

The character of the population is unusually high. Harrison County is one of two in the State that in 1907 had no inmate in the State penitentiary. The strict enforcement of the county option law against saloons is suggestive of the prevailing sentiment of the people, as well as being conducive to the further betterment of the communities. A large part of the population is descendant from the early settlers, although in the towns the change has been greater.

The topography of the surface of the county embraces a number of types. The prevailing type is that of a moderately undulating plain cut by few streams, but pitted with sinkholes. This type embraces mainly the central portion, north and south. The peculiar character of the underlying formations has caused the drainage to be carried on underground, largely. The relation of this structure to surface features and to soils is discussed in another chapter.

The western part of the county, in addition to the sink-hole topography, is much roughened by isolated or somewhat connected elevations forming steep ridges and giving a picturesque aspect to the landscape.

The eastern portion lies near the outcropping edge of several geological formations, from the Knobstone to the Mitchell. The southern half of this section is a strip about three miles wide lying along the Ohio River bottom from Bridgeport to the southern part of Boone Township. It is deeply cut by valleys and embraces a very hilly country. The northern half of the eastern area is traversed by an elaborate system of surface drainage, comprising many of the headwaters of the two Indian Creeks.

Of the once widely extensive forest covering the county the principal remnants are along the streams and on the untillable slopes of the high ridges. Some good farm land is still devoted to timber, but the carriage and furniture factories are eagerly buying up all available tracts, which the unsuspecting farmer readily yields to the uncommonly good offers of the "cruisers," though those offers be only one-half of what the lumber company could

easily afford to pay. But it is so much in advance of the old prices at which the farmer used to sell his timber that he thinks he is the one who is getting the bargain rather than is the buyer.

CLIMATE.

The temperature and rainfall of this region is shown in a general way by the following table. It should be noted, also, that the high per cent of humidity of the atmosphere renders the summer heat quite oppressive and the cold of the winter more biting than would be the case with corresponding temperatures in a more arid region. In spring the precipitation is frequently too great to permit a proper cultivation of crops. The winters are not so cold but that rains and muddy roads are as frequent as in any part of the year. The months of September and October are usually dry and delightful.

SUMMARY OF CLIMATIC CONDITIONS THAT PREVAIL IN OR NEAR THE COUNTIES OF CLARK, FLOYD AND HARRISON, INDIANA. RECORD FOR 21 YEARS.

MEAN TEMPERATURE.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Vevay, Ind.	32	34	43	56	66	74	77	75	69	57	45	36	55
Marengo, Ind.	33	35	44	56	65	74	77	75	69	57	45	36	56
Louisville, Ky.	35	37	45	56	67	75	79	77	70	59	46	38	57

HIGHEST TEMPERATURE FOR PERIOD.

Vevay, Ind.	70	75	85	91	95	99	105	101	99	91	79	72	105
Marengo, Ind.	69	73	81	91	94	98	106	103	100	96	80	71	106
Louisville, Ky.	72	78	86	91	94	100	107	105	102	91	79	74	107

LOWEST TEMPERATURE FOR PERIOD.

Vevay, Ind.	—23	—22	2	24	32	43	50	44	32	18	5	—5	—23
Marengo, Ind.	—18	—28	0	19	29	37	47	49	26	17	5	—19	—28
Louisville, Ky.	—20	—14	3	21	33	44	54	50	36	26	4	—7	—20

MEAN PRECIPITATION.

Vevay, Ind.	3.9	4.1	3.8	3.6	4.5	4.8	3.5	3.3	3.0	2.0	3.7	2.9	43.1
Marengo, Ind.	4.9	6.5	5.3	5.4	5.2	5.4	4.0	4.2	4.0	3.1	5.4	4.2	57.6
Louisville, Ky.	3.9	3.9	4.3	4.0	3.8	4.3	3.8	3.5	2.7	2.6	4.0	3.7	44.5

AVERAGE NUMBER OF RAINY DAYS.

Vevay, Ind.	9	9	11	9	10	9	7	7	6	5	8	7	97
Marengo, Ind.	9	9	10	8	10	9	7	7	6	6	8	8	97
Louisville, Ky.	13	11	13	12	12	12	10	8	8	8	10	11	128

SUMMARY OF CLIMATIC CONDITIONS—Continued.

AVERAGE DEPTH OF SNOW.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Vevay, Ind.	7.5	6.1	4.0	3.8	0.1	0	0	0	T	T	1.1	4.1	26.7
Marengo, Ind.	5.3	5.6	4.6	0.3	T	0	0	0	0	T	0.8	3.4	20.0
Louisville, Ky.	3.7	4.5	3.2	0.2	T	0	0	0	0	T	0.4	2.4	14.4

T Indicates trace.

AGRICULTURE.

The farmer of the early days was satisfied with a small farm and small crops. When he first landed on the lonely banks of the Ohio River he was face to face with innumerable obstacles. The lurking Redman still prowled in the region. Lowland and upland alike were covered with a dense forest, almost unbroken by any prairie land. The soil, protected from the sun by the impenetrable shade. was cold and water-soaked—even covered by standing water in many places. Mosquitoes and malaria made life anything but pleasant at times. There were no roads, and when a trail had finally been cleared the springy, undrained land was almost impassable during a large part of the year. Markets were few and far-distant. Trade was done mainly with the few boats that plied up and down the Ohio River, but most of the household necessities were produced at home. Machinery and tools were scarce and primitive, yet the pioneer farmer had the most arduous task of the century to perform, and he labored well. By toilsome effort the trees were felled, the little log cabin, in all its primitive simplicity, was soon erected and the work of clearing the land went on. Giant oaks, poplars, maples and walnuts all fell a prey to the flames in order to give room for the encroaching grain fields. One who now rides through this same county can hardly realize what was the original condition of the present stretches of open country, dotted with farm houses and covered with crops of corn and wheat and oats.

Much of the early-day farming was done with ox teams. The principal crops were corn, oats, potatoes and hay. Grass was cut by scythes and was raked by hand rakes. Grain was threshed by flails or by being trodden out under the feet of horses. Corn was shocked and later in the season was husked on the barn floor. Plowing was done with a wooden moldboard plow, and grain was cut with a sickle or a cradle. Flour was made at a water mill, and these in time became quite numerous. At one time there were 42

mills on the creeks of Harrison County alone. Money was scarce and resort was had to barter in most of the commercial transactions. Stock was unimproved and received little care. Hogs ran wild and fed on grass, roots and mast from the beech and oak. It was customary to mark the ears of the hogs to prevent them being killed by anyone as wild game. These marks were recorded at the county seat. Wild game was abundant. Turkeys, pigeons, deer and bear were common, and hunting was a profession.

Careful cultivation of the soil did not receive much attention at first. The soil was naturally very productive just after the timber had been taken off, and with the added benefit of the ashes from the burned logs. But in time careless methods began to reduce the fertility and to allow the soil to wash away. Commercial fertilizers were not used and the barnyard manure available was not sufficient for all the land. Now the depleted condition of the soil is being improved upon by many means, such as rotation of crops, rest, clovering and commercial fertilizers. Grain was sown broadcast and corn was dropped by hand. Crops grown under such primitive methods were small and inferior, compared with those grown by modern methods. About the close of the Civil War mowing machines, reapers, horse rakes, better plows and many kinds of labor-saving machinery began to come into use, and farming interests developed rapidly. Gardening and fruit-raising received a good deal of attention and became sources of wealth in many places.

Education has kept pace with other elements of civilization in the region. The first school houses were rudely built of logs, the equipment being simple and meagre, while the teachers were poorly prepared and poorly paid. The school term lasted only two or three months of the year and the chances for an education were small. At present the educational facilities of these counties are unexcelled in the State; yet, sad to state, they are not always taken advantage of to the fullest extent. Good country schools are maintained six or seven months of the year, while many of the towns have high schools, which places a high school education within the grasp of every ambitious youth.

The average-sized farm in Clark County is about 100 acres; in Floyd, about 60 acres, and in Harrison, about 85 acres. A large per cent of the farms of the area are operated by their owners. In Harrison County the average is 90 per cent. The price for ordinary farm labor is 75 cents a day, with board, but in the summer season help is frequently scarce and larger wages are offered. The tendency is for the young men to migrate to the cities for work, they

preferring a little lower wage and the companionship of society, to good wages with isolation on the farm. The price of farm land in Harrison County is generally about $30 an acre. The larger farms are on the bottom lands of the Ohio River. There, also, the larger proportion of renters exist.

The area contains much land of little fertility, and this unproductiveness is shown in the appearance of the dwellings and farm buildings thereon. Other parts are naturally fertile, and this condition is expressed in commodious and well-built houses and barns. In nearly every part the use of commercial fertilizer is considered necessary. On the fertile valleys fertilizers are little used. Once in a while a farmer is found who has discarded their use altogether, he having been convinced that by proper tillage and rotation of crops the productivity of his land is relatively greater than is that of his neighbors who use fertilizers. A great variety of brands of fertilizer are used and some attention is given to the selection of that kind that experience has shown to be best adapted to a given soil. Some of the more common are brands made by the Bash Packing Company, the Chicago Fertilizer Company, the Cincinnati Phosphate Company, the Globe Fertilizer Company, the National Fertilizer Company, and the Northwestern Fertilizing Company. From 200 pounds to 300 pounds per acre are used and the cost of fertilizer varies from $18 to $25 per ton. This is said to increase the productivity of land sometimes to the extent of 15 bushels of wheat per acre. "The better the land the more gain in the use of fertilizers," is the experience of many. Others feel that the purchase of fertilizers barely pays—that the increase in yield is hardly commensurate with the great outlay for fertilizers.

The value of clover as a fertilizer is generally recognized. Some farmers assert that it is equal to the ordinary benefit derived from commercial fertilizers. And clover is thus used to some extent, but not so extensively as it would be were it not for the fact that it is extremely difficult to secure a stand on much of the land. It is held by some that the use of commercial fertilizers has impaired the land for the growth of clover—that before these fertilizers were used it was not difficult to secure a stand of clover. It has been observed that the parts of a field most difficult to seed down are places where the soil is in need of drainage. It is probable that as tile drainage comes more into use that less difficulty will be had in seeding land to clover. Of late years it has been difficult to obtain clover seed free from foul seeds. One of the worst enemies of this kind is a variety of plantain. This plant has a seed much like the clover

seed in size and weight, thus being not easily separated by machinery. The plantain spreads rapidly and crowds out the clover as it goes. Notwithstanding the difficulties attending the raising of clover, it seems reasonable to suppose that by some means or another clovering must supersede the use of commercial fertilizers to a great extent as a permanent means of soil enrichment. It is the farmer's own means and is a less expensive method. It is depending more on natural resources and not so much on the manipulation of the manufacturer or of middle man. The farmer should seek relief from the oppressive drain upon his profits by the substitution of intelligent and attentive practice of "clovering" and rotation of crops for the customary dependence upon commercial fertilizers exclusively.

Wheat is the leading crop of the area. The yield in recent years is a third greater than in former times, on the same land. This is due to better tillage, to the conservation of the fertility of the soil, to the prevention of waste by erosion of the surface and to the use of fertilizers and "clovering." The wheat is put in in the fall. The land is first plowed, as early in the fall as possible. It is then well cut up with the disc, is rolled and harrowed in turn. The seed is then drilled in, the fertilizer being run into the ground with the wheat. The wheat is harvested usually from June 15 to July 1, and there is seldom a failure of crop. The yield varies from 15 to 30 bushels per acre, according to the land and the season. Some years ago wheat was generally stacked before threshing; now the common way is to thresh from the shock. The liability of prolonged wet spells makes this method rather precarious, however. Some farmers store the grain in barns till threshing time, and the straw is usually carefully taken care of. A very good quality of wheat is raised here. The principal varieties are the Pool, the Fultz, the Harvest King, and the Silver Chaff. The Kentucky Wonder is a rather new variety, that has been found to be very productive.

Corn is the next staple product. The average yield per acre is about 35 bushels. As high as 75 or 80 bushels per acre is common on the rich bottom lands of the Ohio. Next to the Ohio bottom lands the best corn land is the loamy creek bottoms or the rolling "limestone" land. Corn is planted in drills or is "checked." The fertilizer is applied in the row with the corn drills, at the rate of 150 pounds to 250 pounds to the acre. Cultivation is continued until the corn is in tassel and is done largely by single-horse cultivators with several small shovels. The use of much fertilizer on corn land has been found to work disastrously in a season when a

moderately wet spring has been followed suddenly by drouth. The roots of the corn in this case would be clustered around the base of the stalk and near the surface. On the other hand, in fields in which no fertilizer had been used in seeding, the corn would send its roots deeper into the earth at once or extend them farther into the surrounding soil, thus affording better resistance to drouth. One of the worst weeds to contend with in the corn field is what is known as horse sorrel. It is practically impossible to kill it out. As good a way as any to keep it in check is by careful cultivation. One spring crop, such as potatoes, followed by late corn, well cultivated, seems to be as good a way as can be found to manage it. The larger part of the corn crop is cut for fodder, though when left shocked in the field it is frequently injured by the fall rains. Many farmers use the shredder and run the fodder into their barns.

The average yield per acre of oats is about 30 bushels. The acreage is generally not so large as that of corn or wheat. The grain is usually threshed from the shock and the straw is fed or baled and sold. In the city market it will bring $10 a ton.

Potatoes are a profitable crop in many parts of the area, a yield of 140 bushels to the acre being about the average. There are two times of the year when potato planting is done. The early crop is planted in the spring and is dug early in the summer. At about the first of August the late crop is planted, following millet or some other early-harvested crop. The late crop will easily mature before frost and is a better crop than the one planted in the spring. The acreage of potatoes is not usually large, many farmers having less than one acre. The care of the crop after planting is often simplified by using a heavy mulch on the newly-planted field, thus at the same time preventing growth of weeds and conserving the moisture of the soil.

One of the most profitable crops is the tomato. It is especially valuable, since it produces well on land that is not well suited to grain production. The foot hills of the Knobs and other hilly tracts are notable areas where this is true. This vegetable, with proper planting and proper care, will produce 300 bushels per acre, and the price ranges from 25 cents to 50 cents a bushel at the canning factory. In the region where tomatoes are largely grown, nearly every railroad station has a canning factory, the output of which is mainly tomatoes.

The hay crop is important. Timothy and clover do well when once started. Timothy yields from one to one and a half tons to the acre, and always brings a good price in the market—$18 to $25 a

ton. The favorite crop for meadow and pasture is orchard grass. Clark County is especially noted as being a good place for this forage crop. The grass grows in tufts or clumps and to about three feet in height. It is vigorous and prolific and gives a good pasturage after the hay crop is removed. It is not easily affected by dry weather nor does it winter-kill. The seed brings a good price and the yield is 7 to 15 bushels of seed per acre. Alfalfa is beginning to be raised to some extent and it has been found to produce well and to be well suited to the soils and climate. It is raised mainly on the Ohio bottom lands and will yield three crops a year, with one and a half to two tons per acre at each cutting. With the more general introduction of this crop the dairying interests in the region will no doubt be enlarged. Millet is raised to some extent as a hay crop. It will yield two to three tons to the acre.

Tobacco is raised to a limited extent in Clark County. It is quite frequently the main crop among the hills overlooking the Ohio River. It is also raised on the Ohio bottom land. The best quality comes from the hillside land. In many places in the vicinity of Bethlehem the hillsides, too steep for a horse to work on, are covered with little patches of tobacco, and the crop when gathered is pulled down the hill on sleds. The tobacco plant is started in a bed early in spring and these beds are covered with cheese cloth to prevent injury from frost or from insects. When two to three inches high the young plant is transferred to the field, being set out in rows about three feet apart. The tobacco grown on the rich bottom lands is heavier and of good color, but inferior in quality to that grown on the limestone hills.

In Clark County, notably in the vicinity of Bethlehem, a very profitable business is the raising of sunflowers. The seed is sold to buyers in Madison and elsewhere. The use to which such great quantities of sunflower seed are put is a mystery to the producer, but it is thought to be used in the manufacture of oil. Buyers are very reticent about telling what the seed is used for. The crop is planted and tended much after the manner of corn culture. The soil of the Ohio Valley is especially adapted to this crop.

Besides the regular farm crops, an immense amount of garden truck is produced for the local markets of Louisville, New Albany and Jeffersonville. Butter-making is not prominent, but eggs and poultry are very abundant. Large stock raisers are not numerous, although every farmer has a small herd of cattle and of hogs, and this industry seems to be increasing. Many farmers keep a few sheep.

Much fruit is produced throughout the area. Apples do well on the soil of the Knobstone shale. Peaches are grown on almost every soil type. Pears, mainly of the Keifer variety, are most abundant along the taller slope of the limestone hills bordering the Ohio River. Blackberries grow wild in great abundance along every road or patch of timber land, and native blue berries are still found on the Knobs. Some of these are shipped to Indianapolis markets.

For the western part of Clark County and the northern part of Floyd, berry-raising has lately come to be the leading industry. The wealth being thus derived from this hitherto rather unprofitable soil of the Knobstone hills is simply marvelous. Farmers who once barely eked out an existence on their little, unprofitable farms, now reap a harvest of $1,000 to $1,500 a year from their berry crop. Strawberries and raspberries were shipped from one station —Borden—in 1907, at the rate of four or five carloads a day for the season of about four weeks. One firm alone cashed checks in the amount of $123,000, all of which was from the sale of berries.

In some parts of Clark County the land is so nearly level and the subsoil is so impervious that crops are frequently drowned out. Tiling has been employed to some extent and with good results. It is probable that much of the lack of fertility attributed to portions of the land is due to insufficient drainage. Much of the heavy, wet land is in need of something to give coarseness and friability to the soil. It lacks humus. It would seem that with the use of much barnyard manure and the turning under of clover these heavy soils might be made far more productive than they are at present. It would seem that the use of the roller and the excessive pulverizing of the surface for winter wheat would better be omitted in the case of soils that thus easily become packed. A comparatively rough surface would hold the snow over the crop in winter and would facilitate evaporation in the spring. But the enterprising farmer is trying every feasible way to accomplish the best results. Care, attention and experiment will tell, and the farmer who does not keep abreast of the times in knowledge of improved methods will go to the wall. The agricultural schools should see a large attendance of young men and the "short courses" for farmers, during winter, should be attended by men from every township. Local meetings for the discussion of immediate and important farm problems should command the support and interest of every farmer in the neighborhood. Where interest in improvement fails, that farmer is liable to be supplanted by others, who will buy his farm at a moderate figure and build up one of the most productive estates in

the county. It is being done now. Farmers must have more faith in the ultimate worth of their own lands. It will not do for anyone to drop out of the game and idly bemoan the "worthlessness" of the land. He must be looking for the redemption of the good name of his property, not so much by the fulfilment of some ancient Indian legend of hidden mineral wealth therein, as by the application of hard, intelligent labor, coupled with the latest knowledge of scientific farming. Probably the legendary silver cave of the old "tunnel mill" will never be found, but a wealth none the less valuable remains to be drawn from the surface, which hitherto has been only partially realized.

SOILS.

As the variety and the distribution of soil types depend on the geological structure and certain geological processes, these types can best be understood by a consideration of the latter. By reference to the geological map of Indiana it will be seen that the uppermost rocks of this region are, successively from east to west, those of the Silurian, the Devonian and the Mississippian (Lower Carb.) periods. It should also be understood that each formation of rocks extends underneath the formation next to it on the west, so that a deep well in western Harrison County might, at a depth, reach the same formation that comes to the surface in eastern Clark County. These ancient rock beds consist of limestones, shales and sandstones. Besides being a determining agency in the process of topography formation, they are, in whole or in part, the source of the local soils. Through long ages since their formation as beds of sediment in the sea bottom, subsequently upheaved, they have been subject to the erosive and the disintegrating agencies of weather. These modifying agencies have left at the surface a layer of residual material varying in depth and in the relative proportions of the original rock elements. In the case of limestones the residual part is generally less than five per cent of the original rock. That is, 100 feet depth of limestone after being acted upon by the weather, would leave only five feet of residual matter. In the case of disintegrated sandstones and shales, the residual matter comprises probably 95 to 100 per cent of the original rock. Not all of the disintegrated material has remained in position, but some has been removed by running water and has been redeposited in stream valleys or has been carried out of the region and deposited farther away. In parts of the area the soils are of the general class just mentioned as having originated from disintegrated rock without having been

modified by running water. These naturally accord with the nature of the rock over which they lie and vary as the successive geological formations vary. In such regions the soil overlying the same formation does not show much variation from one part of the area to another. This class of soils lies generally in the western part of the area, notably in Harrison and Floyd counties and the western part of Clark County. In other portions of the area the soils are made up of material that has been brought to its present position by moving waters or is the worked-over surface soil that existed in those localities previous to the glacial epoch. Much of the remaining area of Clark County is covered with this kind of soil. It is a loess-like mantle covering the upper level portions of country and reaching well up over the foot hills of the Knobs. It is more fully described in this report under "Description of Individual Soil Types." Underlying this mantle in the northeastern part of Clark County lie discontinuous patches of unsorted drift—remnants of ancient terminal moraines that formerly marked the extent of the ice sheet in this locality. This drift is frequently exposed in the bottom of deep ravines or on hillsides, while large isolated bowlders are sometimes found at the surface of loess-covered areas, as if dropped from floating ice moving off from the glacial front. The approximate limit of the ice sheet, as judged from the occurrence of bowlders, is shown on the soil map. It is thus clear that the underlying rocks of this region have less to do in determining the character of the soils that lie above them then is the case in Floyd and Harrison counties, which are unglaciated.

DESCRIPTION OF INDIVIDUAL SOIL TYPES.

The soils may be divided into two groups, according to their origin: (1) Residual, those resulting from the disintegration of rock beds of the same locality; and (2) transported, those that have been formed from material deposited from water or that has been modified by moving water. The first of these includes the upland soils of Harrison and Floyd counties and part of the upland of Clark County. The second comprises most of the soils of Clark County and the bottom lands of Harrison and Floyd counties. Many local variations occur, and a single farm may contain half a dozen distinct grades. It is impracticable to note these local phases, and only the more general types are described in this report.

Miami Silt Loam.

The Miami silt loam is generally a light gray color at the surface, grading at a depth of six inches or a foot into a yellowish buff color. It usually contains some fine sand and often fine quartz gravel. It rarely contains gravel of local origin, other than iron oxid gravel. This occurs in considerable amount in the subsoil and gives a rusty spot on a fresh surface of the lighter colored loam in which it is imbedded. This soil is usually compact, the sand element in it being too small in amount to assist very materially in giving porosity to the mass. The surface soil is quite uniform in appearance, but the subsoil varies more or less in color from a light buff to a brownish yellow. There is also considerable variation in the amount of iron concretionary gravel that the subsoil contains. The soil is moderately plastic, growing more so with depth. It is easily settled by the rain into a heavy, closely-compacted surface that does not readily loosen up to the plow. This soil, being a deposit from glacial waters, probably was once quite continuous over hill and valley, but erosion has removed much from the hill slopes, leaving the greater depth on the level areas more remote from streams. It has a depth of 15 to 20 feet and its lower portion frequently grades at that depth into coarse gravel. In some places it overlies glacial drift, while in other places there seems to be no glacial till between the silt and the surface of the rock below. This soil is of unmistakable glacial origin, having probably been laid down as a fluviolacustrine deposit in front of the receding ice sheet. When first tilled after the timber has been removed, the upper three or four inchs contains considerable vegetable matter and usually has a darker color.

The land was originally heavily forested with beech, oak, poplar, gum, etc. The timber growth has retarded erosion on the level areas remote from the preglacial valleys, and those level tracts are easily flooded with water in a rainy time. The impermeability of the subsoil and the underlying rock bed prevent proper drainage below, and the water is thus retained on the surface until evaporation has had time to assist in its removal. These level undrained tracts are locally called "white slash," and are notoriously poor land until they are drained. Since the timber has been removed and the land has been brought under cultivation the moisture is more readily evaporated. But tile drainage is necessary to put them in condition to realize the full possibilities of their fertility. Some tile draining has been done and the amount is increasing, as

it is found to be a paying investment. The humus content is small and if this could be increased it would no doubt produce marked results in crop production. Tillage of the slash land is attended with some difficulties on account of the heavy nature of the soil and the superabundance of moisture during the spring and early summer. Farmers are tempted to work the land when it is too wet and with the consequence that the soil on drying out is lumpy and unsuitable for plant growth. Many farmers, profiting by their experience in this matter, are very careful not to till the land before it is dried sufficiently. The results are easily seen in the growth of the crop. While there is some difference of opinion as to the proper depth for plowing, the prevailing sentiment seems to be in favor of deep plowing. Some of the most successful in producing large crops plow their land about eight inches deep. Deep plowing not only aids in retaining moisture during a dry spell, but facilitates the drying up of the excess of moisture after a rain.

The boundaries of this soil—the Miami silt loam—are not very closely marked, as it grades easily into other types. The principal difficulty in determining the boundaries of the type is at its contact with the De Kalb silt loam.

The principal crop of the Miami silt loam is wheat. Wheat is said to do better on the "white slash" than on "limestone" land. The yield is 15 to 20 bushels per acre. Commercial fertilizers are used extensively. The average yield of corn is about 33 bushels per acre; of oats, is 25 bushels per acre. Hay is a good crop, yielding, of timothy, about one and a half tons per acre. Potatoes yield about 70 bushels per acre, and rye about 10 bushels per acre. These last are not raised to any great extent. Tomatoes are raised extensively on this soil.

The following tables give the results of mechanical and chemical analyses of this soil:

MECHANICAL ANALYSES OF MIAMI SILT LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
1	Half mile east of Nabb	Silt loam, 0 to 6 inches	Gray buff	Medium	Chert	3.8	.8	5.6	9.6	10.4	67.4
2	Half mile east of Nabb	Silt loam, 6 to 18 inches	Buff	Medium	Chert and iron conc	8.2	2.2	5.4	8.6	9.5	62.4
3	Half mile east of Nabb	Silt loam, 18 to 36 inches	Light buff	Medium	Iron conc	17.4	.8	8	5.9	10.2	52.6
7	N. E. cor. N. W. ¼ N. E. ¼ Sec. 24 T. 2 N., R. 8 E.	Silt loam, 0 to 12 inches	Gray brown	Easy	Iron conc	1	.8	9.3	12.8	19.2	51.4
8	N. E. cor. N. W. ¼ N. E. ¼ Sec. 24 T. 2 N., R. 8 E.	Sandy silt loam, 12 to 24 inches	Pink buff	Medium	Chert	1.2	1	6.2	20.6	27	45
9	N. E. cor. N. W. ¼ N. E. ¼ Sec. 24 T. 2 N., R. 8 E.	Silt and sand loam, 24 to 36 inches	Light buff	Easy	Chert and iron conc	4.2	1.2	6.6	16.6	22	47.2
10	N. E. cor. Sec. 22 T. 2 N., R. 9 E.	Silt loam, 0 to 18 inches	Light gray	Medium	Iron conc	1.8	2.6	5.2	11.4	21	55.2
11	N. E. cor. Sec. 22 T. 2 N., R. 9 E.	Silt loam 18 to 36 inches	Light buff	Medium	Quartz and iron conc	18.6	2.2	7	9.6	15.2	46
23	S. E. cor. Grant 247	Silt loam, 0 to 18 inches	Gray buff	Medium	Quartz, chert and iron conc	2	.6	10.2	18.8	18.8	48.4
24	S. E. cor. Grant 247	Clayey silt loam, 18 to 36 inches	Light buff	Medium	Chert and iron conc	2	.8	8.2	12.7	18.9	56.8
28	Watson, near interurban station	Silt loam, 0 to 6 inches	Light gray	Easy	Iron conc	6.4	1.2	6.2	2.4	3	80.4
29	Watson, near interurban station	Compact silt loam, 6 to 18 inches	Light buff	Medium	Iron conc	1	.6	3.4	.5	1.2	90.2
30	Watson, near interurban station	Clayey silt loam, tenacious, 18 to 36 inches	Mottled, blue-gray and yellow	Medium	Iron conc	.2	.2	2.4	.7	4.2	89.2

Chemical Analysis of Miami Silt Loam.

Soil sample No.	23	24
Laboratory No.	17	16
Reaction to litmus	Neutral	Acid
Moisture at 105° C.	1.5	1.95
Total soil nitrogen	.099	.133

Analysis of Fine Earth Dried at 105° C.

Volatile and organic matter	2.628	2.170
Insoluble in HCl (1.115 sp. gr.)	92.902	90.835
Soluble silica	.074	.043
Ferric oxide (Fe_2O_3)	1.715	2.313
Alumina (Al_2O_3)	2.037	3.205
Phosphoric acid, anhydrid (P_2O_5)	.119	.177
Calcium oxide (CaO)	.266	.597
Magnesium oxide (MgO)	.267	.621
Sulphuric acid, anhydrid (SO_3)	.018	.024
Potassium oxide (K_2O)	.131	.226
Sodium oxide (Na_2O)	.111	.138
Total	100.268	100.349

New Washington Clay Loam.

This is a type of soil occurring mainly on hill slopes in central and eastern Clark County. It is commonly known there as "limestone" land, and is essentially the residual soil of the disintegrated limestone of the Jeffersonville and the Niagara formations. The surface soil is a light buff, grading downward into reddish yellow, then to a dark red. It frequently contains fragments of chert and has a considerable proportion of clay, the subsoil being very plastic. There are intermediary stages between this and the Miami silt loam, where the limestone residual seems to have been slightly worked over by the waters of the fore-glacial lake. The soil usually overlies limestone, which is at no great depth, often cropping out at the surface. The surface soil is a moderately loose loam, easily tilled and fertile. This is well known as being one of the most productive soils in the area. Originally timbered with sugar maple, walnut, etc., it now produces large crops of corn, wheat and vegetables. In fertility it resembles the Bedford limestone land of Harrison County.

The following tables give the results of mechanical and chemical analyses of this soil:

MECHANICAL ANALYSES OF NEW WASHINGTON CLAY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
12	N. W. ¼ Sec. 28 T. 2 N., R. 9 E.	Loose loam, 0 to 6 inches	Brown	Easy	Iron conc.	0	1	12.2	3.6	10.6	67.6
13	N. W. ¼ Sec. 28 T. 2 N., R. 9 E.	Silty clay loam, 6 to 18 inches	Reddish brown	Difficult	Iron conc.	1.4	6.4	30.7	22.7	14.5	24
14	N. W. ¼ Sec. 28 T. 2 N., R. 9 E.	Silty clay loam, 18 to 36 inches	Dark reddish brown	Medium	Iron conc.	2.8	4.6	20.2	7.4	10	52

Chemical Analyses of New Washington Clay Loam.

Soil sample No.	12	13–14
Laboratory No.	18	20
Reaction to litmus	Neutral	Acid
Moisture at 105° C.	2.87	4.08
Total soil nitrogen	.108	.085

Analysis of Fine Earth Dried at 105° C.

Volatile and organic matter	4.002	3.501
Insoluble in Hcl (1.115 sp. gr.)	85.808	83.445
Soluble silica	.085	.096
Ferric oxid (Fe_2O_3)	3.488	4.359
Alumina (Al_2O_3)	5.350	7.214
Phosphoric acid, anhydrid (P_2O_5)	.176	.244
Calcium oxid (CaO)	.229	.190
Magnesium oxid (MgO)	.592	.627
Sulphuric acid anhydrid (SO_3)	.032	.033
Potassium oxid (K O)	.371	.346
Sodium oxid (Na_2O)	.120	.148
Total	100.233	100.203

Dekalb Silt Loam.

The soil that forms this type is partly a residuum and partly a deposit from glacial waters. It covers mainly what may be called the foot hills of the Knobs, but it also overlies certain areas of the New Albany black shale. In either case it contains much of the material of the underlying rock. The color is generally a light buff near the surface, grading into yellowish or bluish gray below. It occurs generally on the upper part of the undulating surface lying along Silver Creek and its branches. It is, as a whole, the least productive of all the soils of Clark County.

The most productive crop is that of tomatoes, which, accordingly, are extensively raised here. The yield may be as great as 300 bushels per acre. Wheat yields 15 to 20 bushels per acre; corn, 20 to 30; oats, 20 to 25; potatoes, 150. Melons also do well here.

The soil is a stiff clay, except about six inches on top, which is moderately loose. Where the soil is closely underlain with New Albany black shale (slate) there is a marked difference in the productivity between wet and dry seasons. When wet seasons prevail the "slate" land is at its best, but in dry seasons such land is not able to retain enough moisture for productive growth of crops. Then it is that the land underlain by the comparatively barren,

but more porous, Knobstone shale, exceeds the slate land in crops. The Dekalb silt loam is very susceptible to poor treatment, and if plowed when it is wet it becomes hard and cloddy.

The following table gives the results of mechanical analyses of this soil:

MECHANICAL ANALYSES OF DEKALB SILT LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
31	Near the road, about on the line between Grants 204 and 187	Granular loam, 0 to 12 inches	Gray-brown	Easy	Iron conc	2.2	1.2	.9	1.8	3	86.5
32	Near the road, about on the line between Grants 204 and 187	Tenacious clay loam, 12 to 24 inches.	Light brown	Medium	Iron conc and shale	1.6	3	9.2	3.2	8	71.2
33	Near the road about on the line between Grants 204 and 187	Tenacious clay loam, 24 to 36 inches.	Brown	Medium	Shale	7.2	8.3	8.8	2.9	3.2	65.8
58	S. E. part of Grant 44	Loose silt loam, 0 to 12 inches	Buff	Easy	Quartz	.4	2	2.6	3.2	3	85
59	S. E part of Grant 44	Granular clay, 12 to 24 inches	Buff to gray mottled	Difficult	Quartz	.4	1.4	1.6	9.2	11	72.6
60	S. E. part of Grant 44	Tenacious clay, 24 to 36 inches	Gray	Very difficult	Iron conc and black shale.	5.6	1.8	6	2.8	6	74.2
61	Near west side of Grant 106 near the road	Loose loam, 0 to 12 inches	Buff	Difficult	Iron conc and Knobstone shale	5.6	2.2	1.8	7	8	75.7
62	Near west side of Grant 106 near the road	Tenacious clay, 12 to 24 inches	Yellow	Difficult	Iron conc	.4	1.4	6.4	9	15	65
63	Near west side of Grant 106 near the road	Clay, 24 to 36 inches	Yellowish buff	Difficult	Iron conc, chert and Knobstone shale	41.8	2.8	3.4	4	10.8	37.8

KNOBSTONE SANDY LOAM.

The Knobstone type embraces the soils of the Knobstone formation as it occurs in a prominent system of hills formed by the eastern outcrop of the formation in western Clark County and in Floyd County. It is mainly the residuum of the upper members of this formation and its sand content is derived from the uppermost beds. It usually appears in a buff color as surface soil, with a subsoil brownish yellow. It is comparatively fertile, considered with the soil occurring on the foot hills of these Knobs. Owing to the very broken surface that it occupies, there is much of the tract that is too steep for cultivation. Excellent wheat can be raised on top of the Knobs. The main crop is tomatoes. All kinds of fruit do well here. Apples and peaches are especially suited to this soil and this situation. When other parts of the country fail, here can be found a fair crop, while in good seasons the production is greater than the farmer can handle. Berries of all kinds are naturally adapted to conditions found on these hills. While some attention is already given to fruit raising, the acreage is continually increasing. The price of land here now is not commensurate with the wealth-producing capacity of the soil. The farmer here is gradually learning to divert his efforts from general farming to fruit-raising. The chief drawback seems to be the rather inaccessibility of the region, owing to the altitude, poor roads, and the comparative remoteness from market of some portions. To see what is now being done in the fruit business here is an eye-opener to the future possibilities in that line. A farm of 15 acres can be bought for $400, and which in two years after clearing of timber will have yielded a net income of $500 a year.

The following table gives the results of mechanical analyses of this soil:

MECHANICAL ANALYSES OF KNOBSTONE SANDY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
25	N. E¼ Sec. 3 T. 1 N. R. 6 E.......	Loose sandy loam, 0 to 6 inches.....	Light gray..............	Easy...........	Sandstone and iron conc..	18.6	3	5.8	1.9	7.2	68.6
26	N. E. ¼ Sec. 3 T. 1 N., R. 6 E.......	Sandy loam, 6 to 18 inches.........	Brownish yellow.........	Easy...........	Sandstone..............	56.8	2.8	10.8	8.8	3.4	15.6
27	N. E. ¼ Sec. 3 T. 1 N., R. 6 E.......	Sandy loam, moderately tenacious, 18 to 30 inches..................	Grayish yellow..........	Medium........	Sandstone..............	70.6	4.2	11	2.8	3.8	3.6

Yazoo Clay.

Probably the most fertile soil of any in the area occurs in the narrow strips of bottom lying along the Ohio River and that are usually annually covered by high water of the river. The prevailing color is a dark chocolate brown. It varies in texture from that made up largely of clay and silt to a variety containing considerable fine sand. Having been made up of sediment from the river floods the texture does not vary greatly with depth, while in plant growing properties the subsoil to a depth of 10 feet is as rich as the surface foot. This soil produces abundantly. Corn is the principal crop and this produces 50 to 80 bushels per acre. Alfalfa is beginning to be raised and it does well, as many as four crops per season being produced, with a yield of one to two tons to a crop. In the vicinity of Bethlehem large acreages of sunflowers are raised on this land, while tobacco is found to do remarkably well, although the quality is not so fine as when grown on limestone land. This soil needs no fertilizer, since it has naturally an abundance of the elements necessary for plant growth. This land is not subject to drouth, nor does its low-lying position materially affect the culture and growth of crops by being too wet. It is true that the liability to periodic overflow renders this less suitable for small grain, yet even on some of the higher portions 20 bushels of wheat per acre may be reasonably expected.

The farm buildings of this area have been situated on the highest parts of the bottom land, but in more recent years the dwellings are being moved to the edge of the hills, where all danger from floods is removed.

The results of mechanical and chemical analyses of this soil are shown in the following tables:

MECHANICAL ANALYSIS OF YAZOO CLAY.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
54a	S. E. part of Grant 5	Silty clay loam, 0 to 12 inches	Brown								
54	S. E. part of Grant 5	Silty clay loam, 12 to 36 inches	Dark brown	Difficult		0	0	0	.1	.8	97.4

Chemical Analysis of Yazoo Clay.

Soil sample No.	54a
Laboratory No.	19
Reaction to litmus	Neutral
Moisture at 105° C.	2.29
Total soil nitrogen	.092

Analysis of Fine Earth Dried at 105° C.

Volatile and organic matter	5.207
Insoluble in HCl (1.115 sp. gr.)	83.691
Soluble silica	.074
Ferric oxid (Fe_2O_3)	4.053
Alumina (Al_2O_3)	4.357
Phosphoric acid, anhydrid (P_2O_5)	.278
Calcium oxid (CaO)	.852
Magnesium oxid (MgO)	1.003
Sulphuric acid, anhydrid (SO_3)	.057
Potassium oxid (K_2O)	.491
Sodium oxid (Na_2O)	.206
Total	100.269

Jeffersonville Fine Sandy Loam.

The greater part of the Ohio River bottom land is seldom or never covered by high water. This higher portion exists as a high terrace skirting the upland, running far back up the creek valleys and bordering the low bottom (of the Yazoo clay) or, where that is wanting, in some instances coming close to the Ohio River. The soil varies much on this higher terrace. In some places it is mainly sand, and, before vegetation had ever become abundant upon it, was blown into low dunes and ridges, which now cause slight irregularities in the surface. Other parts show a quality and texture not much different from the Miami silt loam. It is a terrace that was probably built up by the river at the time when the melting glacial floods were spreading fine silt in a blanket-like deposit over the upland of eastern Clark County. As a rule the higher parts of this terrace are the most sandy. Such areas are found in the vicinity of Jeffersonville and of New Amsterdam. The various grades of soil occurring on this upper terrace are put together to form one general group, the boundaries of which generally coincide with the extent of the terrace. Also there can be no sharp distinction made between the limits of the river terrace and the corresponding terrace of the tributary streams, and the line of separation shown on the soil map is very arbitrary, the general quality of soil of the high

river terrace and that of the high creek terrace, however, being after some miles quite distinct.

The crop-producing capacity of the soils of this area is quite variable, but on the whole it is inferior to that of the New Washington clay loam. The sandy areas north of New Amsterdam are best adapted to melons and berries. Much of the land just north and northwest of Jeffersonville comprises largely the light colored silt that on the upland grades into Miami silt loam. This part is slightly lower than the sandy portions that occur irregularly on the same terrace and the land is more nearly a "white slash." Much of this land in the vicinity of Jeffersonville is devoted to hay. The looser and sandier parts form good general farming land. Many fine estates are seen along the highway leading from Jeffersonville to Utica. Most of this wealth has probably been produced by the intensive farming of the not-unusually-fertile land of the high terrace. Corn yields from 35 to 40 bushels per acre. Potatoes are a good crop, and all kinds of fruit do well here, if proper care is taken of the soil.

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

MECHANICAL ANALYSES OF JEFFERSONVILLE FINE SANDY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
46	Just east of the interurban bridge over Silver creek, opposite Glenwood Park	Loose loam, 0 to 6 inches	Buff	Medium	Quartz and iron conc	2.6	4.7	7.5	21.3	21.3	42.7
47	Just east of the interurban bridge over Silver creek, opposite Glenwood Park	Compact loam, 6 to 18 inches	Buff	Difficult	Iron conc	1.2	6.8	16.6	3	6	64.8
48	Just east of the interurban bridge over Silver creek, opposite Glenwood Park	Tenacious clay	Brownish buff, mottled	Difficult	Iron conc	.1	.2	2	.8	5	87.8
49	1½ miles N. W. of Jeffersonville, Grant 19	Sandy loam, 0 to 6 inches	Gray buff	Easy	Iron conc	.4	.7	4.4	5	5.4	82.6
50	1½ miles N. W. of Jeffersonville, Grant 19	Clayey silt, 6 to 18 inches	Brown buff	Medium	Iron conc	.4	.15	4.	4.6	5.2	81.6
51	1½ miles N. W. of Jeffersonville, Grant 19	Sandy clay, 18 to 36 inches	Brown buff	Difficult	Quartz	.2	.2	.9	4	7.4	85.6
52	About 1½ miles N. E. of Jeffersonville on "upper Utica" road, Grant 3	Sand, 0 to 12 inches	Dark brown	Very easy		0	0	.4	29	45.2	23.8
53	About 1½ miles N. E. of Jeffersonville on "upper Utica" road, Grant 3	Sand, 12 to 36 inches	Brown	Very easy		0	0	.1	38.8	47.6	14.2

MECHANICAL ANALYSES OF JEFFERSONVILLE FINE SANDY LOAM—Continued.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of course gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
55	Near Utica-Jeffersonville pike, in E. part of Grant 3.	Silt loam, 0 to 12 inches.	Gray buff.	Easy.	Quartz and limestone.	5.2	.2	1.2	5.4	20	66.8
56	Near Utica-Jeffersonville pike, in E. part of Grant 3.	Crumbly silt loam, 12 to 24 inches.	Light brown.	Medium.	Quartz.	1.1	.3	.6	2.4	23.6	70
57	Near Utica-Jeffersonville pike, in E part of Grant 3.	Silt loam, 24 to 36 inches.	Brown.	Medium.		0	.2	.2	2.4	25.4	70
86	North side of Sec. 7, T. 6 S., R. 5 E.	Silty loam, 0 to 18 inches.	Buff.	Easy.	Iron conc.	.4	1	5.8	3.6	7.4	79.6
87	North side of Sec. 7, T. 6 S., R. 5 E.	Tenacious silty clay, 18 to 40 inches.	Reddish brown.	Difficult.		0	0	.2	6.8	17.2	75.8
95	S. side Frac. Sec. 2, T. 5 S., R. 2 E., just N. of New Amsterdam.	Sandy loam, 0 to 6 inches.	Gray.	Easy.	Chert.	1	0	1	14.8	49.3	34.4
96	S. side Frac. Sec. 2, T. 5 S., R. 2 E., just N. of New Amsterdam.	Sand, 6 to 40 inches.	Brown.	Easy.		0	0	2.4	31	54.4	12.6

Waverly Silt Loam.

This type occurs along the valleys of the streams within the area. In general it includes both the low, flood plain and a "second bottom" or terrace from three to ten feet above. As a rule the bottom lands of these streams consist of a series of terraces—two or three in number—each one being three to ten feet higher than the next lower one. In some places the distinction between the terraces can not be noticed. These terraces follow the natural order of formation that arises when an area is uplifted after having been trenched by a drainage system. The lower end of the stream valley is first cut below the former level, a new flood plain soon appearing there, while the upper reaches of the stream retain the same old flood plain for some time longer. Thus anyone in following along the flood plain of the headwaters of some stream will find himself almost imperceptibly elevated to a "second bottom," or terrace, by the time he has gone a few miles down the valley. This arrangement of terraces renders an exact delineation of their boundaries almost an impossibility. In this report no distinction is generally made between the high and the low creek bottoms.

There is considerable variety in the soils occurring as alluvial deposits along these valleys. As a rule the lower levels—the present flood plains—are the most fertile, but even these bottoms are frequently made up of material that is very poor in productivity. The quality of the alluvial deposits of small streams is largely affected by the nature of the geological formations composing the adjacent highlands. The low-bottom type varies in color from a grayish buff to a brownish buff at the surface, and the subsoil varies from a light buff to a dark brown. The texture varies from that in which there are considerable amounts of medium to fine sand to that having a content mainly of silt and clay. Fourteen-mile Creek and other small streams in the eastern part of Clark County have so little bottom land that it is scarcely worth mentioning.

Silver Creek and its tributaries have for the most part wide valleys. The low-bottom type here is generally a light buff colored clay loam. The upper bottom type here is lighter in color than the low-bottom type. In some places the low bottom is of the "white slash" order. The upper branches of Silver Creek have the most fertile bottom land of any part of that system. From Memphis to its mouth the main stream has little very fertile bottom. Along Muddy Fork, below Bridgeport, the bottom land also is poor, compared with that farther up the valley.

Indian Creek has a narrow valley from Crandall to its mouth, while the upper portions have considerable bottom land for so small streams—from 20 to 40 rods much of the way. The upper parts of the branches of Indian Creek and Buck Creek have rather wide sloping valleys.

The valley of Blue River is very narrow and crooked. Its meandering course was determined ages ago when the stream was flowing at a level some 200 feet above the present one. As the stream has sunk its way through the limestone walls of its present canyon-like valley, it has in some degree accentuated its meanders, but the downward cutting has always exceeded the lateral erosion. This type of valley is found with other streams of this area in certain portions of their courses, but in none other is it so emphatically displayed as in Blue River valley. There are narrow strips of low bottom lying within the bends of the stream. These are seldom over 40 rods wide in the widest part and usually do not extend farther than half a mile along the stream.

The soil of the bottom lands of Harrison County is generally a light loam, often somewhat sandy, having a grayish-brown color. It is fertile, as a rule, when so situated as to receive additional deposits of sediment from high water.

The principal crop of these alluvial soils is that of corn. Some of the best will produce as high as 80 bushels per acre, while 100 bushels per acre have been reported. Grass, also, is a paying crop. Other crops are raised to a greater or lesser degree, though usually other parts of the farm are devoted to crops that cannot so well be raised on the bottom land.

The following table shows the results of mechanical analyses of creek-bottom soils:

MECHANICAL ANALYSES OF WAVERLY SILT LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
4	14-mile creek, N. E. ¼ Sec. 23, T. 2 N., R. 8 E.	Sandy loam, 0 to 12 inches	Brown	Difficult	Chert	.6	.6	2.4	6.4	29	62
5	14-mile creek, N. E. ¼ Sec. 23, T. 2 N., R. 8 E.	Sandy clay, 12 to 36 inches	Dark brown	Difficult	Chert	1.4	.6	2	5.8	17.4	68
6	14-mile creek, N. E. ¼ Sec. 23, T. 2 N., R. 8 E.	Sandy clay, 36 to 60 inches	Gray-brown	Very difficult	Chert and iron conc.	3.	1.2	6.4	17.2	28	44
15	N. W. ¼ Sec. 25 T. 2 N., R. 8 E.	Silt loam, 0 to 18 inches	Brown buff	Medium	Limestone and iron conc.	0	3	4.6	6.6	20.8	65.6
16	N. W. ¼ Sec. 25 T. 2 N., R. 8 E.	Silt loam, 18 to 36 inches	Dark brown	Difficult	Chert and iron conc.	7.2	1	5.4	8.6	16	59.2
40	Middle of W. side of Grant 68	Silt loam, 0 to 12 inches	Gray-buff	Easy	Iron conc.	1.2	1.4	5	4.4	8.4	76.4
41	Middle of W. side of Grant 68	Compact silt loam, 12 to 24 inches	Buff	Medium	Iron conc.	1.2	1.2	19.8	4	6	63.6
42	Middle of W. side of Grant 68	Compact silt loam, 24 to 36 inches	Light buff	Medium	Iron conc.	18.4	2.2	7.2	3.4	6.6	60.6
88	S. E. Cor. Sec. 1 T. 6 S., R. 4 E.	Loose silt loam, 0 to 36 inches	Gray-buff	Medium		0	.2	1	2.3	13.4	78.3
89	½ mi. E. of Sharp's Mills, Sec. 13, T. 3 S., R. 2 E.	Loose sandy loam, 0 to 12 inches	Buff-gray	Easy	Chert	.2	.1	.1	.6	20	74
90	½ mi. E. of Sharp's Mills, Sec. 13, T. 3 S., R. 2 E.	Sandy loam, 12 to 36 inches	Buff	Medium		.1	0	0	1	14	80.4
101	S. W. ¼ Sec. 18, T. 4 S., R. 2 E.	Loose silt loam, 0 to 12 inches	Gray-buff	Medium		.1	.2	5.	1.8	7.6	83.3
102	S. W. ¼ Sec. 18, T. 4 S., R. 2 E.	Clayey silt loam, tenacious below 12 to 36 inches	Yellow-buff	Difficult	Chert	.2	.3	.9	2.4	10.6	81.6

MECHANICAL ANALYSES OF WAVERLY SILT LOAM—Continued.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
103	W. side Sec. 36, T. 3 S., R. 3 E.	Sandy loam, 0 to 12 inches	Gray-buff	Easy		0	0	.2	.2	6.6	91
104	W. side Sec. 36, T. 3 S., R. 3 E.	Sandy loam, 12 to 24 inches	Light brown	Medium		0	0	0	.4	7.2	90.2
105	Sec. 25, T. 2 S., R. 4 E.	Sandy loam, 0 to 12 inches	Buff-gray	Easy		0	0	.3	.5	2.5	92.4
106	Sec. 25, T. 2 S., R. 4 E.	Sandy loam, 12 to 36 inches	Brown-buff	Easy		0	0	.2	18	30	53.8
114	S. W. Cor. Sec. 9, T. 2 S., R. 5 E.	Loose silt loam, 0 to 18 inches	Gray-buff	Easy		.1	.1	1	1	2	95
115	S. W. Cor. Sec. 9, T. 2 S., R. 5 E.	Silt loam, 18 to 36 inches	Gray-brown	Easy		.2	.2	.3	.1	.8	95.6
120	S. W. ¼ Sec. 18, T. 4 S., R. 5 E.	Sandy loam, 0 to 12 inches	Brown-gray	Medium	Chert	1.6	.1	1.4	2.2	8.4	84

Muck.

This is a dark-colored soil—almost black, its color forming a striking contrast with the usual buff-colored soils of the region. At a depth of three to four feet the color changes gradually to a yellowish gray. It is of very fine texture, being made up almost wholly of silt, clay and organic matter. When wet, the soil becomes very plastic and owing to this plasticity it is rather difficult of tillage. In such condition it compresses into large, heavy masses before the plow, and these, on drying, are like lumps of brick. In extreme drouth the surface hardens and cracks open to a foot or two in depth. This soil much resembles the "gumbo" of the Missouri River bottoms in western Iowa. A wagon driven over it when the surface is slightly wet, will have its wheels completely clogged by the adhesive mud. Cultivated fields in drying out become baked, with a coarsely granular covering on top. The best results are obtained when the land is plowed in the fall, thus allowing the frost to pulverize the surface and to prepare it for seed growth in the spring. This type occurs in only limited areas, and in Clark County alone is it noticeable to any great extent. The larger of these is found two and a half miles northwest of Jeffersonville, on the upper terrace. Other isolated patches occur in the northern part of the county, near Nabb. Its occurrence is usually on level or poorly drained tracts remote from streams. Its origin seems to have been from the slow accumulation from forests that originally covered the land, with the possible addition of sediment deposited from the still waters that may have frequently flooded the tract.

Notwithstanding the difficulty of culture under certain conditions, it is one of the most fertile soils. Corn, oats and timothy are the principal crops and no fertilizer is needed. Corn yields on an average 35 bushels per acre; oats, 35 bushels; timothy, one and a half to two tons per acre. With proper drainage and the addition of humus this soil could be made much more productive. The areas near Nabb, having a less depth of the soil and having been carefully farmed for many years, as well as being better drained, are less difficult of cultivation.

The following table gives the results of mechanical analyses of this soil:

MECHANICAL ANALYSES OF MUCK.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
21	Farm of Martin Mace, ½ mile S. E. of Nabb. Grant 249	Sandy loam 0 to 12 inches	Dark gray	Easy	Chert and iron conc	4.6	1	4.2	6.4	11.6	73.4
22	Farm of Martin Mace, ½ mile S. E. of Nabb. Grant 249	Tenacious sandy loam 12 to 30 inchs.	Light buff	Difficult	Iron, conc., chert	2	1.3	8	6.4	10.4	70.1
43	N. W. side of Grant 33	Loam 0 to 12 inches	Gray-black	Very difficult		0	0	.7	.7	.1	92.2
44	N. W. side of Grant 33	Clay 12 to 24 inches	Gray-black	Very difficult		0	0	.6	.3	.4	93
45	N. W. side of Grant 33	Clay 24 to 36 inches	Gray-buff	Very difficult		0	0	0	.1	.4	94.8

New Washington Sandy Clay Loam.

A limited and local variety of soil occurs on a low ridge running southeast from the vicinity of Nabb, almost parallel to, and near, the northeast line of Grants 249, 232, 215 and 198. This ridge is 30 or 40 feet above the country to the east or to the west. It resembles a terminal moraine, but its structure would suggest an esker formation. It is composed largely of sand, apparently stratified at some depth. In making wells on this ridge, sand is encountered to a depth of 30 or 40 feet, then gravel or sand to a depth of 57 feet. No shale or limestone has been struck in wells nearly 70 feet deep—a depth much below the level of the outcrop of New Albany black shale about half a mile to the west. On the southeast flank of this ridge a partial section could be obtained. The lower part of this exposure is about 10 rods from Fourteen-Mile Creek, Grant 198, and about 40 feet above it. The lower portion contains pebbles and bowlders of quartzite, granite, greenstone, limestone, etc., some of which are distinctly glacially polished and grooved. Above this bed of bowlders the material is more largely gravel and sand, somewhat arranged by water. The lower matrix is a drab-colored clay; the upper 12 feet of the section shows the effects of oxidation, it being of a yellowish color. Some bowlders occur over the surface of this ridge. A similiar arrangement of structure in this ridge was shown in making a well on top of the ridge about half a mile northwest of the outcrop just described.

Other similar deposits were noticed on Grants 248 to 231, about half a mile southeast of Marysville, and on the southeast quarter of Grant 90.

The soil is a dark red, sandy clay, very fertile, with the upper six inches of a grayish buff color. It resembles a limestone soil in color, but its origin, of course, is different from residual limestone soils. The drainage is accomplished by means of the gentle slope of the surface and by the underground filtration through the porous subsoil. In this respect it has the advantage over a limestone soil underlain by a comparatively impervious layer of rock.

The fertility of this tract is shown in the large growth of corn that it produces, excelling any other in the neighborhood, growing on Miami silt loam. This ridge is especially productive at its junction with the level land to the west, where the colluvial soil has gathered. The usual farm crops and many varieties of fruit are produced on this soil in abundance.

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

MECHANICAL ANALYSES OF NEW WASHINGTON SANDY CLAY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
17	Farm of C. F. Graves, S. E. side of Grant 215	Sandy loam, 0 to 12 inches	Red-brown	Easy		0	.1	2	6.6	10.5	75.4
18	Farm of C. F. Graves, S. E. side of Grant 215	Sandy loam, more compact than 17, 12 to 24 inches	Red-brown	Medium		0	.1	1.6	15.2	8.4	71.6
19	Farm of C. F. Graves, S. E. side of Grant 215	Compact sandy loam, 24 to 36 inches	Red-buff	Medium	Iron conc	1	2	26.2	18.1	20.2	31.4
20	Farm of C. F. Graves, S. E. side of Grant 215	Sandy clay, 36 to 60 inches	Red-brown	Medium	Iron conc and chert	0	1.6	19.2	21.8	25.5	31
37	S. E. ¼ Grant 90	Loose silt loam, 0 to 12 inches	Gray-brown	Medium	Chert	.2	.15	3.8	4	3.6	85.2
38	S. E. ¼ Grant 90	Clay silt loam, 12 to 24 inches	Yellow-brown	Medium	Quartz and iron conc	.1	.4	4.6	3.2	4.7	84.8
39	S. E. ¼ Grant 90	Tenacious sandy clay, 24 to 36 inch	Red-brown	Medium	Iron conc	1.6	1.6	18.8	13.6	10.2	52.4
40	S. E. ¼ Grant 90	Gravelly loam, 36 to 48 inches	Dark red-brown	Medium	Iron conc and chert	22	8	16.6	15.4	9.2	27.4

Harrodsburg Clay Loam.

This type of residual limestone soil overlies the Harrodsburg formation. It is found capping the Knobstone ridges in the northern part of Floyd County and the adjacent parts of Clark County. It is a grayish, rather loose loam in the surface foot, while the subsoil is a yellowish tenacious clay, more compact than the surface layer. Both the surface and the subsoil contain some flint gravel.

It is a fair, general farming land, but berries and other fruit make the most paying crop. Corn yields about 25 bushels per acre; oats, about 20; wheat, about 15. Timothy yields one and a half tons per acre.

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

MECHANICAL ANALYSES OF HARRODSBURG CLAY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
34	½ mile N. of Co. line S. W. Cor. Sec. 16, T. 1 S., R. 5 E.	Loose loam 0 to 6 inches	Brown-yellow	Med.	Iron, conc. and chert	.3	.8	1.6	2.3	8.4	83.8
35	½ mile N. of Co. line S. W. Cor. Sec. 16, T. 1 S., R. 5, E.	Tenacious Clay, 6 to 18 inches	Yellow-brown	Med.	Iron, conc. and chert	10.4	1	3.2	2.4	31.2	49.7
36	½ mile N. of Co. line, S. W. Cor. Sec. 16 T. 1 S., R. 5 E	Tenacious clay, 18 to 36 inches	Yellow-brown	Med.	Chert	2	.5	2.2	6.	43.8	44.2
64	S.E. ¼ of S.W. ¼ Sec. 24, T. 1 S., R. 5 E.	Loose loam, 0 to 12 inches	Brown-gray	Med.	Chert	1.6	.6	7.6	2.4	3.2	83.2
65	S.E. ¼ of S.W. ¼ Sec. 24, T. 1 S., R. 5 E.	Tenacious clay, 12 to 36 inches	Red-buff	Med.	Chert	1.7	2.4	7.8	3.3	6	79.6

Bedford Clay Loam.

One of the best limestone soils in the area is found overlying the outcrops of the Bedford limestone, being residual from that formation. It occurs mostly in Floyd County. The upper foot consists of a brownish-gray, loose loam. The subsoil consists mainly of a dark red, tenacious clay. This is a rich farming land. Corn will produce 40 bushels per acre; wheat, 20; timothy, 1½ to 2 tons. The soil is adapted to general farming and fruit raising. The price of such land is $75 to $100 an acre.

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

MECHANICAL ANALYSES OF BEDFORD CLAY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
112	Center of Sec. 8, T. 2 S., R. 5 E.	Loose loam 0 to 12 inches	Red-brown	Medium	....	0	.3	1.8	1.4	2.4	92.6
113	Center of Sec. 8, T. 2 S., R. 5 E.	Clay, 12 to 36 inches	Dark red	Difficult	Chert and iron conc	2	.8	2.8	3.6	6	78

MITCHELL CLAY LOAM.

A greater part of the territory of the area is covered with soil of the Mitchell clay loam type. It is the soil of most of Harrison County. It is found overlying the Mitchell limestone and may be considered as the residuum of the upper part of that formation. The surface soil is a loose grayish loam. This is underlain by one to two feet of brownish-yellow clay loam. Below this is a six-inch layer of mottled yellowish and grayish sandy clay loam, with considerable flint gravel. Underneath the gravelly layer is found a bed of dark red clay, very tenacious, of a thickness varying from one to several feet. In some places the surface has been removed by erosion, so that the depth to the red clay varies from nothing to three or more feet.

The topography of the surface of the most of Harrison County is peculiar in having no system of surface drainage. The underlying rocks are much eroded, having many caverns and underground passages for water. The roofs of many of these cavities having fallen in, the surface is left much broken with deep pit-like depressions called sink-holes. The water that falls in rain is gathered into these sink-holes instead of running off on the surface through a system of valleys and streams. As there is usually an opening at the bottom, these sink-holes are generally dry. By artificial or natural means the opening may be closed, and a small pond of water will cover the bottom, while inwash of soil from the surrounding plowed fields tends to fill them up. Their diameters vary from five to twenty rods, and they are from 15 to 30 feet deep.

Frequently, instead of the circular sink-hole, the depression extends in a broad valley-like surface for two or three miles, with the drainage above ground, a small stream possibly occupying the lowest part and draining at last into a hole in the ground, becoming from there on an underground stream. All of these disappearing streams connect with the main drainage channels of the region—such as Buck Creek, Indian Creek and Blue River—or there may be complete underground connection with the Ohio River. Often one of these underground streams appears suddenly at the surface, forming a "spring." Wilson's spring, in the southern part of Spencer Township, is a notable example. Here the water bursts forth from the ground in volume enough to form a good sized creek, which furnishes 30 to 50 horsepower for a mill, throughout the summer. In Indian Creek, about two miles southwest of Corydon, there is a place where the stream at low water entirely disappears

through the bottom of its channel, leaving the channel a bare rock surface for half a mile or more, when the water again begins to follow the creek bed.

Around the edges of these sink-holes the soil has become thin and stony through the erosion of the surface layer. The roughness of surface and the stoniness of the land increase as one approaches the creek valleys. At a distance of a mile or so from the streams the surface is quite gently rolling, Boone Township comprising many of the most level and most fertile tracts. Other notably fertile areas are certain broad basin-shaped valleys lying among the hills of the Huron formation in the southwestern part of the county, such as "Ripperdan Valley," in the vicinity of Valley City, and "Grassy Valley," a mile or so northeast of Valley City. The soil of these valleys is somewhat different in appearance from the soil of the same geological horizon in other parts of the county, but it is grouped with the other as a type.

Corn, wheat and oats are the crops grown most successfully. The yield of wheat is 15 to 25 bushels per acre; of corn, 20 to 50; of oats, 20 to 30; potatoes, 100 to 250 bushels per acre. Tomatoes are extensively raised in the northern part, where railroad facilities are obtainable. Fruit of all kinds is raised, but no large orchards occur. The productivity of the Mitchell clay loam varies greatly in different parts of the area, being dependent upon the relative amount of erosion that has removed the surface soil. When the surface has been washed away till the flinty layer is nearly at the surface, the fields are stony and comparatively unproductive. It has been found that deep plowing, which would reach to the red clay lying below the flinty layer, will result in adding to the fertility of the soil.

The amount of stock raised in regions of this soil is comparatively small, this being due partly, probably, to the difficulty of securing water supply. A few farmers are raising fine stock to some extent.

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

MECHANICAL ANALYSES OF MITCHELL CLAY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
69a	Farm of W. E. Yeager, Sec. 1, T. 6 S., R. 3 E.	Loose loam 0 to 12 inches	Gray-brown								
69	Farm of W. E. Yeager, Sec. 1, T. 6 S., R. 3 E.	Clay loam, 12 to 24 inches	Yellow-brown	Medium		0	0	.4	1.4	.4	95
70	Farm of W. E. Yeager, Sec. 1, T. 6 S., R. 3 E.	Silty clay loam, 24 to 48 inches	Yellow and gray mottled.	Medium		.4	.2	3	1.6	4.2	87
70a	Farm of W. E. Yeager, Sec. 1, T. 6 S., R. 3 E.	Tenacious clay, 48 to 60 inches	Dark red	Difficult							
74	N. W. Cor. Sec. 20, T. 4 S., R. 4 E.	Loose loam, 0 to 6 inches	Gray-buff	Easy	Iron conc	1	1.2	4.8	3.4	4	87.6
75	N. W. Cor. Sec. 20, T. 4 S., R. 4 E.	Sandy clay loam, 6 to 24 inches	Yellow-brown	Difficult	Iron conc	1.8	2.8	9.2	4	7.8	73.2
76	N. W. Cor. Sec. 20, T. 4 S., R. 4 E.	Sandy clay loam, 24 to 30 inches	Yellow and gray mottled.	Medium	Chert and iron conc	64.3	1	12	.2	2.4	16.8
77	N. W. Cor. Sec. 20, T. 4 S., R. 4 E.	Tenacious clay, 32 to 42 or more in's.	Dark red	Difficult	Iron conc	5.2	.8	.8	.2	2.8	86.2
78	Sec. 7, T. 5 S., R. 3 E, ½ mile west of Valley City	Loose loam, 0 to 18 inches	Gray-buff	Easy	Chert, etc	0	1.4	3	5.6	11.9	87.2
79	Sec. 7, T. 5 S., R. 3 E., ½ mile west of Valley City	Clayey loam, 18 to 36 inches	Red-buff	Medium	Chert	6.8	2.2	4.6	9.6	.94	70.8
80	Sec. 7, T. 5 S., R. 3 E., ½ mile west of Valley City	Clay	Red-buff	Easy	Chert	31	2.4	2.8	3	10	52.8
91	N. W. ¼ Sec. 18, T. 3 S., R. 3 E.	Loose loam, 0 to 12 inches	Brown-buff	Easy		.1	.1	.8	1.3	1.4	94.2
92	N. W. ¼ Sec. 18, T. 3 S., R. 3 E.	Tenacious clay, 12 to 48 inches	Red-brown	Medium		0	0	1.5	6.4	19	74.6
107	N. W. ¼ Sec. 30, T. 1 S., R. 5 E.	Sandy loam, 0 to 6 inches	Gray-buff	Easy		.1	.1	1	2.8	6	89.5
108	N. W. ¼ Sec. 30, T. 1 S., R. 5 E.	Sandy clay loam, 6 to 24 inches	Light-buff	Medium		0	.1	.3	2.6	11	85.6
109	N. W. ¼ Sec. 30, T. 1 S., R. 5 E.	Sandy clay loam, 24 to 40 inches	Buff mottled	Medium	Iron conc	.2	.2	2.6	4.6	22.2	65.4

Huron Sandy Loam.

The outcrop of the Huron formation occurs in irregular and isolated patches in the western part of Harrison County, forming round-topped hills or flat-topped ridges rising a hundred feet or so above the surrounding country. It is made up of limestone, with several intervening beds of shale and is capped with a layer of moderately tough brownish-gray sandstone. It is this sandstone layer that has protected the top while erosion has cut away the slopes, causing the rough topography of the region. Certain layers of the underlying limestone contain much chert.

The soil is a brown sandy loam, where the sandstone comes near the surface and on the slopes below. Where these ridges are of sufficient extent to have an area of level land on top, the surface soil is a very fine light gray sand or silt, in some places forming a heavy impermeable layer of "slash." Such areas are poor for crops. The soil of the Huron is in general only fairly fertile. Fruit does well on this soil, apples and peaches, especially, make a paying crop. Much of the surface of the Huron area is too stony for proper cultivation. These hills are most commonly forest-covered—poplar, oak, hickory and chestnut. But the more level parts and the gentler slopes are being reduced to farming land.

The following table gives the results of mechanical analyses of this soil:

MECHANICAL ANALYSES OF HURON SANDY LOAM.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm. per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.001 mm., per cent.
81	Near top of hill, S. side Sec. 5, T. 5 S., R. 3 E.	Sandy loam, 0 to 18 inches	Buff	Medium		0	0	.7	.4	19.8	72.3
82	Near top of hill, S. side Sec. 5, T. 5 S., R. 3 E.	Sandy loam, 18 to 36 inches	Yellow-buff	Medium	Iron, conc.	4	.4	1.6	2	40.4	50.4
83	¼ the way down from top of same hill	Loose loam, 0 to 18 inches	Brown-buff	Medium		0	0	.6	.2	3.4	90.2
84	½ the way down from top of same hill	Sandy loam, 18 to 36 inches	Red-brown	Medium		0	.8	1.4	2.8	6.8	86
85	¾ the way down from top of same hill	Sandy clay loam, 36 to 48 inches	Brown-red	Medium	Iron conc.	1.2	0	3.4	1.2	15	76.1
97	Farm of S. S. Brandenburg, S. E. ¼ Sec. 36, T. 4 S., R. 2 E.	Sandy loam, 0 to 6 inches	Brown-buff	Medium	Iron conc.	.2	.1	.1	.4	2	95
98	Farm of S. S. Brandenburg, S. E. ¼ Sec. 36, T. 4 S., R. 2 E.	Sandy loam, 6 to 24 inches	Brown-yellow	Difficult		0	0	.3	.6	.6	96.6

Huron Sandy Loam—Sub-Type.

Along the eastern edge of the Mitchell formation and on the upper parts of the drainage divide running along the eastern side of Harrison County and into Floyd County, there are numerous deposits of sand. These deposits are very noticeable where the wagon road has cut into the hillsides in the central part of Taylor township, Harrison County. The sand is usually colored a brownish yellow by iron oxid, but in some places it is nearly white. These sand deposits occur at a certain level, but do not at the surface appear as a continuous stratum.

As to the origin of these sand beds, the aeolian theory has been advanced. It has also been suggested that they are of a sea deposit, but one of much more recent formation than the Huron beds lying above the Mitchell group a little farther to the west. Many evidences seem to point to water deposition as the origin, while some of the facts connected with the arrangement of the beds would lead one to class them as correlative with the lower part of the Huron formation. As the soil type is very similar to that found on the Huron formation farther west, the location of this soil area also is indicated on the soil map as Huron sandy loam.

In many instances the red clay, customarily associated with the residuum of limestone beds, occurs just above the sand, frequently merging gradually into it. Coarse chert gravel is nearly always found overlying the sand. In several places the sand at the top is consolidated into a firm gray or brown sandstone. At one place near the south part of the N. E. ¼, Sec. 28, T. 5 S., R. 5 E., a layer of sandy limestone, or sandstone, with fossil shells, occurs just above the sand. Near the south line of Sec. 28, T. 5 S., R. 5 E., the road cuts through the sand formation exposing a section about 10 feet thick. The top is a grayish loam grading at a depth of one to two feet into a yellowish sandy clay, which in turn grades below into red, sandy, tenacious clay. The appearance is as if a limestone stratum had disintegrated just above a layer of sandstone.

The soil of this area is a grayish buff, moderately friable loam at the surface, growing coarser as it merges into the subsoil, which is often of a mottled red and buff color and may contain coarse gravel of chert, sandstone or iron concretion. The surface soil is not always affected by the underlying sand, the sandier areas being on the slopes where erosion has brought the surface of the ground to the level of the sand.

Similar deposits of sand occur in the southwestern corner of Clark County and the northwestern part of Floyd County. In this neighborhood large quantities of white sand were removed some years ago for the New Albany glass works. The deposit here is about 30 feet thick, the upper part being colored by iron oxid.

The soil of this area is especially adapted to fruit. Many acres of strawberries are grown, and apple and peach trees do well. Corn yields about 40 bushels per acre; wheat about 20 bushels.

The following table shows the mechanical analyses of this soil:

MECHANICAL ANALYSES OF HURON SANDY LOAM—SUB-TYPE.

Number.	LOCALITY.	DESCRIPTION.	Color (dry).	Friability.	Nature of coarse gravel.	Coarse gravel, larger than 2 mm., per cent.	Gravel, 2 to 1 mm., per cent.	Coarse sand, 1 to 0.5 mm., per cent.	Medium sand, 0.5 to 0.25 mm., per cent.	Fine sand, 0.25 to 0.1 mm., per cent.	Very fine sand, silt and clay, 0.1 to 0.0001 mm., per cent.
66	Middle of W. side Sec. 8, T. 1 S., R.5E.	Loose loam, 0 to 12 inches	Buff	Easy		0	0	1.2	4	15	78.4
67	Middle of W. side Sec. 8, T.1 S., R.5E.	Sandy loam, 12 to 36 inches	Yellow buff	Medium		0	0	.3	7.4	23.4	64.5
68	Middle of W. side Sec. 8, T. 1 S., R.5E.	Sand 36 to 48 inches or more	Buff	Medium	Iron conc	.4	.4	1	20.8	38	40
110	S. E. Cor. Sec. 19, T. 1 S., R. 5 E., about 40 rods N. of the corner	Sandy loam, 0 to 12 inches	Gray-buff	Medium		0	.4	.7	8.8	34.2	51
111	S. E. Cor. Sec. 19, T. 1 S., R. 5 E., about 40 rods N. of the corner	Sandy loam, 12 to 36 inches or more	Mottled buff	Medium	Sandstone	1.2	.3	.4	14.1	41.2	37
118	¼ mile west of N. E. Cor. Sec. 14, T. 4 S., R. 5 E.	Sandy loam, 0 to 18 inches	Buff	Medium		0	0	.6	2.4	33.6	61
119	¼ mile west of N. E. Cor. Sec. 14, T. 4. S., R. 5 E	Sandy loam, grading below into a red sandy clay, under which is a reddish sand	Red-buff, mottled	Medium	Chert and soft sandstone	4	0	3.4	3.2	52.6	36.8

SUMMARY.

In the above discussion we have attempted to show the present conditions as dependent upon the past and as suggestive of what may be expected of the future. We have seen that former methods of farming, with new land, were less effective in producing wealth than are modern methods on old, worn-out soil. We have seen that, whereas the former generations allowed the land to decrease in fertility, modern enterprise is seizing the legacy of depleted natural wealth and is endeavoring to redeem, to conserve and to accentuate its value. We have observed that thoughtless and unscientific labor must be superseded by efforts directed by experience, by experiment and by enlarged apprehension of conditions and possibilities. To some extent we have gone over the relations existing between natural processes, with their results, and the manipulation of the soil to produce crops. From the facts set forth here, it should be easier for the farmer to arrive at results in his efforts to solve the problems of production. He should study the tables of mechanical and chemical analyses of the main types of soil and should deduce conclusions as to the particular need of his own land. He must experiment. After all is said and done in the way of a soil survey, it rests with the farmer to work out his own solution for the proper adjustment of conditions for the ideal operation and utilization of refractory soils. This report should be of service also to those farmers in other parts of the State, and in other States, who wish to gain some idea of agricultural conditions in this region preparatory to investment in these lands.

It has been seen that there is a great variety of soil and that there is a marked disparity in their fertilities. The cause for this difference, it has been observed, is attributable to certain chemical and physical properties of the soil, to insufficient drainage, to excessive erosion, etc. While much may be attained through the soil survey, it would seem that the most effective way for the State to secure intelligent, concise and conclusive information as to the needs of particular soils would be by having a small area of each type operated for a term of years experimentally. The State could well afford to rent or buy these experimental tracts and to have a thorough and systematic course of experiments applied, with a view to ascertaining all possible facts connected with crop production on those areas. In no other way can experimental farming be so effective, for in no other way can every condition of climate, of

surface, of geological structure and of soil be realized. Many parts of this area have a confessedly poor soil, for some reason. It is a matter of supreme importance to the farmers of these regions that something be done, by State aid, that will show actual results in increasing the productivity of these soils, if the results of the soil survey be not sufficient.

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