A Soil Survey of Decatur, Jennings, Jefferson, Ripley, Dearborn, Ohio and Switzerland Counties, Indiana.

By L. C. Ward.

THE TERRITORY.

The territory embraced in this report consists of the seven counties above mentioned, lying in the southeastern corner of Indiana. The area is bounded on the south by the Ohio River, on the east by the State of Ohio, and on the north and west by the limiting lines of the counties named above. With the exception of Decatur County, a common bond of geology justifies the consideration of this territory in a single report.

The work done is an attempt to classify the soils of the territory on the basis, first, of their origin, and, secondly, their physical and chemical composition. The methods, in the main, are those used by the Soil Survey of the United States Department of Agriculture; and wherever possible the system of nomenclature used by that survey has been followed.

Geology and Physiography.

No discussion of the soils of a region can be intelligently begun without some discussion of its geological history, and the subsequent effects of weathering, stream action and other agencies which have operated to make it what it is. These will be considered in detail in connection with the descriptions of the soils by counties. But it seems desirable here to consider these subjects in their general relations with the area as a whole. This general description must be understood as applying to all the region except Decatur County, which, in two-thirds of its area, is entirely different from the remainder of the territory.

Geologically, the region under discussion forms part of the western side of the Cincinnati dome, a name given by geologists to an island which arose from the ancient interior sea, and has probably been land ever since. This dome is elliptical, with its

long axis nearly north and south, with the present city of Cincinnati not far from its focus. On this western side the rocks dip to the west at an inclination of from 10 to 60 feet per mile. The surface, however, rises toward the west, perhaps because of the increasing resistance of the rocks, in an ever greater degree; hence, in traveling from Cincinnati to Batesville, in Ripley County, a distance of fifty miles, one rises gradually from a height of about 475 feet above tide to about 1,050 feet. As a whole, the area is a plateau, with an average elevation of about 900 feet above sea-level—a plateau with its highest levels in the northern part of the area, sloping off to the south and east, gradually, until within a mile or two of the Ohio River, and then abruptly sloping down into the valley of that stream, 300 feet or more in a distance of four or five miles. This plateau is underlain with limestones and shales, beveled to a small degree where they outcrop. These, in order, beginning with the lowest and oldest, are as follows:

(1) The Trenton formation, which has been mapped as a narrow ribbon in the extreme southeastern corner;

(2) The Utica shales, exposed in the deepest valleys near the Ohio;

(3) The Lorraine limestone, which is the principal outcropping formation for 10 to 20 miles back from the Ohio;

(4) The Hudson River group, the upland limestones and shales between the last-mentioned group and the Niagara;

(5) The Niagara, a hard limestone which extends in a belt averaging 15 miles in width from the river to the northern limits of the territory;

(6) The Corniferous limestone, a narrow strip just above the Niagara, and,

(7) The New Albany shales, which are the surface strata on the western border of the region.

The first four groups are commonly known to geologists as members of the Ordovician or Lower Silurian series, and the last three as parts of the Upper Silurian strata. The arrangment of these strata can best be understood by reference to a good geological map of the State. The influence of each formation will be considered in detail in connection with the counties in which it occurs. Suffice it to say here, that the Niagara limestone is the backbone of the entire area, a resistant stratum furnishing a pronounced divide between the softer rocks on each side.

Mention must be made here, also, of the glaciation of this re-

gion. Any map of the United States, representing its condition during the great Ice Age, shows the terminal line of the glacier as just touching the Ohio Valley near the southern border of our area. If the reader will understand by this line, a boundary, not of the ice itself but of certain *results* of glaciation, it is, no doubt, nearly correct. But of the actual presence of the ice within the limits of these counties there is very little evidence, except in the extreme northern portion. Probably the greatest influence of the glacier upon this area lay in the deposition, from the waters escaping from it, of enormous quantities of silt, sand and gravel, partly in terraces along the Ohio River, but mainly as a great sheet of yellow "loess" over the greater portion of the plateau.

Physiographically, the region is a dissected plateau, with the master stream, the Ohio, just approaching maturity. The Ohio, in its course along the southern border, flows in a rather deep gorge, averaging perhaps 300 feet in depth. The stream fills practically the entire gorge floor, flood plains being found only at intervals on the inner sides of the bends. Of course, with the principal river not yet possessed of flood plains, one should not expect very extensive valley floors along the tributary creeks. As a matter of fact, these smaller streams all flow in narrow, deep valleys, in some places near the river veritable canyons. Very few of them have bottoms at all commensurate with the size of the current. It is probable, also, that where bottoms are found they are due mainly to the influence of glaciation. Very nearly all of the Ohio valley floor is made up of gravel and sand terraces, of which the composing material is entirely glacial. Along Laughery, Muscatatuck and numerous smaller tributaries the soil of the bottoms is found to contain many glacial pebbles, and sand and loess from the neighboring hills. It is certain that in the extreme southern border of the area, where one would naturally expect the streams to show their greatest development of valley floor, no bottom ground occurs. In this portion of their courses, however, the creeks have little material to carry, since the valley sides are largely stone. Farther up, the hill tops are mainly loose clay, sand and loam—material easily eroded by the active rills of the uplands, but carried in flood times into the more gently-sloping larger valleys in such quantity that much of the suspended material must be laid down as alluvium.

CLIMATE.

From the agricultural standpoint, the climate of this region is very favorable. The average date of killing frost is nearly a week later than in northern Indiana, and late spring frosts are not so likely. The Ohio valley has its beginning of spring at least two weeks earlier than Huntington or Ft. Wayne, as I have determined by the collection of data as to the times of blossoming and "leafing out" of common trees and wild flowers. The total annual rainfall averages not far from 40 inches—an amount sufficient for all crops likely to be attempted in this region, without irrigation. Few seasons are too wet for the majority of crops, but once in every five or six years an extraordinarily dry August injures late maturing crops, as corn or late potatoes.

In the collection of samples for chemical analysis, no account has been taken of county boundaries. The aim has been to obtain a fair average specimen of each soil type. Thus, for the Miami silt loam, eight samples were taken from widely different points in its occurrence, and these thoroughly mixed. From this mixture a sample was chosen which presents the average characters of this soil. For the mechanical analysis, on the other hand, the samples were tested by counties. If a soil thus tested differed in no great particulars from a previous test of the same type, the test refers back to the previous test. When there is a divergence, a second table is included in the report.

JEFFERSON COUNTY.

The extreme length of this county is 26 miles, east to west; its breadth 23 miles, north to south. Its approximate area is 360 square miles. Madison, the county seat, is in the southern end of the county on the Ohio River, and on a branch of the Pennsylvania Railway lines—the old J., M. & I., the first railroad in the State. The extreme western side of the county is crossed by the Louisville branch of the B. & O. S. W. Railway.

CLIMATE.

The records of the Weather Bureau, compiled at Madison, show the average annual temperature at that point to be 55.7° Fahr., with a range of from 31.5° F. in February to 77.9° F. in July. The average annual precipitation at the same place is 40.96 inches, with a range of from 2.06 inches in October to 4.86 inches in March. On the uplands in the north of the county, the tempera-

ture is perhaps 2° lower. These conditions of temperature and precipitation are sufficient for any ordinary farming; and taken in connection with the early spring and late fall of this section of the State, this county is, from the climatic standpoint, one of the most favorably situated in the State.

Geology and Physiography.

Within the borders of this county are represented all the strata mentioned in the opening section except the Trenton. The eastern third of the county is underlain by the Utica shales, Lorraine limestone, and Hudson River group of mixed limestone and shales. All three of these formations are more or less shaly with intercalated beds of thin, hard limestone. On the whole, however, all are soft and easily worn. A belt averaging about 8 miles in width, extending north and south across the county, has for its underlying rock the Niagara limestone, a hard resistant stratum, whose wearing qualities are responsible for the great upland region in this county. Above the Niagara comes the Corniferous limestone, almost as hard, with the New Albany shales, a much softer formation, for the cap-rock on the western border. On all of the uplands there are traces of glacial action, very faint in most of the county. These traces consist for the most part of occasional fragments of glacially-transported pebbles, and the presence of certain soils whose origin is hard to explain as a result of mere rock decay.

Physiographically, the Ohio River has been the greatest factor in the bringing about of the present appearance of the land. This great stream, in cutting its gorge down through the rocks, has carried the minor tributary streams with it. These, therefore, are now found occupying deep, narrow valleys, incised often 300 feet beneath the surface of the uplands. The other factor of importance has been the resistance of the Niagara limestone. This rock has so well protected the uplands that the streams have been able to do relatively little sidewise cutting. The topography, then, of the greater part of this county may be described as the resultant of these two factors—a gently-rolling interstream upland, cut deeply by narrow, steep-sided gorges—essentially a youthful topography.

SOILS.

Five types of soil have been mapped in Jefferson County. Four of these have been derived from the decomposition of the underlying formations, with perhaps some glacial action. One of

the four, the Miami silt loam, is perhaps entirely glacial, and another, that mapped as limestone upland, has been only slightly influenced by glaciation. The fifth soil consists entirely of material deposited by the Ohio River in its flood plain, or, in the smaller streams, of deposited material plus some wash from the neighboring hillsides. These soils, arranged in order of amount of territory occupied, are:

Volusia silt loam	161 square miles
Limestone, upland	126 square miles
Miami silt loam	41 square miles
Waverley silt and gravelly loam	13 square miles
Scottsburg silt loam	19 square miles

The Scottsburg Silt Loam.

This type of soil occurs very sparingly in Jefferson County, forming oval or nearly circular patches of from 10 acres to 1,200 acres in extent on the highest points of land in the western part of the county. It is a light-colored soil, in the summer when dry being almost white. When wet it is gray or drab in color. At depths of 8 to 15 inches this color gives place to a slightly yellow subsoil, sometimes mottled with drab and darker yellow. In places there is considerable sand; but for the most part sand is absent, and the soil in such places is very much like a stiff clay. This soil type is easily recognized by its nearly white color, by its stiffness and by its flatness. The tracts of this soil are in many places so flat as to be swampy. Where the patches are small, indicating advanced erosion, little streams have worked their way into the swamps and drained them; but in the larger tracts, say 100 acres and up, even in June swampy, marshy places are common. The native forest in such places consists of the water loving trees of southern Indiana—elm, black gum, sweet gum, beech and black hickory.

This soil is called by the farmers "thin." It undoubtedly is poor farm soil, so poor that much of it is still uncleared. This stiff, tenacious soil is slow to part with its water, and consequently is too wet for the plow until late in the season. On the other hand, only 15 inches down is a bed of clay, almost impervious; and in July or August, if drought should come, plant roots could find no moisture in the subsoil. Therefore this is a bad soil for dry summers. If it is to be cultivated at all, probably the best scheme is to tile thoroughly, thereby securing early summer plowing; and then to plant to such crops as mature early.

When this soil is first cleared, a few good crops can be obtained, until the meager supply of humus is exhausted. After that stage is reached, careful rotations of clover must be made to obtain anything like fair yields. Thus, on one such area, corn yielded 30 bushels per acre for three years, and then dropped to 10 bushels. Wheat and grasses do better than corn, if enough commercial fertilizer be used, since these crops are harvested before dry weather begins. Clover does fairly well, and should be sown every third year to keep this soil in even fair condition. The most profitable crops, however, seem to be tomatoes, garden vegetables, and small fruit, but this is due probably to the fact that gardens are usually kept in better condition than the larger fields.

Taken all in all, this soil is poor, and Jefferson County is fortunate in possessing so little of it.

Volusia Silt Loam.

This soil is one of the most important of the county, being surpassed in general agricultural virtues only by the limestone upland to the east. This soil lies almost altogether to the west of a line passing through Bright's, a village on the J., M. & I. Railway. It is recognized as a fair farming soil, adapted to most of the crops usually attempted in this region. It forms the surface soil of the western part of the county, except where the Scottsburg caps the higher hills. It is formed by the decay of the New Albany shales, and thus lies well east of the present outcrops of that formation, over ground where it formerly existed. The evidence that this soil resulted from the decay of the shales is the presence in both of great numbers of peculiarly-shaped brown iron concretions. These, in the beds of the smaller streams, are so numerous as to form small gravel banks; and they have been used to a limited extent in road repair work.

The Volusia is a brown soil, sometimes, however, yellowish when dry. At depths of two or three inches it is invariably brown, and the color increases in depth with the depth of the soil. In the surface, sand is present in noticeable quantities, very fine in texture. At depths of 8 to 12 inches the soil gives place to the subsoil, light red or yellow in color, stiffer than the surface and with less sand. With increasing depth practically all of the sand disappears, leaving a heavy, tenacious clay which grades into shale at depths of four to five feet. Throughout the entire depth iron concretions are met, more numerous at the top. The shale be-

neath contains these concretions also, but not nearly so numerously as the weathered clay. This fact points to the theory that many feet of the shale must have been decomposed to yield one foot of the soil and subsoil.

The topography of the Volusia area is rather broken. The underlying Corniferous and Niagara formations have served to protect the uplands from great erosion. Consequently, to a depth of about 30 to 40 feet below the general surface, the hills are rounded and the valleys rather open. When once the streams get through the harder rock upon the softer shales below, they cut almost straight down with steep-walled, deep valleys. The effect upon the drainage is good. Practically all the area covered by this soil is well drained naturally, and the deep gorges rapidly carry off surface waters. Where the underlying shale is close to the surface, along the steeper upland slopes, crops suffer from drought, but on the majority of this soil body there is little danger in average seasons. Corn averages here 32 bushels, wheat 18 bushels, oats 27 bushels and clover 1.5 tons per acre. Tomatoes thrive, and garden truck generally. Careful cultivation and systematic rotation pays well here, as upon most clay lands; and the figures given above are often exceeded by those farmers who mix brains with their fertilizer and care with their crop rotations.

Since this soil and the Scottsburg silt loam occur in the same district, it has seemed well to place together tables showing the mechanical composition of the two soils, side by side, for comparative purposes:

Volusia Silt Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	2.4%	16.2%	5.4%	66.2%	10.7%
Subsoil	.7%	9.9%	8.2%	56.3%	26.2%

Scottsburg Silt Loam.

Soil	1.1	12.6	11.7	60.4	15.6
Subsoil	.5	5.7	6.6	70.4	18.7

The principal differences are in the content of gravel, (which is practically all iron concretions), and in the colors of the two soils. There is yet another physical difference, which does not come out in the table, namely, the tenacity. The Volusia, probably because of its higher sand and concretion content, is a rather loose, crumbly soil. The Scottsburg loam, on the contrary, has a tendency to pack into hard lumps. Probably the great difference in the

farming value of the lands is traceable to this physical difference in the soils.

The Limestone Upland Soil.

This somewhat awkward name has been applied locally for years to a certain class of soil in this and neighboring counties, and adopted in this report, although it is not recognized in the Soil Primer of the U. S. Department of Agriculture. It is used here because no other designation could be found which could be made to apply. In Jefferson County this soil is second in extent and a very close second in farming value to the Volusia, if, indeed, it does not surpass that soil. The name is used to designate those soils which have been formed from the decay of limestones, without much admixture of shale products. On the western border no hard and fast line can be drawn between this region and the Volusia. Indeed, there is a belt, some half-mile in width, which is a mixture of the two. The criterion of separation of the two is the presence or absence of chert or flint pebbles. The Niagara, in its upper layers, is rather thickly studded with chert concretions, while these are almost entirely absent in the overlying rocks. It is obvious, then, that if a soil is found containing many flint pebbles, it must have resulted largely from the decay of the flint-bearing rock; and all soils containing these in quantity have been called Limestone Upland. In the eastern portion of this area the flint pebbles are absent, but the soil contains many rock fragments and fossils exactly like those still in place in the stream beds of the vicinity.

Soil Characters.

In attempting to describe this soil one must recognize two regions in the area covered by it. The difference is partly topographical and partly due to the difference in the composition of the rocks whose decay produced the soil. The western half of this belt, comprising those soils produced by the decay of the upper members of the Niagara, is a gently-rolling upland, with none of the hillsides too steep for cultivation. Back from the river six or eight miles the streams occupy open valleys, and the ground may be plowed almost to the creek banks. Near the river the creeks have cut through the Niagara, and below that formation have steep-sided gorges, whose walls can not usually be cultivated. On this portion (the western half) of the Limestone Upland the soil is red. It is distinctly redder than the brown Volusia, and

somewhat more compact. At depths of 10 to 20 inches this red soil gives place to an orange-colored or yellow subsoil, the difference in color between soil and subsoil depending upon the extent of oxidation of the iron so plentifully contained in the soil. Pebbles of flint occur abundantly, forming a sort of gravel, which tends to keep the soil open and porous. These pebbles are angular, and vary in size from a hickory nut to a large egg. This soil is strong, capable of raising great crops of the usual farm products of this region. In average seasons corn runs here 45 to 55 bushels, wheat 18 to 20 bushels, clover 2 tons or more and timothy 1.5 tons per acre. Drought has little effect upon this soil, since moisture penetrates the entire depth of soil and subsoil. The rolling character of the land renders tiling unnecessary in 99 per cent of the area. This is a limestone soil at its best.

The eastern portion of the Limestone Upland, to a distance of five miles, approximately, from Indian Kentuck, is occupied by a soil of a different character. The resistant Niagara is absent here, and the streams have had only soft shales and limestones to work upon. Consequently the gorges are deep, and the sides of the valleys in most places too steep for cultivation. This is a hillside soil, made up of the products of the decay of the rock. It might well be called a stony loam, since flakes and slabs of limestone are plentifully mixed with sand and clay. It is a very open, porous soil, usually less than 24 inches in depth, with the ledge rock immediately below. In wet periods, in the spring and autumn, great bodies of it slide down the hills, exposing scars very noticeable among the heavy underbrush. As to fertility, it is doubtful whether any soil in the State equals this for the first two years after being cleared. When new it is black, loose, porous and, of course, well drained. Where the hillsides are gently sloping enough for cultivation this soil yields tobacco, corn and anything else planted in Indiana. In the alluvial fans which occur along the foot of the hills, potatoes and garden truck grow luxuriantly. Unfortunately, however, these soils are transitory. Erosion is proceeding at such a rate in this area, and the streams are so active, that within five years after clearing most of the soil is gone. It is a common practice on these steep slopes to get as much profit out of the soil as possible in the shortest time, and then clear a new tract. Thus, tobacco is planted the first two years and then corn as long as there is soil enough. This wasteful method has resulted in the abandoning of many farms as worn out. It is an actual fact that much of this region is not worth as much as it was forty years ago. The salvation of the soil rests in find-

ing some crop that will perform the function of tree roots in holding the soil between years of plowed crops, and alfalfa seems destined to that use. Little of it is sown in Jefferson County, but in Switzerland County it is coming into use and will be considered there as a crop for such soils as these. The following table gives the mechanical analyses of samples of both Limestone Upland soils, one being designated as Limestone silt loam, the other Limestone stony loam:

Limestone Silt Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	4.2%	6.7%	8.3%	59.2%	22.0%
Subsoil	2.3%	5.7%	7.8%	63.3%	21.7%

Limestone Stony Loam.

	Gravel.	Sand.	Very fine sand.	Silt.	Clay.
Soil	16.3%	14.2%	17.7%	50.1%	2.3%

It will be noticed that the latter soil is much more composed of coarse elements than the former; the greater per cent of gravel is explained by the fact that this rock is much less weathered than the former. The higher sand content is due to the admixture of shale products, as well as the fact that the finer clay particles have to a great extent been removed by stream action.

Glaciation and the Volusia, Scottsburg and Limestone Upland Soils.

These three soils have been mapped as drift soils. There is very little evidence for such placing, in the soils themselves. Each is exactly what one would expect to result from the decay of the underlying rock. Not a dozen pebbles of igneous rock were seen in the area covered by these soils, nor any sign of till or boulder clay. There is not a glacial striation on the Niagara limestone at any of its exposures. The soils themselves do not seem to have been disturbed. The iron concretions in the Volusia and the flint fragments in the Limestone Upland increase gradually in relative numbers as the surface is approached; and the soils grade downward from true soil, through fine waste, coarse waste, rock fragments into the solid rock below. It may be true that these soils have been affected by glaciation, but there is now no sign of such action. Quoting from Mangum and Neill, in their Report on the Soils of Scott County* in this connection:

* U. S. Dept. of Agriculture, Soil Survey of Scott County, Ind., page 10.

"The surface material of the area is, in the main, so similiar to that formed by the disintegration of the underlying geological formations that it is difficult to determine what proportion of the soils is derived from material reworked by glacial agencies and what proportion has been derived directly from the decomposition of the rocks."

The Miami Silt Loam.

This soil, the third in extent of the soils of Jefferson County, occurs here as two tongues extending south from a larger body of the same soil in Ripley County. Since its chief occurrence in the seven counties is in Ripley, it will be taken up in more detail there. At this place it will be sufficient to say that it is a clay soil, usually yellow, but often bleached to white, with a subsoil of a deeper yellow hue, mottled with drab and containing lumps of bog iron ore. It is invariably flat and poorly drained, and supports a group of plants more or less swamp-like in character. There is evidence that this soil was formely more extensive in Jefferson County, forming the cap of the interstream ridges of the eastern half of the county. When it finally had been removed from those points it left behind a few small glacial pebbles, with here and there a trace of blue till. This soil requires tiling and careful cultivation to render it dry enough for good farming. It is a grass soil primarily, yielding as well in timothy and wheat as the better Limestone Upland soil, but not so well in corn or potatoes. It responds fairly well to commercial fertilizer, but experience shows that barnyard manure and clover are the better soil dressings. This soil is undoubtedly glacial. The evidence will be given later, in connection with the work upon Ripley County.

A mechanical analysis of this soil, taken from near the center of its area, shows:

Mechanical Analysis Miami Silt Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.56%	12.0%	8.2%	60.3%	21.4%
Subsoil	.5%	14.0%	9.6%	51.2%	25.5%

Waverley Silt Loam.

This soil-type, which occurs only sparingly in Jefferson County, is defined as soil deposited by streams upon their valley floors, or flood-plain soils. Of this type there is little along the Ohio within this county. In the northwest portion of the county

on Big Creek there is a narrow bottom occurring principally in small tracts on the inside of the bends. This bottom soil is derived from the hillsides, and is much like the soils of the uplands. The sand content is a little greater, and the clay somewhat less. There is a greater amount of organic material, shown by the darker color of the soil, but its relation to the uplands is clear. This soil is well drained and porous. It raises corn, wheat, potatoes and garden truck, and is the best tomato soil in the county. The canning factory at Deputy relies upon the bottom lands in the vicinity for most of its pack.

A glance at the map shows that the greater part of Jefferson County is on the outer side of the bend in the Ohio. This means, of course, that there will be little river bottom in this county. Only in the extreme southwest portion, in Saluda Township, is there any considerable river bottom. These deposits are partly glacial, as shown by the glacial pebbles contained in them, and partly due to local deposition, as shown by the iron concretions and flint pebbles so similiar to those in the uplands. Besides these sources, the bottoms contain much silt brought down by the river. These river bottom soils will be taken up in detail in connection with Ohio and Switzerland counties, where they form the most valuable soils of those counties.

Agricultural Conditions.

There is as much variation in farming conditions in different parts of Jefferson County as one can well imagine. In some portions the farms are as well and as carefully cultivated as any in the State. In other localities there is a general air of shiftlessness and poor farming that can hardly be excused. The soils of this county are such that only the most careful husbandry can keep them at their highest state of productivity. Experience shows that for such soils as these no fertilizer is equal to barnyard manure; and yet in many places this valuable material is found piled close to the edge of a brook that soon carries away the best part of it. Care must constantly be exercised on the steep hills to prevent their washing away. That this can be prevented in many places is shown by a number of fine hillside farms. That it is not always prevented is shown by the number of worn-out farms. The great need of this county is a wise rotation of crops, conservation of all manure elements, and a return to the soil, from year to year, of a little more plant food than is taken off. Such a

policy has produced some of the finest farms in southern Indiana —farms that have brought their owner at least moderate wealth, and which are today more valuable than ever they were.

The principal drawback to farming in perhaps half this county is a lack of transportation facilities. True, the river flows along one edge of the county, but there is difficulty in descending the steep river bluffs with any fair sized load; and the best farming land in the county is at a great hauling distance from a shipping point. The railways, also, are far removed from at least one-third of the county, and some of that the equal of any land in the county for farming purposes. This points to concentration of weight in sale products, which is reached probably in the hog and cattle. At any rate, two thousand pounds of hog, worth $120, are no harder to haul twelve miles to market than two thousand pounds of corn, worth $20; and the farmers in this county whose farms indicate careful work, are those who have most hogs and cattle to sell.

Erratum.—In the soil map of Jefferson, the portion of the legend reading "Miami Clay Loam" should read "Miami Silt Loam."

Chemical Analysis of the Volusia Silt Loam Occurrence—Jefferson and Jennings Counties.

Moisture at 105° C	3.87
Total soil nitrogen	.115
Reaction of soil to litmus	Acid
Volatile and organic matter	3.910
Insoluble in Hcl (1.115 sp. gr.)	83.272
Soluble silica	.034
Ferric oxide (Fe_2O_3)	3.903
Alumina (Al_2O_3)	7.860
Phosphoric acid (Anhyd) (P_2O_5)	.137
Calcium oxide (CaO)	.169
Magnesium oxide (MgO)	.378
Sulphuric acid (Anhyd) (So_3)	.046
Potassium oxide (K_2O)	.359
Sodium oxide (Na_2O)	.098
Total	100.256

RIPLEY COUNTY.

LOCATION.

This county is in the southeast corner of Indiana, one county removed from the State of Ohio on the east, and also from the Ohio River on the south. Its greatest length is about 27 miles, its greatest width 18 miles, with an area of approximately 450 square miles.

Climate.

The average temperature of the county, obtained from averaging temperatures furnished by the Weather Bureau at points east, west, north and south, is about 54°, with a minimum for February of 30°, and a maximum for July of 77°. The precipitation averages about 40 inches. From the climatic standpoint this county is as favorably situated as can be expected in this latitude.

Geology and Physiography.

Laughery Creek forms the dividing line for its entire length in this county between the soft limestones (impure) and shales of the Cincinnati epoch on the east, and the Niagara formation of the Upper Silurian on the west. The outcrops of the Niagara form an escarpment on the western bank of this stream easily recognizable throughout the county. The topography of the county is directly a result of the geological structure. East of Laughery the rocks are soft and easily eroded. Even the smaller streams in that half of the county flow in narrow, steep-walled gorges, especially as they approach the master stream. On the western side of the county, however, the resistant Niagara furnishes a solid base for the streams, and only the larger are able to cut through it into the softer rocks beneath. These are Big and Little Graham, Otter Creek and Tanglewood Creek. Generally speaking, the area east of Laughery is a very much dissected plateau, the area to the west much smoother. Toward the east border of the county, however, where the streams head, the surface is quite level; and on the western plateau the surface is very broken in the southwest corner of the county near the larger streams named above.

As a consequence of the dip of the rock to the west in this county, Laughery has been forced always toward the western bank with greater pressure than toward the eastern. This fact, in connection with the presence of a resistant rock on the west, and soft rock on the east, has resulted in a peculiar valley form. The western valley side is practically everywhere steep—so steep that cultivation is entirely out of the question. It is an ideal cliff-and-talus slope for much of its course, averaging something more than 125 feet in height throughout the county. The eastern valley-side is much less precipitous, in some places arable from top to bottom, and nearly everywhere of gentle slope enough to allow of an accumulation of soil over the rocks. The entire expression of this valley is youth, or early maturity. There are bottoms, or alluvial

deposits along the stream, but these are comparatively small, and found only on the inner sides of the bends of the stream. There are few true meanders, and the valley sides are entirely too steep to admit placing the stream in any other stage than youth. Such alluvial lands as occur are of great farming value, and are the most valuable agricultural asset of the county in point of fertility and productiveness.

The underlying rocks of this county have not exerted a profound influence upon the chemical composition of the soils except in very limited areas. Glacial debris was carried out by the escaping waters from the old ice front and laid down over practically all of this county, in a sheet varying from 30 feet in thickness on the north boundary, to 3 or 5 feet toward the south. Perhaps some of the debris was derived from rocks now buried beneath later accumulations, but there is little positive evidence for such belief. But if the underlying strata have contributed little to the composition of the soils, they have influenced to a very great degree the present condition and value of lands. On the western side of the county the resistant Niagara limestone has protected the glacial clays from erosion, by preventing stream action. Hence in this area the soils lie in great flats, which are unprofitable unless drained. On the eastern side of the county, where the rocks are softer, the streams soon recovered their former channels, and have since then been carrying off great quantities of glacial clays and sands, leaving the eastern side much better drained than the western.

THE SOILS IN DETAIL.

Miami Series.

The principal soils of this county, both from the point of view of extent and value, belong to the series called by the U. S. Government Soil Survey, Miami. These soils are described in the Soil Primer as "light colored surface soils," as "derived from glaciation," and as "having been timbered either now or originally." This last characteristic is necessary to separate the Miami soils from the poorer members of the prairie-making soils. These Miami soils are often called "Loess," a name applied to certain fine-grained, light-colored soils which occur in many places on the earth. With regard to the derivation of Loess in general there is at present a great conflict of opinion, some geologists holding it to be due to wind deposit, others to water. In Indiana there can be little doubt that water was the agent, for our so-called loessal soils,

at least in southeastern Indiana, are not true Loess. In the six counties which contain much of this material, it is invariably found to contain a considerable percentage (1 to 6) of very small pebbles, none larger than buckshot, evenly scattered throughout the entire mass of soil. Small as they are, these pebbles are too heavy for any ordinary wind to move about, and if we imagine their being carried by storm-winds, there is little chance of their being evenly distributed. Further than that, such storm-winds would have to exceed in violence any of the last five years, for repeatedly within that time I have seen great winds blow the dust from our roads, leaving behind the pebbles. But there is other evidence. Quite often, in digging wells and cellars, one cuts through beds of gravel, with pebbles as large as a hickory nut, which are clearly too large for wind-carrying, and yet which bear evidence, by their arrangement, of deposition. It seems better, on the whole, not to call these deposits, in the area described here, Loess, but to use the term Miami, which at any rate is accurately defined.

Reference to the map of Ripley County accompanying this report, shows that about eight-tenths of the area is mapped as Miami soil, either Miami clay or Miami silt. The reasons for making the distinction between these soils east of Laughery and west, rests upon internal differences in part, and partly upon diverse conditions of drainage, including till, and farming value. It is probable that a long while ago, shortly after the glacial waters had subsided, both sides of the county were covered with a layer of waste substantially alike in its composition, and that it was all more like the soil mapped as Miami silt than Miami clay. But, as we have shown, erosion was much more rapid on the east than the west side, and valleys were carved through the waste very soon. Thus it happened that in this region the early glacial surface was soon cut to pieces and the soil dragged down into the valleys. At the present, on the highest lands of this area, in the vicinity of Milan, and Clinton in Adams township, there are tracts of soil which bear a very close resemblance to the Miami silt; but for the most part the soils in this area are a mixture of glacial waste and the clay resulting from the decay of the shale and impure limestone below. This, then, is the first characteristic of the Miami clay loam. We keep the name Miami to indicate the fact that the soil is partly glacial, and use the word clay to indicate that part of the soil substance results from the decay of native rock. The addition of "loam" implies that this mixture is in a tillable state. The soil is yellow at the surface, grading down-

ward into a brown subsoil, somewhat mottled and stained in places with darker brown spots. These mottled places, when examined, are often found to contain nodules of limonite or bog iron. Furthermore, on this eastern area, the soil is frequently found to contain siliceous fossils and bits of limestone identical with the fossils and rock below. Over most of the area covered by this soil drainage is good, due to the rolling nature of the surface, and the abundance of small streams. Tiling is necessary on the higher lands about the head waters, and in some of the flat valleys. In the northern part of this area the blue till, an impervious stratum, is found, at depths of from 6 to 30 feet, about 12 feet being a fair average.

When we compare the Miami silt loam with the Miami clay loam, the chief difference at first noticeable is compactness in the latter. In the clay, the admixture of limestone residuum left the soil somewhat porous; but in the silt, where rock fragments are few, the soil is exceedingly close and compact. The color of the Miami silt loam is light yellow to drab when damp, but when dry it is often almost white. At depths of six inches to one foot the soil grades into a subsoil of lemon-yellow, with brown mottlings; and from top to bottom there occur numerous very fine pebbles of granite, quartz, slate and other glacially transported fragments. At depths seldom exceeding ten feet, and usually about four, the blue till is found, a dense, impervious blue clay containing many bowlders, from the size of a cocoanut to the size of a flour barrel. Where a stream cuts into this bowlder-clay, its floor is studded with hundreds of these stones. The presence of the blue till exerts a marked influence upon the soil, if it is within five feet of the surface. Water cannot penetrate it except very slowly; hence the silt lying above becomes heavily waterlogged, all the more because these lands are flat. Such soils are hard to cultivate, being too wet for the plow until a month after hillside ground has dried out. They are readily recognized by the timber growing upon them, which is chiefly swamp-growth—beech, sweet gum, black gum, swamp maple, etc. Another mark is "crawfish chimneys." These creatures, in excavating their holes, find an ideal condition of permanent water in the upper portion of the blue till; and this material, when heaped up in their peculiar style, dries into a white chimney. Of these, I counted in a space three paces (9 feet) square, 53; and there were at least five acres as badly infested. The early settlers were careful of buying "crawfish" land, and a farm containing much of such soil is considered even yet poor.

Another peculiarity of these lands is the white or drab-colored mud of early spring, from which they are known locally as "Buttermilk flats," or "slashes." Trivial as such marks may seem, they yet have value because based upon real characters in the soils. Where the till is still closer to the surface, say 2 or 3 feet, another important effect of its presence is noticed in dry years. For the same reason that moisture does not pass downward in wet times, it cannot pass upward in dry, nor can plant roots penetrate such formations. In droughts, then, the plants which first die are those in the soil which was wettest in the spring.

Methods of Cultivation.

When the first settlements were made along the Ohio, the slashes and swamps of Ripley County were a "hissing and a byword" among the settlers on the hills near the river. They were esteemed of little value except for hunting grounds; and to a great extent the prejudices of those days yet live. When Ohio and Switzerland and Dearborn counties were famous throughout the Ohio Valley for hay, and potatoes, and corn from the bottoms, Ripley was a wilderness, except along the streams, where the country was broken enough to suit the pioneer. After awhile, however, it was discovered that these wet lands would grow crops if they were properly plowed, in narrow "lands," with ditches running down the faint slopes to the creeks. Plowed in this manner, wheat and grasses grew pretty well, and yielded fairly, but the waste of land was great, since only the higher portions would grow crops. Then came the tile-makers, who made not only their tiles, but the fortunes of wet counties as well. The flat lands, drained thoroughly with tile, prove as good as any in the district. They are not as fertile or productive as the bottoms along the creeks; neither are crops drowned or uprooted by freshet. They will not raise corn or tobacco, as the hillside soils further south, but neither are they gone in five years' time. They do not raise such enormous crops as the black lands of northern Indiana, but neither do they bankrupt the poor man who tries to work out a home for his family. Considering the crops which these lands raise, they are the cheapest in the State; and it is easily enough shown that they furnish at least twice as good an investment as the prairie lands of Illinois.

The other soils of importance in Ripley County are represented in the map as Waverley loam and limestone clay. The


Soil Map
of
Ripley County.
Batesville
Bunman
Osgood
Milan
Versailles
Laughery
MCL
MSL
WSL
LSC
LEGEND
Miami Clay Loam
Miami Silt Loam
Waverley Loam
Lime-stone-Clay

former name is used by the U. S. Soil Survey to denote any river or stream deposited soil, commonly known as bottom ground. Of this soil, there is comparatively little in Ripley County, a mere strip averaging perhaps half a mile in width along Laughery, and smaller belts along the smaller streams. In places the Laughery bottoms are more than a mile wide; and whether wide or narrow, they are the finest soil in the county. In the upper part of the valley, down as far as the B. & O. S. W. Railway, the bottom soils are principally the wash from the hillsides, and are much like the hillside soils in color, being somewhat darker because of the greater organic content. They are sandier, too, much of the finer clay having been carried away by the streams. Thus these valley soils are more "mellow" or "light" than the uplands, and are thus more desirable. From the B. & O. S. W. Railway south, the bottom soils are chiefly made up of the residuum from the decay of the limestones and shales in the valley sides. The soil is dark, mellow and rich, and no better can be found in the State for general farming.

The other soil mentioned above is the limestone-clay soil. This is the product of disintegration of the shales and limestones underlying the county. Where this decay has progressed far with little removal of the waste an excellent soil is left, loose, fertile and producing abundant crops. It is, however, a hillside soil, often on very steep slopes. It is therefore temporary, unless carefully conserved. In the areas of limestone-clay on the west side of the county there is very little of the shale products, and the soil is a reddish clay. It is not nearly so fertile as the limestone-clay along Laughery Creek; but it lies better, in that it does not slope so much, and is permanent. This limestone-clay soil is very important in Ohio and Switzerland counties, and will be more fully considered there. It is enough here to call attention merely to the extent of territory covered.

Agricultural Conditions.

This county has had a very slow agricultural development. When the counties to the east and south were among the best in the Ohio Valley from the farming standpoint, Ripley was scarcely touched by the plow. This was in part due to its exceedingly heavy forests; in part to the swampy nature of the soil over two-thirds of the county, and the malaria that lurked in the swamps; and in part to remoteness from the river, at that time the sole out-

let for surplus farm produce. The last difficulty was partially overcome by the building of the Big Four and the old O. & M. Railways, at least for the northern half of the county. But only in the last ten years, when the increasing price of lumber has resulted in the cutting of practically all the woods, has the county become fairly cleared. The lumbering industry, until the last decade, has been of too much ready-money value in this county to allow of superior farming. Any able-bodied man could make good wages in the woods, or buy a saw mill rigging and go into business during the winter. As a result, a large proportion of the rural population farmed in the summer and lumbered in the winter. With the passing of the woods, however, it became necessary for the farmer to farm better than before, and he had more time for his real work. When the forests were once in large measure gone the soil dried considerably, and moderate sums spent for tiling brought results. We thus find a remarkable change in the farms of Ripley County within the last ten years. New buildings and better are being built every year; an excellent system of free macadamized roads, with substantial bridges, connects all places of importance in the county. Telephone lines are strung everywhere, and rural mail service is nearly complete. No better illustration of the change in conditions can be given than the increase in land values There are farms which ten years ago were for sale at $25 per acre, and now are held at $75. In Shelby Township there are farms which have sold within the last year for $40, and which ten years ago were worth not more than $5. Real estate men estimate the average increase in values at 100 per cent; and in localities especially favored with good drainage facilities and good roads, as high as 200 per cent.

The greatest difficulty in the way of farming in a large part of this county is remoteness from railroads. There are settlements in the southern part of the county where the soil is good and conditions favorable to successful farming, which are 17 or 18 miles from a shipping point. A north and south railroad, even a trolley line, equipped to carry freight, would be a godsend to this county and would advance it fifty years.

Mechanical Analysis of Soils of Ripley County.

Table No. 1. Miami Clay Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.87%	6.01%	12.2%	61.2%	19.5%
Subsoil	.6%	3.64%	9.18%	54.4%	32.3%

Table No. 2. Miami Silt Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.18%	2.8%	5.2%	86.0%	6.0%
Subsoil	.00%	1.6%	4.4%	81:0%	12.7%

Table No. 3. Waverley Sandy Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.25	12.2	40.2	31.8	16.2
Subsoil	.28	10.6	36.6	33.3	19.7

Chemical Analysis of the Miami Clay Loam. Occurrence—Ripley, Dearborn and in Smaller Bodies in the Other Counties.

Moisture at 105° C.	.366
Total soil nitrogen	.115
Reaction of soil to litmus	Acid
Volatile and organic matter	3.910
Insoluble in Hcl (1.115 sp. gr.)	84.567
Soluble silica	.086
Ferric oxide (Fe_2O_3)	4.345
Alumina (Al_2O_3)	6.167
Phosphoric acid (Anhyd) (P_2O_5)	.153
Calcium oxide (CaO)	.428
Magnesium oxide (MgO)	.639
Sulphuric ac. anhyd (SO_3)	.021
Potassium oxide (K_2O)	.383
Sodium oxide (Na_2O)	.164
Total	100.372

Chemical Analysis of Miami Silt Loam. Occurrence—Ripley County, with Tongues Extending Into Jefferson and Jennings.

Moisture at 105° C.	1.23
Total soil nitrogen	.101
Reaction of soil to litmus	Acid
Volatile and organic matter	3.268
Insoluble in Hcl (1.115 sp. gr.)	93.033
Soluble silica	.124
Ferric oxide (Fe_2O_3)	1.094
Alumina (Al_2O_3)	1.673
Phosphoric ac. anhyd. (P_2O_5)	.111
Calcium oxide (CaO)	.306
Magnesium oxide (MgO)	.201
Sulphuric ac. anhyd. (SO_3)	.042
Potassium oxide (K_2O)	.347
Sodium oxide (Na_2O)	.233
Total	100.432

JENNINGS COUNTY.

Location and Boundaries.

Jennings County lies just west of Ripley and northwest of Jefferson, being bounded on its eastern side by these counties, on the south by Scott, west by Jackson, and north by Decatur. Its extreme length is 25 miles, extreme width 19 miles, with an approximate area of 400 square miles. In climate it is very much like Ripley and Jefferson.

Geology and Topography.

This county is underlain by the New Albany shales for more than half its area; just east of that formation is the Corniferous limestone forming a belt from two to eight miles wide, extending north and south through the county; and a narrow strip averaging from four miles wide along the eastern border is Niagara limestone. The Corniferous formation is thin in most of its outcrops in this county, and has had little influence upon the topography or the soils.

From the standpoint of drainage, this county is well supplied with water courses. The Muscatatuck and the Big Graham Creek are considerable streams here, with well opened valleys and numerous small tributaries. Besides these larger streams there are a dozen or more smaller creeks, five to twenty miles in length, which all aid in giving the most of this county plenty of outlet for rainfall.

The general expression of the topography in Jennings is rolling to rough. On the uplands, far from the streams, there is some flat country, and some gently rolling. There are, however, too many streams to permit of much of this smooth surface; and over most of the county, notably in the southeast corner, there is much very rough land. The surface, as a whole, seems to be merely the product of local conditions. On the shales the valleys are usually well-opened, with fair-sized bottoms. The valley walls are often gently sloping enough for cultivation, and nearly everywhere for trees or shrubs. Where the limestones form the surface rock the valleys are commonly narrower, with more or less cliff-like walls.

THE SOILS IN DETAIL.

Of the six types of soil recognized in Jennings County, the Volusia is by far the most extensive. Then follow, in the order named, Miami silt loam, Limestone upland, Miami Clay loam, Waverley silt loam and Scottsburg silt loam.

It is scarcely necessary to enter into a lengthy discussion of the Volusia soil here, since that has already been done in the soil descriptions for Jefferson County. It is a soil derived from the weathering, with perhaps some glacial modifications, of shales. In Jennings County there is no trace of any glacial modifications save in the northwest corner of the county, where this type merges into the Miami soils. In this area the Volusia silt loam is a light brown to light yellow soil, often ashy or drab when dry, but with its characteristic shades of brown when damp, or an inch or two below the surface. It has a depth of 8 to 12 inches, with a subsoil of from 6 inches to 6 feet. This subsoil, in its lower layers, contains many fragments of the parent shale; and the fact that these fragments grow progressively smaller, as well as less numerous, toward the top, is pretty good evidence that glaciation had little influence upon this soil. The soil proper contains some sand, and occasional iron concretions. These, however, are not so numerous as in the same soil in Jefferson County. The sand is not sufficient in amount to exert much influence upon the soils, and, indeed, is scarcely noticeable in some localities.

This soil lies, in Jennings County, mainly in a flat to gently rolling upland, rough only near the larger streams. By far the greater part of it is tillable, and a fair farming soil. It cannot rank with the limestone soil of Jefferson County, nor the sandy loam of Decatur; but where it is intelligently farmed fair crops can be raised in favorable seasons. By reason of the nearness of the impermeable underlying shale, it is not a dry-weather soil; and droughty seasons prevent the ripening of corn. This points to the cultivation of crops which mature early in the summer, and the small grains and grasses prove to be the best farming crop year after year. Berries do well in this soil, if the ground is properly prepared and fertilized. This soil is deficient in some of the necessary plant foods, especially nitrates and nitrites; and the sowing of clover every third or fourth year is recommended by many of the most skilful farmers. This is not a corn soil, although good crops are raised in good years. The chances, however, are so much against corn success here that a surer crop ought to be tried.

The second soil in extent in this county is the Miami silt loam, of which there are two bodies, one along the eastern side, and one on the northern. The eastern body is an extension of the great body of Miami soil in Ripley County, and is described there. The northern body is a southward tongue from the Decatur County Miami. It is distinctly sandy, and loose, with enough sand in its composition to furnish valuable sand bars in the creeks. It is a yellow to brown soil, 8 to 15 inches in depth, resting upon a brown subsoil 12 to 40 inches deep. The soil consists of about 20 per cent sand, 70 per cent clay, 10 per cent silt and pebbles. It lies in gently rolling uplands, somewhat broken near the larger streams. It is practically all cultivable, and is the best corn soil in the county, away from the bottoms. It does very well in wheat, oats and grass. Fruit trees thrive, and ought to be more numerous. The only objection to this soil in Jennings County is that there isn't enough of it. It requires fertilizer, preferably barnyard or clover, and well repays careful cultivation.

The soils mapped as Limestone upland (for want of a better name in this county) are those found on the valley sides, and interstream spaces where the Miami soils have been removed by erosion. The northeast corner of the county contains the largest body of this soil, derived probably from the Niagara limestone with some admixture of Miami clay. It is a yellow to red soil, mostly clay, with a good many chert fragments from the limestone. Once in a while iron concretions occur in abundance, derived probably by the decay of some outlying mass of shale. In this body of soil there is no hard and fast line of separation from the Miami soils north and south. These grade insensibly into the Limestone soil, by outwash and stream transportation. Usually the Limestone upland soil in this area is 10-12 inches deep, with a subsoil extending down to the rock at depths of 2 to 8 feet. It is an excellent grass and fruit soil, fair for wheat, oats and potatoes, and not very good for corn.

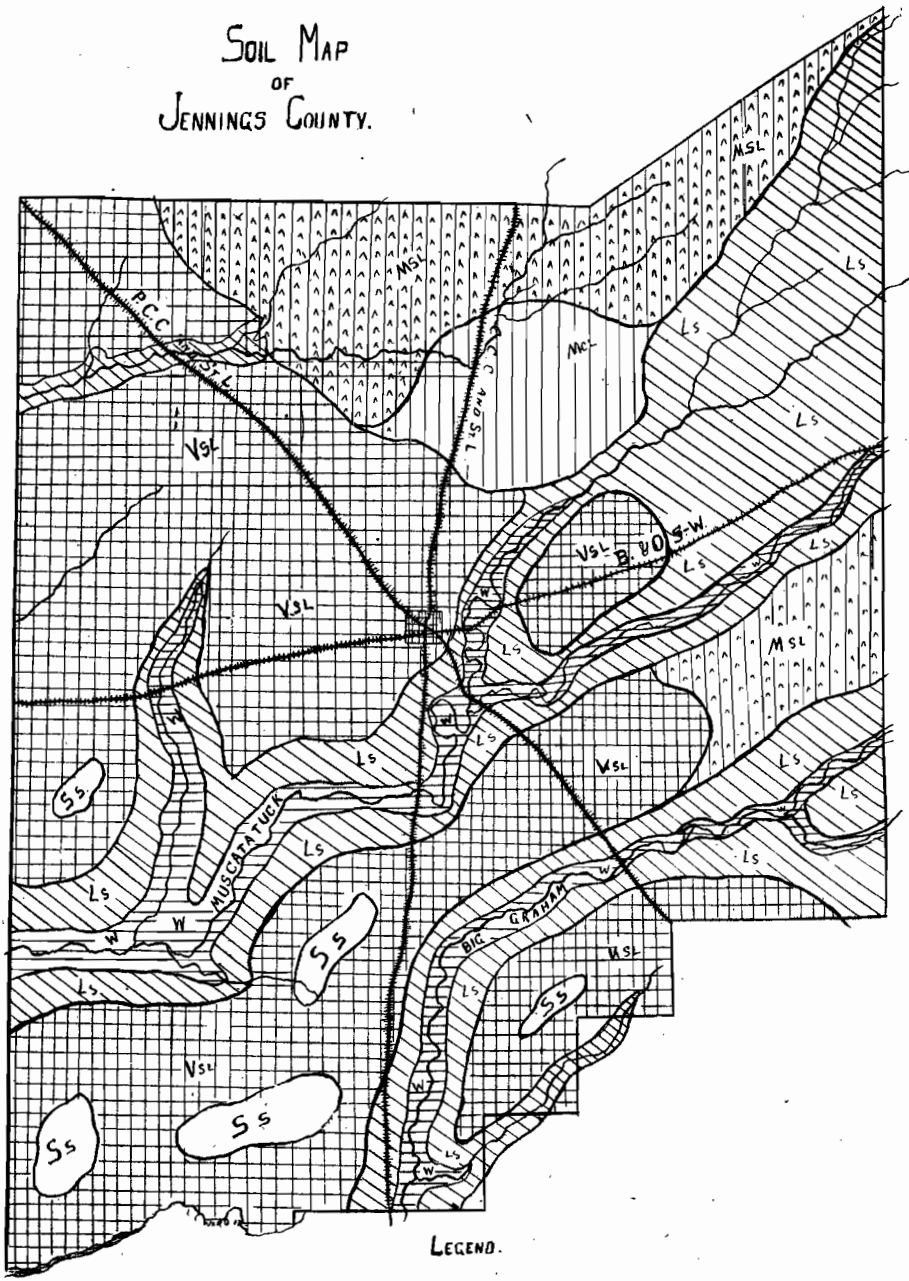
Along the valley sides the name "Limestone Uplands" does not strictly apply throughout the county. In the western portion the principal source of soil material is in the shales; but even here there is enough limestone to give the soil much the same appearance wherever it occurs. This valley-side limestone soil is for the most part useless, on account of the steepness of the hillsides, and the thinness of the soil. In many places, too, it consists mainly of flat plates of shale, too rough for plowing. It is not a true soil in such places and is of little worth.

Just south of the main belt of Miami silt in this county there occurs an area of about 40 square miles of Miami clay loam. This differs from the Miami in being almost white in color with faint yellow mottlings; in having a yellow subsoil of heavy clay, grading into blue till at 4 to 6 feet. It lies flat, with no hills or hollows except close to the streams. It is poor soil, covered with a growth of marsh timber, and hard to drain, except within half a mile of the valleys. Water stands in the lower portions practically all of the year; and there are numerous little ponds where the blue till forms an impervious bottom for some of the hollows. Where cultivated, this soil is used for grass and wheat, requiring fertilizer and drainage. For some reason clover does not grow well, and that valuable fertilizer can not be used.

Along the larger streams there are narrow bottoms (exaggerated in the map) of good soil, where it lies so it can be farmed. On the shale areas in the western part of the county where the valleys are open and the streams have come nearer to their base level, these bottom lands are often more than half a mile in width. In this area, also, the creeks do not rise so high, and destructive freshets are not so likely. On the limestone belts, however, the valleys are narrow, with little bottom ground, and that subject to flood. Since the streams with their headwaters reach practically all of the soils of the county, the bottom ground is made up of an aggregation of all. It is sandier than most uplands, with enough clay for stability. Often the valleys are so low-lying that tiling is necessary. On the whole, they furnish about as fertile a soil as any in the county, when properly cultivated.

In the southwest corner the highest uplands are composed of the Scottsburg silt loam, described in Jefferson County soils. It may be known by its whiteness, by its almost invariable flatness and wetness, and by being higher than any area near it. It differs from the Miami clay (the only soil in this county which it resembles in the least), by not having mottled spots in its make-up, and principally by the absence of the blue till. Here, as in Jefferson County, the Scottsburg silt has poor drainage and is on that account scarcely used for farming. It is yet timbered, with the swamp-tree forms—elms, black hickory, burr oak, sweet gum, etc. Fortunately there is little of it in this county.

Soil Map
of
Jennings County.



Legend.

MCL — Miami Clay Loam	MSL — Miami Silt Loam
VSL — Volusia Silt Loam.	SS — Scottsburg Silt
LS — Limestone Upland	W — Waverley Loam

Farming Methods.

Generally speaking, this is a county of poor farms. There are places, of course, where excellent farming is being done, particularly in the vicinity of Scipio and Queenstown. But, taking the county as a whole, there is much slip-shod work. The soils here are naturally poor, and require careful management to keep them in fair shape. It is the exception to find farms in this county which are growing better from year to year. It seems probable that stock raising would help in this matter. Many hillsides which plow down in five years would last indefinitely as pasture. There are abundant springs of fine water, and grass grows naturally here. It looks like a horse and cattle country over most of the county. At any rate, the present method of selling off everything that can be sold can, in the end, only result in degeneration of farms.

From the point of view of transportation facilities, no county in southeastern Indiana is so well situated as Jennings. There is scarcely a farm in the county more than six miles from a railroad; and there are shipping stations conveniently near almost all farms. With markets so near as they are, three large cities being within 75 miles, it would seem that only a proper selection of crops is needed to insure success. The quality of fruit and garden truck is excellent where any attempt has been made in that direction; and it seems that on the better soils of the county horticulture and truck farming will be more profitable than general farming.

Mechanical Analysis of Jennings County Soils.

Table No. 1. Miami Clay Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.90	11.6	9.7	58.6	19.7
Subsoil	.60	14.3	8.8	60.6	17.0

Table No. 2. Limestone Upland.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	12.2	14.8	8.7	29.4	34.5
Subsoil	11.7	12.9	8.9	31.2	35.8

DEARBORN AND OHIO COUNTIES.

Location and Size.

Dearborn County is the extreme southeastern corner of Indiana, being bounded on the east by Ohio and the Ohio River, and on the south by Ohio County. This latter small county is so closely related in surface features and geological structure to Dearborn that it seems well to consider their soil make-up together.

The extreme length of Dearborn County is about 26 miles and breadth about 16 miles, with an area of approximately 315 square miles. Ohio County has an extreme length from east to west of 16 miles, and a breadth of 9 miles, with an approximate area of 87 square miles.

Geology and Topography.

These two counties are very near the center of the Cincinnati dome. The Ohio River has cut a deep gorge through the comparatively soft rocks of this dome—a gorge which in these counties averages some 350 feet in depth. The smaller streams in this area, then, are compelled to maintain a pretty rapid course by the steepness of their slopes. At the very edge of the river, where the river channel is deepest, the lowest rocks exposed are the Utica shales. These are soft, blue shales, often soft enough to cut readily with a knife, at other places, where freshly exposed, still somewhat hard. These shales contain many thin beds of limestone (mostly impure) interbedded with the shale. This shale formation forms the bottom layer in nearly every creek bottom as one passes back into the hills away from the river. Thus on Tanner's Creek, these shales can be traced in the creek bottom beyond Guilford, or about 8 miles, in direct line from the river. On Hogan Creek these shales are found at about the same distance from the Ohio; and on Laughery, a larger stream, the shales extend back at least 16 miles. Down near the river the lower 40 feet of the bluffs are made up of this shale; and further down the river, in Ohio County, the lower 60 feet.

Next above the Utica shales in these counties comes the Lorraine limestone. In Ohio County at least 9-10 of the surface is underlain with this formation. In Dearborn County about half the surface is underlain with this rock. In this part of the county it is merely a matter of courtesy to call this formation a limestone. A typical section of it shows a good deal more shale than limestone; and what there is of the latter is usually so impure

that it is of no practical use, either for building stone or lime. There are occasional thin layers of hard, crystalline limestone which are put to use as road metal, but they do not form one per cent of this entire formation. This rock extends up the creeks to a distance of 16 to 18 miles on Tanner's and Hogan, and on Laughery beyond these counties and 12 miles into Ripley. Between the latter creek and Hogan this rock is the capping layer of all the hills; but between Hogan and Tanner's Creek the divide is capped with the limestones of the Hudson River group. These, like the Lorraine group, are mostly shale and impure limestone, soft, easily weathered and of little practical use. In the northwest corner of Dearborn County, and in one or two patches of Ohio, the surface formation is glacial in origin, and conceals the rocks.

The topography of these counties is entirely a product of the softness of the rock and the proximity of the river. The latter has a deep gorge, and the creeks from the back country have had to maintain steep courses in cutting down to the river level. Thus Tanner's Creek in sixteen miles falls 400 feet; Hogan Creek in the same distance falls 425 feet, or falls of about 25 feet per mile. Even a small stream, with such a fall is capable of carrying large loads and of digging out a deep gorge. Then the smaller streams which flow into the creeks named above have even steeper slopes, and of course are able to work with amazing power. It comes as a surprise to see for the first time what enormous blocks of stone one of these hill torrents can carry; but after seeing that, one is not surprised that the country should be so rough.

The general expression of the topography here is of long, high ridges, with deep gorges between. Only the upper third of the ridges, in most places, is gently sloping enough for cultivation, and even that, in many places, is too steep for plowed soil to stick. Near the Ohio, and on the lower courses of the larger creeks, the hills are steeper than in the back country, at least for the lower half of the ridges; and in most places no attempt is made to cultivate these slopes.

The Soils in Detail.

In these two counties there are not many distinct types of soil. In the first place, there is little variety in the underlying rocks and could therefore be little variety in the soils resulting from their decay. In order of area covered these soils can be classified as follows:

(1) Limestone upland, which occupies at least two-thirds of the area of these counties;

(2) The Miami clay loam, which occupies nearly one-third the area;

(3) Waverley clay loam, the bottom soil along the Ohio River and creeks;

(4) Waverley gravel, the terrace soils.

The Limestone Upland Soil.

This soil may be divided into two general groups, depending upon whether the rocks from which it was derived were limestone chiefly or shale. In the first class comes most of the soil mapped as limestone upland. It is the great upland soil in this county, formed by the decay of the Hudson River and Lorraine limestones and shales. It is yellow to brown in color, markedly darker than the Miami soils to the west. It is principally a slope soil, and in nearly every locality is much mixed with flat fragments and plates of limestone. In many places these fragments are so numerous and large as seriously to interfere with plowing. Often they are gathered together and built into fences. Near the Miami areas there is often a mixture of that soil and the limestone soil. Where pure, this soil is fertile and loamy. On the steeper slopes it is usually sown to grass, wheat or rye, since these crops assist in holding the soil on the hills. Where the slopes are gentle, or in small bottoms, corn is grown successfully. This soil is excellent for small fruits, berries, etc., and for orchards. It is an excellent soil for most farming purposes. Being shallow, it is, however, subject to drouth with late maturing crops. There is a strong tendency to wash, and every community contains abandoned fields where the forces of erosion overcame the rate of decay of the rock. The small bottoms along the creeks in this region are peculiar in their formation. At least 50 per cent of the bottom material consists of flat plates of rock tilted at an angle of about 30°, with soil between the plates. As a result, the plowing of these small bottoms is almost as difficult as hillside plowing.

The most fertile soils in these counties is undoubtedly the shale soils, or the limestone upland soils on the lower portions of the slopes. In Ohio County, and near the river in Dearborn County, this division of the Limestone upland soil reaches within 60 feet of the hill tops. When freshly cleared these soils resulting from the decay of the shales have no superior in fertility in the State.

They are dark brown or black, from the high percentage of humus which they contain, but after being cropped for three or four years they become somewhat lighter in color. It is often mixed with fragments of limestone from the slopes above. It is a loose soil, from 1 to 4 feet in depth, deeper at the foot of the slopes. It is in this soil that the tobacco of Dearborn and Ohio counties is raised—the most profitable crop that can be raised in Indiana soil, but exhausting to the ground. This soil raises excellent corn, or anything else that requires a strong soil. Wherever it is possible to retain this soil, it does not seem to diminish in fertility, but its situation is bad, being subject to erosion, soil creep and freezing and thawing. Unless exceptionally well cared for, within five or six years after clearing, practically all of the soil is gone, washed into the creeks and carried down into the river.

The Miami Clay Loam.

This soil, the second in extent in these counties, is similar to the Miami clay loam of Ripley County, of which it is merely an extension. In Ohio County the two bodies of Miami are outliers from the main body, separated by the action of Laughery Creek from the original plateau surface. In these counties, as in Ripley, this soil lies flat, with poor drainage. It is a compact, yellow clay soil, nearly white when dry. In the subsoil there are mottles, and sometimes a blue till at the base. This soil bears a marsh vegetation, sweet gum, beech, etc. It is a good grass soil here as elsewhere, and fairly good for wheat when fertilized. It invariably requires tiling and careful rotation of crops to yield profitable results. The town of Dillsboro, in Dearborn County, is on the line separating the Miami clay from the Limestone upland. It is a matter of common remark that east of Dillsboro corn is better than west, while the soils on the west produce better wheat and grass.

The Waverley or Bottom Soils.

The principal development of Waverley soils in these counties is in the "Bottoms" of the Ohio and the creeks just as they leave the hills for the river plain. In Dearborn County the principal area of Waverley soils has been known for a hundred years as the "Big Bottoms." This comprises a body of about 7,200 acres of land, lying between the Miami River and the Ohio, crossed by Hogan and Tanner's Creek. It is likely that this great alluvial plain is due to deposition of silt from the waters of the Miami, the

Ohio and the two creeks in times of high water, when the smaller streams had their currents checked by the back-waters of the Ohio. At any rate, this result follows during every flood, when a thin layer of silt is deposited over the entire plain. From the fact that the lower parts of this soil contain much sand and pebbles foreign to the uplands, it seems certain that a large part of this bottom land was laid down in the period of the ice invasion, and that these Waverley soils are in part due to glacial floods, in part to the annual flood of the Ohio.

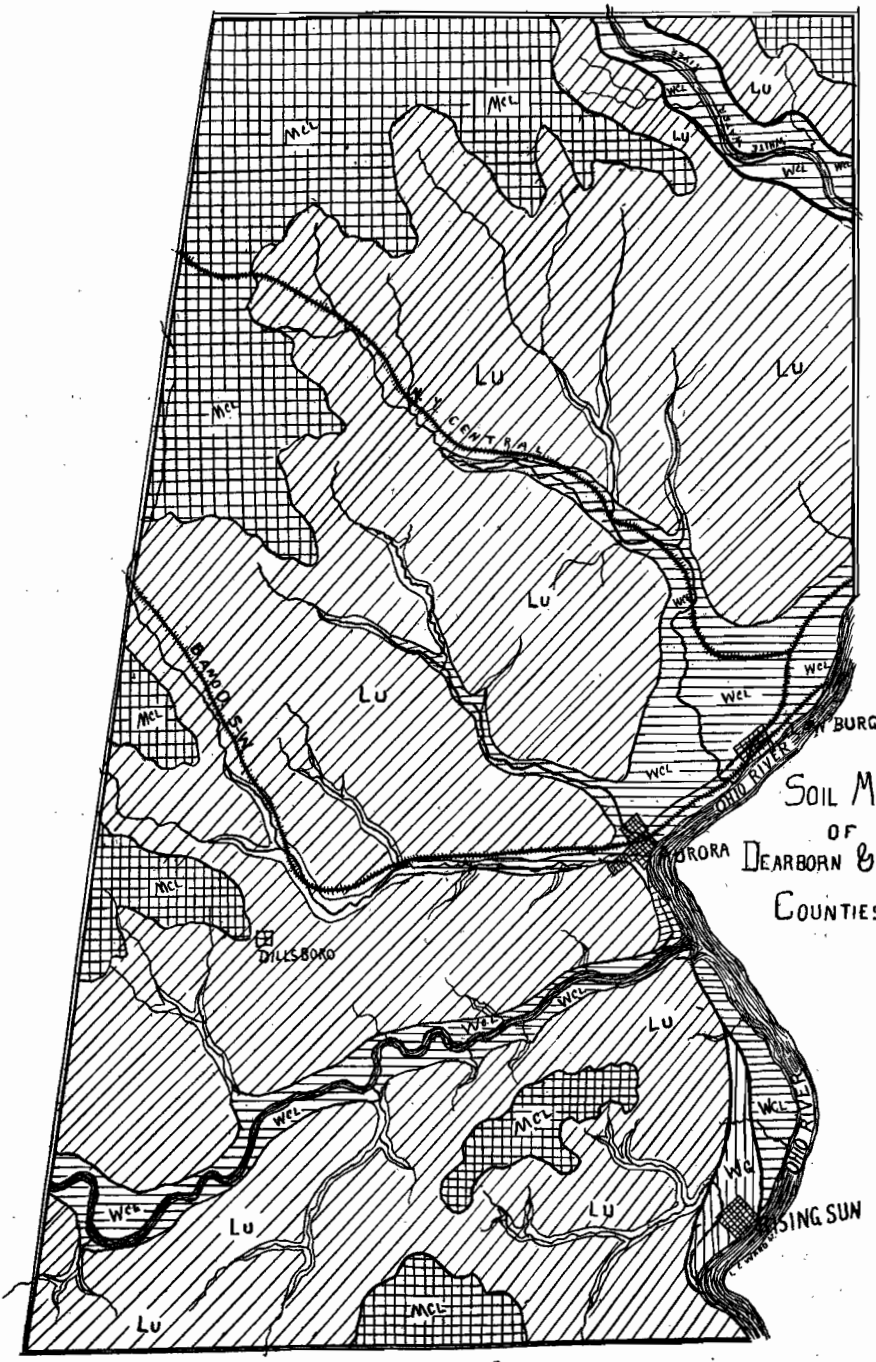
This flat-floored valley, with its hills conveniently near, offered an attractive place for settlement to the early emigrants from the East. The first clearing was made in the "Big Bottoms" in 1794, and it has been permanently occupied since then. For a hundred years this land was planted in corn, some portions of the valley having certainly been planted to that crop every year of the century. In late years the bottoms have not been so fertile, or, at any rate, the corn crops have not been so large. This is probably due to lack of rotation and can be mended by some attention to that phase of good farming. In the summer of 1907, while there was a great deal of corn in this valley, probably one-third of the bottoms were in grass, wheat or oats. Physically, no soil could be better. It is fine, loamy, easily plowed and cultivated, deep enough to withstand drought, and fertile beyond most soil. It is close to a good market, and, indeed, has but one danger, that of overflow. This, however, is in part counterbalanced by the increase in fertility due to the silt left behind, and is the original source of the bottom.

In Ohio County there is a narrow belt of bottom ground, usually less than one-quarter mile in width, but widening near Rising Sun to a width of nearly a mile. In this bottom the soil is light colored, almost yellow, of fine silt. Like the "Big Bottoms," it is an excellent corn soil, and is said to be even better than that soil for grass, wheat and oats. Much tobacco is also grown in this soil, and garden truck. These bottoms resemble closely those of Switzerland County and will be dealt with then more fully. In the vicinity of Rising Sun the terraces of glacial times are conspicuous. Traces of these appear near Lawrenceburg, but they are too small to be of importance until near Rising Sun. The city itself is built on the first terrace above the bottoms—a terrace averaging perhaps 30 feet above the river in June. Back of this yet another terrace can be traced in remnants of gravel and sand. There can be no question of the glacial origin of these terraces, for practical-

ly all of the pebbles are of rocks foreign to this region—granite, diorite, slate, sandstone, etc. They mark a time when the river was much higher and more heavily burdened than it is now. These terraces are extensively developed in Switzerland County and will be treated there.

Farming Methods.

Agriculture is difficult in such a country as that of Dearborn and Ohio counties in the rough portions. The soil when freshly cleared is usually fertile enough, but incessant care is required to keep it from washing away. In many places this can only be prevented by growing such crops as require little plowing and loosening of the soil. These slopes have, in the past, been famous for their hay and their small grain, but hay is exhaustive to soil, and the best hay crops are things of the past in this area. Corn is not a good crop, for the looseness of soil necessary for that grain offers too great a chance for the washing of the earth into the valleys. The fact that these hillsides sooner or later become bare has led to a very destructive method of farming in some localities. A typical case is the following, which occurred in Ohio County. A woods was partly cleared and burnt over for a space of six acres. This was planted to tobacco for two successive years, and the receipts from the two crops were nearly sufficient to pay the original cost of the farm. The ground, however, was about exhausted for tobacco, and the owner sold the farm to another person for about two-thirds of what it cost him. He cleared about $700 from his two crops of tobacco. Then the second owner planted to corn, and obtained a good crop the first year, a poorer crop the second year, and not enough to pay the third year. The fourth year of his occupancy, and the sixth after clearing, this ground lay vacant, and by the middle of the summer following the hillside was practically bare rock. In the meantime, the second owner had cleared some five acres and the same process began anew on this tract. There is little wonder that the hill country in these counties is growing constantly poorer. The worst feature of the case is that there seems to be no remedy, unless the growing of alfalfa will improve matters. To some extent this valuable grass is grown in Switzerland County, where it seems to have a real value in holding the soil, and at the same time producing a crop with a market value. In the summer of 1907, however, alfalfa on these hillsides was apparently dying, and if it should turn out impossible to grow suc-



Soil Map of Dearborn & Ohio Counties.

Legend

- Wcl — Waverley Clay Loam
- Lu — Limestone Upland
- Wg — Waverley Gravel Loam
- Mcl — Miami Clay Loam

cessfully here, the case will be desperate. Unless some remedy is found, it is only a question of time until these farms will have to be abandoned. Residents are free enough in saying that their farms are losing in value year by year. Perhaps the intensive farming methods of Switzerland and mountainous Germany, with their terracing and stone walls, might be of service here; but such methods are not to be expected in a country of cheap lands.

In the river bottoms, where the soil is, or was, the equal of any in the country, a near-sighted policy of farming very nearly ruined much of the soil. Corn was profitable in this easily tilled soil, and much of it was practically tilled to death in corn. Only when much of it was practically exhausted did the farmers awake to a necessity of fertilization. Now one sees a reasonable rotation of clover with the more exhausting crops, and in course of time these bottoms can be brought to their ancient fertility.

Transportation facilities are poor for a great part of these two counties, hauls of eight to ten miles to market being not uncommon. Ten miles through these hills are equal to fifteen miles in smoother country. For this reason and for the further reason that such crops need little stirring of the soil, it has been suggested that an attempt be made to grow fruit extensively in this region. Even with the little care now given to fruit trees, exceptionally fine peaches and apples grow here; and it is possible that the fruit crop will one day be the salvation of these hillsides.

Mechanical Analysis of Soils of Dearborn and Ohio Counties.

Table No. 1. Limestone Upland.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	8.2%	16.6%	10.7%	34.1%	30.3%
Subsoil	10.1%	18.3%	12.2%	30.3%	29.3%

Table No. 2. Waverley Clay Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.4%	6.6%	9.2%	59.2%	25.1%
Subsoil	.5%	7.7%	9.0%	54.7%	27.9%

Table No. 3. Waverley Gravel Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	8.6%	12.9%	16.6%	36.6%	25.1%
Subsoil	9.1%	13.1%	18.4%	34.2%	26.1%

Chemical Analysis of Waverley Sandy Loam. Occurrence—Bottom Lands of Laughery Creek in Ripley, Ohio and Dearborn Counties.

Moisture at 105° C.	2.63
Total soil nitrogen	.160
Reaction of soil to litmus	Acid
Volatile and organic matter	5.940
Insoluble in Hcl (1.115 sp. gr.)	85.270
Soluble silica	.071
Ferric oxide (Fe_2O_3)	3.047
Alumina (Al_2O_3)	3.253
Phosphoric acid anhyd. (P_2O_5)	.275
Calcium oxide (CaO)	1.162
Magnesium oxide (MgO)	.437
Sulphuric acid anhyd. (SO_3)	.050
Potassium oxide (K_2O)	.321
Sodium oxide (Na_2O)	.171
Total	99.997

Chemical Analysis of the Upland Soils of Northern Dearborn County—A Mixture of Miami Clay and Decayed Shales.

Moisture at 105° C.	4.73
Total soil nitrogen	.116
Reaction of soil to litmus	Very faintly acid
Volatile and organic matter	4.353
Insoluble in Hcl (1.115 sp. gr.)	78.695
Soluble silica	.076
Ferric oxide (Fe_2O_3)	5.370
Alumina (Al_2O_3)	8.588
Phosphoric acid anhyd. (P_2O_5)	.210
Calcium oxide (CaO)	.764
Magnesium oxide (MgO)	.859
Sulphuric acid anhyd. (SO_3)	.036
Potassium oxide (K_2O)	.726
Sodium oxide (Na_2O)	.252
Total	99.929

SWITZERLAND COUNTY.

This little county is in the extreme southeast corner of the State, having the Ohio River for its eastern and southern boundaries. It has a maximum length of 23 miles and a breadth of 18 miles, with an approximate area of 210 square miles. In climate it is little different from the other counties of this district.

Geology and Physiography.

In geology this county is exactly like its northern neighbors, Ohio and Dearborn. Along the Ohio and in the lowest portions of the creek beds, the outcropping rock is the Utica shale. In 8-10 of the county the rock exposed is the Lorraine limestone. In the northwest corner of the county the Hudson River group caps the highest land in the county, with a small outlier of Niagara limestone at the extreme summit.

There are no large streams in Switzerland County, but the proximity of the Ohio River gives to these minor streams a tremendous fall and cutting power. They have therefore excavated deep gorges through the soft rocks—gorges which, near the debouching of the streams onto the river plain, are often 350 feet in depth, and too steep walled in many places even for trees to stick. Along the river these little streams come down from the hills at intervals of two to five miles, and the deep notches which they have sawn into the escarpment are very striking. The closeness of these streams, and the depth of their valleys, result in a region of great roughness, with little level land. In this county there is a small body of comparatively level ground near Allensville and East Enterprise, and a smaller body of similar surface in the northwest corner. Along the Ohio there are some level bottom lands, and a little valley floor along the lower courses of some of the smaller streams. All the remainder of the county is hilly, varying from merely strongly rolling to mountainous.

The Soils in Detail.

There is not a great deal of difference between the soils of this county and those of Jefferson on the west, or Ohio on the north. In the north central portion there is an irregular oval of level land, perhaps three miles across, which is Miami clay loam, so often described before. It is somewhat startling to see, in this upland fringed about with great hills, a marsh vegetation; and yet the Miami clay here, as elsewhere, retains its moisture-bearing characters. In comparison with the limestone upland soils surrounding it, this soil is poor, and is commonly spoken of as "thin." It raises grass, wheat or rye, but not much corn. At the edges this soil grades imperceptibly into the Limestone Upland, a soil which has been described in detail in Dearborn and Ohio counties. It bears exactly the same characters here as in those counties. It is everywhere a fertile soil where it can be persuaded to stay on the

hillside. Along some of the streams this soil is retained as a little bottom, and is of exceptional fertility. This is the great tobacco soil of these counties, and is said to have no superior for that crop anywhere in the United States. The principal other crops which it produces are corn, grass and anything that grows in this latitude. Of late, an effort has been made to grow alfalfa upon these hillsides. It has done fairly well, and may in time be a profitable crop here.

The principal discussion of Switzerland County soils will be of the bottom soils or river terraces, because, in the first place, this soil is more extensively developed in this county than elsewhere in the district, and is also the most valuable soil in the county. This county is geographically well situated for the development of flood plains of the meander type. Two excellent meanders are developed on the eastern side of the county, and a less noticeable one on the southwestern border. There is more or less flood plain along the entire course of the river in this county except at Patriot and Florence, where the sweep of the river is almost under the hills. In the bends, however, above and below Patriot, there are excellent developments of alluvium, in the region famous in old days from one end of the Ohio to the other as the "Egypt bottoms." On examination it is readily seen that the bottom ground consists really of two terraces. The first, or lower terrace, in July of 1907 was scarcely more than 10 feet above the river level. It is composed entirely of fine, silty material, which is a slippery, clayey mud when wet. It is dark brown in color when damp, contains no pebbles or gravel particles, and little sand. It is evidently recent river deposit, and is being added to at every flood. Spring after spring this bottom is overflowed, scarcely ever missing a four-weeks' submergence. If this flooding occurs in February or early March, the soil may dry sufficiently to get a crop of corn planted, and if the river continues favorable a great crop will be gathered. Some years, however, the river stays high until too late for corn, and then the soil becomes a rank waste of horseweeds. In eight years out of ten, however, this bottom raises corn, and is accounted among the most desirable land in this part of the State. The second terrace, or "Egypt bottoms" proper, is somewhat higher than the first bottom, sloping gradually or abruptly back from the latter toward the back hills. This terrace is the "bottom" of the river when it was larger than now, probably in glacial times. At any rate, much of this terrace contains glacial pebbles. In structure this terrace differs from the lower one in

having a gravel subsoil, and considerable sand in the surface. It is not flat, but rolling, and in some places pretty badly cut up by creeks. It is overflowed only in the higher floods, averaging perhaps twice in five years. This has been sufficient to yield a layer of silt from two to ten inches deep over the surface. This is an excellent farming soil, which can not be excelled anywhere in the State. It has been marked, too, by excellent farmers, who have loved their soil enough to keep it getting better year after year. There is no better looking farm country anywhere. The crops here are an indication of the care of the farms. After almost a hundred years of cultivation this ground raises as good crops now as ever, which of course a well-farmed soil ought.

Mechanical Analysis of Switzerland County Soils.

Table No. 1. Limestone Upland.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	7.9%	14.4%	12.6%	36.3%	28.3%
Subsoil	10.6%	17.6%	13.3%	32.4%	25.8%

Table No. 2. Waverley Silt Loam (First Bottom).

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	.3%	7.1%	12.4%	61.3%	19.0%
Subsoil	.5%	7.7%	11.8%	58.8%	21.3%

Table No. 3. Waverley Sandy Loam (Second Bottom).

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	6.3%	21.4%	18.8%	30.3%	33.4%
Subsoil	8.6%	25.4%	22.2%	26.2%	17.9%

Chemical Analysis of Waverley Loam. Occurrence—Bottom Lands of the Ohio River in the Counties of Switzerland, Ohio, Dearborn and Jefferson.

Moisture at 105° C.	2.20
Total soil nitrogen	.280
Reaction of soil to litmus	Acid
Volatile and organic matter	6.428
Insoluble in Hcl (1.115 sp. gr.)	80.029
Soluble silica	.044
Ferric oxide (Fe_2O_3)	5.290
Alumina (Al_2O_3)	5.536
Phosphoric acid anhyd (P_2O_5)	.220
Calcium oxide (CaO)	1.444
Magnesium oxide (MgO)	.932

Sulphuric acid anhyd (SO_3)	.056
Potassium oxide (K_2O)	.148
Sodium oxide (Na_2O)	.132
Total	100.26

Chemical Analysis of Limestone Upland Soil of Dearborn, Switzerland, Ohio and Jefferson Counties—The Tobacco Soil of Southeast Indiana.

Moisture at 105° C	3.74
Total soil nitrogen	.183
Reaction of soil to litmus	Very faintly acid
Volatile and organic matter	6.342
Insoluble in Hcl (1.115 sp. gr.)	74.985
Soluble silica	.075
Ferric oxide (Fe_2O_3)	6.508
Alumina (Al_2O_3)	7.195
Phosphoric acid (anhyd) (P_2O_5)	.571
Calcium oxide (CaO)	1.300
Magnesium oxde (MgO)	1.380
Sulphuric acid anhyd (SO_3)	.039
Potassium oxide (K_2O)	.855
Sodium oxide (Na_2O)	.644
Total	99.914

DECATUR COUNTY.

Location and Size.

This county is likewise in the southeastern part of the State, one county removed from the Ohio boundary, and two removed from the Ohio River. Its greatest length is 21 miles, greatest breadth the same. Its area is approximately 375 square miles.

Geology and Physiography.

Geologically, there is very little difference between this county and Jennings. In the deepest stream beds in the southern part of the county the soft limestones of the Hudson River formation appear. These outcrops are small and of no practicable importance, since they contribute nothing to the soils and are in themselves of no value. The southeastern third of this county is underlain by the Niagara limestone, perhaps the most valuable stone in the State, after the Oolitic. In Decatur County it lies as a rule close to the surface, usually at depths of 4 to 12 feet on the level, outcropping on stream banks, and occasionally being found

only at depths of 30 feet. It is a very valuable rock commercially in this county, being quarried extensively at Newpoint, Westpoint, St. Paul and in many small local quarries. The product is used for building stone, especially for trimming, for abutments, for flagging in sidewalks, and in a crushed state for macadam and for concrete construction. From the standpoint of soils, it is of importance chiefly from the fact of its resistance to weathering, which has resulted in very flat uplands. The northwestern half of the county is underlain at depths of 5 to 40 feet by the Corniferous limestone, a softer rock as a rule than the Niagara. Finally, the entire surface of the county, except near the streams, is covered with a mantle of glacial waste, which effectively covers the underlying rocks over practically all the county.

The topography of the county is a product of two great factors —the Niagara limestone and the arrangement of the drift. The latter is disposed in belts of one to five miles in width crossing the county from southwest to northeast. In the northwest corner there occurs a till-plain where the surface is nearly level, rolling in gentle waves and only a little broken by streams. Then comes a belt about 4 miles in width of upland—a glacial moraine. This is followed by another till-plain, from 6 to 10 miles in width, gently rolling, with occasional knolls and swales, somewhat cut by streams. This is followed by a second ridge averaging five miles in width, with the remaining southeastern corner occupied by a flat plain of loess. Under the last feature lies the Niagara limestone, at an average depth of 7 feet. The streams are comparatively of little importance in this county as agents in bringing about the present surface, since this surface would be practically the same if the streams had not come into being. Their courses have been largely determined by the belts of drift.

The Soils in Detail.

In describing the soils of this county, one can do no better than take them in their order from one side of the county to the other. At the outset, it is evident that one factor which has been of the first importance heretofore will have little to do with the soils here, namely, the character of the underlying rock. It is probable that not an acre of tillable soil in this county has resulted from the disintegration of the underlying rock, but has, on the contrary, been carried here through the agency of the ice from some region to the north. We shall begin our discussion of

the soils in this county with a soil which we have described several times before, the Miami Clay Loam.

This soil occurs in a small area in the extreme southeastern corner of the county. It is part of the great area of this soil which occurs in Ripley County. It is there described as a yellow clay, sometimes almost white where it is dry, with mottles of darker yellow in its deeper portions. This soil is underlain with blue till, and in most places grades into that form of glacial waste imperceptibly. It consists almost entirely of clay, with a small admixture (usually less than 5 per cent.) of sand. There are practically no gravel pebbles in it. It is a pretty good material for tile and brickmaking, and has been used considerably for that in the past. From the farming standpoint it is poor. Grasses do fairly well, and wheat. Fertilizing must be constantly done, and, away from the streams, tiling.

The Miami Silt Loam.

This soil is mapped as occupying almost one-third the area of the county. It forms a belt in the southeastern part of the county, almost the full width of the territory on the south, and narrowing to about five miles on the north. It must be understood that this soil is not uniform throughout its occurrence. An average sample would show about 60 per cent clay, 20 per cent silt, 15-18 per cent fine sand, and some little gravel in spots. As one approaches the Miami clay loam, however, this composition changes until the sand is reduced to 5 per cent or less, and the clay correspondingly larger in amount. It was impossible to use any hard and fast rule in separating these areas, but the presence or absence of gravel pebbles gives about the line as mapped. Going to the northwest, as one approaches the ridge, this soil becomes sandier on account of the outwash from the moraine, and is to be distinguished from the Miami Sandy Loam because the latter has no clay subsoil, while the Silt Loam has.

The Miami Silt Loam is a yellow to brown soil with a subsoil usually darker in color, and much streaked and mottled with iron oxide. A few concretions of bog iron ore occur in this soil, and a good many glacial pebbles. Rarely bowlders are found, sometimes of large size. The subsoil grows heavier and more tenacious as one digs deeper, and at four to eight feet is a very stiff clay. It is not, however, blue till; and this character serves to distinguish the Miami Silt Loam from the Miami Clay Loam. The

farming value of this soil varies considerably with reference to the place of observation. Down near the Miami clay this soil is very much like its neighbor—poor, ill-drained and not valued very highly. It is flat and swampy by nature, due to the closeness to the surface of the Niagara. Tiling must be resorted to constantly; and the soil is so poor that often a field will not repay the expense of drainage. Practically the only good crops are grasses, and sometimes wheat, if fertilizer enough be used. As one approaches the ridge, however, the increasing percentage of sand results in a looser soil, permitting much of the rainfall to soak into the soil; tiling helps here, also. Then the Niagara is here somewhat deeper, and the surface therefore more rolling. In this sandier region corn can be grown with success, as well as wheat and grass. Some of the best farms in Decatur County are in this region, close to the foot of the ridge. They owe their superior fertility solely to the outwash from this ridge, for at distances of two to four miles out from it corn makes only half a crop. It is said that one can tell within five rows where one soil begins and the other ends.

Upland Clay Loam.

A belt some four miles in width succeeds the Miami Silt Loam, which has been called here the Upland Clay Loam. It has been so called for two reasons. First, much of it is really upland, standing visibly higher than the till plains on either side. Secondly, the knolls appear to be principally clay, and very often are entirely of that material. It must not be understood that this belt is a continuous ridge, extending as a well-marked divide from one corner of the county to the other. It is, on the contrary, a belt of hill and hollow. It is made up of a great number, possibly five hundred, low rounded knolls with swales or sags between. The knolls average, perhaps, 30 feet higher than the plains, and the swales are probably about at the plain level. The soil of the typical knoll is yellow in color at the surface, grading into a darker yellow at depths of two to four feet. It is made up principally of clay, with a good deal (about 10 per cent) of fine sand in its composition. Besides these it contains here and there small pockets of gravel, and often at depths of 16 to 30 feet a gravel base; and huge boulders are often found in these gravel bases. In the swales, the soil is sandy, with little clay in evidence. It is black or brown in color, due to the presence of much humus.

Usually at depths of 6 to 10 feet sheets of clay are found, which dip upward in every direction, forming a little saucer-shaped depression, in the middle of which lies the lowland. Many of these little hollows were undoubtedly in a former age lakes. Some of them are still marshy, and practically all require tiling. The soil here is remarkably fertile, ranking with any in the State. It is great corn soil, and is rarely planted to anything else, unless it be clover. The knolls, on the other hand, are better for wheat and grass. A farm in this belt is a joy forever, with its capacity for varied crops, with its excellent drainage, and the abundance of pure water which can be had by driving wells into the gravel at the base of the hills. Very little fertilizer is used here aside from the barnyard products and clover. There are many fine farms in this belt, and some fine cattle.

Miami Sand Loam.

This soil occupies a belt averaging five miles in width lying west of the ridge soil. It is, as the name implies, a "light-colored glacial soil." It is, however, light-colored only on the knolls and knobs which occur plentifully in its surface, interrupted by extensive lower grounds. It is a typical till-plain, uninfluenced by anything except glacial action. In general, it would be called level, varying throughout the county probably less than 50 feet between its highest and lowest points. Yet there is not a flat farm in the area, and not many single fields so flat that cultivation is difficult. A good deal of tile is used in the lower grounds, and is said to yield a high income on the investment. The knolls, which make up perhaps 10 per cent of the total area, are far less fertile than the lowlands. They contain considerable sand, and give up their water content easily, either by evaporation into the air or by conduction into the nearby lowlands. In a dry summer, even of average dryness, they therefore usually yield far less than the swales. They make up so little of the total surface, however, that one forgets their shortcomings on account of the superior excellence of the lowlands. These areas, which often are 200 acres in extent, are the banner corn soils of Decatur County. They are carefully farmed also, being put in clover every fourth or fifth year. Oats are good here also, and, somewhat uncommonly, wheat yields well enough to be a very important crop, especially on farms where the knoll land is much in evidence. Occa-

sionally throughout this area occur drumlins, whose graceful swells have tempted every farmer owning one to build his house upon it. Some of the famous farms of this county have as no little part of their claim to honor the beautiful situation of the homestead on one of these hills, commanding a view of every field of the estate. A particularly large and beautiful one of these drumlins can be seen from the cars of the Big Four Railway and the interurban about one-half mile east of Adams.

The remainder of the soils in this county belong to one or the other of the soils already described. In the extreme northwest corner is a little triangle of Miami Sandy Loam, and just east of this there is a small belt of Upland Clay Loam. Along the larger streams there occur little strips of bottom ground (mapped as Waverley), which differ little from the surrounding slopes, and are of such little extent as to need no extended description. These bottoms are usually not more than one-fourth mile in width, and are composed of material washed from the neighboring uplands. As a rule they are pretty wet and require tiling, but when drained they are valuable little fields.

There are few counties in the State which are any better farmed than Decatur, especially on the sandier portions. In the southeast corner the heavy clay soil limits farming practically to the grasses and small grain, but in at least eight-tenths of the county any crop suitable to the latitude can be grown successfully. On the typical corn lands corn yields as well, year by year, as anywhere in the State, and the same farm which yields a "bumper" corn crop may, the same year, yield a good wheat crop on the more clayey knolls. Grasses thrive in the wet bottom grounds, and good water is easily obtained. All conditions are favorable to stock raising, and much of the corn of this county goes to market as fat hogs and cattle. Such a method, of course, can not be otherwise than good farming, since practically everything is returned to the soil, and in Decatur County most of the farm lands are continually increasing in value. The excellence of transportation has a great deal to do with farm values here. There is scarcely a farm in the county farther than six miles from a railway, and the vast majority are within three miles. An excellent system of macadamized and gravelled roads connects almost every community with the railway.

Mechanical Analysis of Decatur County Soils.

Table No. 1. Miami Clay Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	0.7%	11.8%	6.3%	61.3%	20.2%
Subsoil	.6%	16.3%	8.8%	56.6%	17.6%

Table No. 2. Miami Sandy Loam.

	1mm+ Gravel.	.16mm+ Sand.	.08mm+ Very fine sand.	.04mm+ Silt.	.0017mm+ Clay.
Soil	4.6%	18.3%	18.8%	32.5%	26.1%
Subsoil	5.8%	19.8%	16.6%	33.8%	24.2%