Soil Survey of White County.

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White County, situated in the northwestern part of Indiana, comprises an area of 324,480 acres, or about 507 square miles. The general outline is that of a rectangle, 24 miles north and south by 27 miles east and west, lacking, however, an area 5 by 6 miles in the northwest corner, and an area about 10 by 12 miles in the southeast corner. The county line is located along section lines, with the exception of several miles south of Monticello, where it follows the meanders of the Tippecanoe River.

The adjoining counties are Pulaski on the north, Cass on the east, Carroll on the south and east, Tippecanoe on the south, Benton on the west, and Jasper on the west and north.

The general topography of White County is that of a level to gently-undulating plain lying over 800 feet above sea level.

There are three main physiographic divisions, which are: (1) the till plain and low moraines identified by Leverett as of early Wisconsin age; (2) the old lake plain and associated ridges of the Kankakee basin; and (3) the bottoms of the Tippecanoe River and its tributaries.

The first main division occupies the southern half of the county, and is divided into timbered and prairie regions. The timbered belt or "clay land" is found adjacent to the Tippecanoe River, and extends 3 to 7 miles westward into the prairie region, as long tongues along the larger creeks. The area lying between the Pennsylvania Railroad and the Carroll County line is included in this region. Throughout the timbered belt are areas of black land which were the beds of old sloughs and marshes. The timber growth was never so heavy in White County as farther east in Indiana, but the original forests contained many large trees, such as white, red and black oaks, hickory, tulip, elm, sycamore, maples, walnuts and basswood. The topography of this region is comparatively uneven because of the several stream valleys which are cut through it and on account of a few low morainic ridges occurring in this locality.

The prairie region occupies the southwestern portion of the county. On the east the prairie dovetails with the timbered land along the Tippecanoe River, and extends north to the low wooded sand ridge which passes from Monticello through Smithson and West Point church. The prairie also includes the land within a radius of three or four miles of Wolcott, but in that locality the soils are somewhat lighter in texture than the main body of prairie land.

The prairie region is a gently undulating plain, which was originally devoid of all trees except for some large lone cottonwoods and a few isolated groves where timber had gained a foothold and was protected from prairie fires by surrounding bodies of marshy land. Several low morainic ridges traverse this region in an east-west direction, one of which passes just north of Badger Corner, and another along the northern line of Round Grove township, etc. From the tops of these ridges the very flat land between them often resembles an old lake basin. Much of the land was originally very marshy, and water covered it during rainy seasons, but it is now well drained by ditches and tile drains. The soils are deep, black and of a very uniform silty texture.

The northern half of White County is part of or related to the old lake plain or marshes of the Kankakee basin. It skirts around the prairie land about Wolcott and is separated from the silty or "clay" lands on the south by a sharp boundary which is marked by low broken sand ridges running through West Point church, Smithson, Monticello, Idaville, and Burnett's Creek. Often this boundary is a sudden and absolute change from deep yellow sand to heavy black lands, while elsewhere there are transitional zones of loam and fine sandy loam soils.

While the general topography of this lake region is quite flattish, every section is broken more or less by sandy ridges from 3 to 40 feet high. The ridges enclose the flats in such a way as to prevent natural surface drainage, so caused by the formation of extensive marshes and ponds where muck beds were often developed. The ridges were invariably timbered, as were some of the better-drained flats, but the wetter areas bore a heavy growth of marsh grasses, rushes, and flags.

Probably the original material of this region was laid down by ice in glacial times, and was subsequently reworked and assorted by stream and wave action in shallow waters of lakes formed from the melting ice. Then, before vegetation protected the soil, the land surface was more or less reworked by wind, and in some

places was blown into dunes of remarkably uniform-textured fine sand. In some of the larger ridges, as in southeastern Cass township, the core of the hills may be old moraines of boulder till, but such material is now entirely covered by the wind-blown sands. The sandy material extends down to bed rock in the northern portion of White County, but farther south it overlaps the early Wisconsin till plain, and in places is only a thin veneer over the heavy land.

The third physiographic division, or river bottoms of White County, embraces a relatively small area. Along the Tippecanoe River and some of the larger creeks there are narrow overflowed bottoms seldom more than 200 or 300 yards wide. They lie 3 to 10 feet above normal stream level, and from a few feet to over 100 feet below the general level of the plains. Often the bottoms are bordered by steep slopes or perpendicular bluffs, and the eroded belt of land seldom extends more than one-quarter of a mile back from the valley.

Within most of the larger bends of the Tippecanoe River below Wright's Ford and along the larger creeks there are second or non-overflowed bottoms, which lie from 10 to 40 feet above the streams. These are the remnants of old flood plains formed by the streams when they carried volumes of water from the melting glaciers and so formed the characteristic gravel substratum. These terraces are usually flat, although a number of them have decided slopes from their upper limits to the first bottom level. They are uneroded except where tributary streams cut through them.

The general level of White County is between 800 and 900 feet above sea level. The vicinity of Monon is probably the highest part of the county on the average, but Hickory Ridge about 3 miles north of Brookston is the most pronounced elevation. It rises about 50 feet above surrounding lands. Another moraine of relatively pronounced relief is found north of Chalmers.

Most of White County lies in the drainage basin of the Tippecanoe River, which crosses the north county line near Buffalo and flows in a general southerly direction to Monticello. It forms the east county line for about 5 miles south of Monticello, and from there flows only a short distance east of the county line. Bends of the river enter White County for a short distance at the Springboro bridge and at the southeastern corner of Prairie township.

Formerly a large part of the area had limted natural surface

drainage, and no network of small streams was developed. Their channels, which were ill-defined beyond 2 to 7 miles from the Tippecanoe, did not effectively drain even the adjacent land. Often ponds existed within a few feet of stream bluffs for lack of outlets. Now a complete system of dredged and scraper ditches and tile drains rapidy carry away the rainfall from almost all parts of the county. The Big Monon Creek and its branches head in Pulaski County and drain the land north and east of Monon into the Tippecanoe River. The Little Monon and its branches head around Wolcott and flow towards Monon. On account of the limestone bars in the original creek bottom, much of the water now flows through the dredged cutoff, passing about three miles south of the town, and emptying into the Tippecanoe at Wright's Ford. Honey Creek parallels in a general way the Little Monon, and empties about three miles north of Monticello. The northeastern part of the county is well drained by the Headlee, Patton, Burgett, Keans Creek and Pike Creek ditches, which flow in a westerly direction.

The county has an abundant supply of good drinking water free from salts, drawn from surface and driven wells and from springs.

The east and west line of sand ridges which bisects the county also divides the drainage. South of it Big, Spring, and Moots Creeks, together with several small streams, carry off the waters of the prairie region towards the east and southeast. A portion of Round Grove township is drained by the Vanatta ditch, which flows southward into Benton County and finds an outlet through the Fox River into the Wabash. Burnett's Creek also flows into the Wabash. The land around Lee and in the northwestern part of Princeton township also lies outside of the Tippecanoe basin, and the waters drain westward into Jasper County.

At Buffalo the Tippecanoe valley lies only 15 to 30 feet below the surrounding country; at Monticello it is 85 feet below the plain, and its valley reaches a depth of over 120 feet near the southern border of the county. The upper course is comparatively straight, with moderate currents and sandy bottoms. As it nears the border of the old lake plain the valley becomes deeper, the currents swifter, and the bottom more rocky, and ox-bows accompanied by high terraces appear. At Norway a small outcrop of shale occurs, and the "limestone riffles" below Monticello show where the stream has cut down through the glacial till to bed rock. The creek valley equals that of the river

in depth near their junction, but rises to the general land level within a few miles of their mouths.

The population of White County, as given in the Census of 1910, was 17,602, or 35 per square mile. It was classed as rural, as there are no large towns, and the interests and prosperity of the area are almost exclusively dependent upon agriculture.

The original settlers were drawn largely from the states lying east of Indiana, although a goodly number of pioneers came from Tennessee and Kentucky. They were of English, Scotch, Irish, Dutch, etc., stock. The county has received some people of foreign birth, though not in large numbers. Of recent years the country near Reynolds and Seafield has been colonized to some extent by farmers of German origin. Also there has been a large influx of Illinois farmers, who have been attracted by the rich black lands of the county.

Although there was a steady growth in population up to 1900, there was a decrease of over 1,500 in the following decade. A decrease in the number of farms in the county during the same period would indicate that some farmers were buying out their neighbors who then moved away.

Monticello is the county seat and largest town in White County, and had a population of 2,168 in 1910. It is centrally located on the Indianapolis branch of the Monon railroad, and on the Logansport and Effner branch of the Pennsylvania railroad. Good train service is afforded to Indianapolis (85 miles), Chicago (98 miles), and Logansport (22 miles). Monticello is the trading center for the surrounding country, and is a pretty residence town. It has several thriving factories supporting a few hundred persons, and a hydro-electric plant on the Tippecanoe River which supplies light and power to over twenty towns and villages.

Monon (population about 1,200) is a junction point for the several branches of the Monon railroad. Here are located rock quarries which supply large amounts of crushed limestone for the roads, and may become a source of agricultural lime. Brookston, Wolcott, Reynolds, Chalmers, Burnett's Creek, and Idaville are important small towns which are distributing and shipping points for the adjacent territory. Seafield, Lee, Smithson, and Guernsey also have grain elevators and shipping facilities. Besides these railroad towns, there are also settlements and country stores at Buffalo, Headlee, Sitka, Round Grove, Badger Grove, etc. Over 80 per cent. of the farms in White County are within 6 miles of from one to four shipping points.

Chicago is the principal market for both grain and live stock, although Indianapolis and the East get a part of the products shipped from the county. Feeding cattle and sheep are often bought in Kansas City, Omaha, and other western points.

White County has an almost complete network of well-improved roads, which is being extended every year. The main pikes are surfaced with gravel or crushed limestone, and are kept in good condition. There are some sandy roads in the northern half of the county, and some graded dirt roads in the southern portion, but practically all can be traversed at all seasons by farm vehicles or light motor cars.

CLIMATE.

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

The Weather Bureau data recorded at Delphi, Indiana, may apply fairly well to White County, although Delphi is situated in the deep Wabash Valley, while White County occupies a higher level plain. The winter mean temperature is given as 26 degrees Fahrenheit, but there are often great and sudden changes of weather so the season becomes a series of cold waves and thaws with an average snowfall of 20 inches. The recorded maximum temperature of 70 degrees and a minimum of 26 degrees for January shows what extremes may occur. Other seasons exhibit equal variability. While the summer mean is 72 degrees, the temperature may go above 100 degrees or drop to 40 degrees.

The rainfall averages 37 inches per annum, and is well distributed throughout the year, being especially plentiful during the growing season. Each year brings unexpected conditions—perhaps rains or droughts of several weeks' duration—but the farmer can count on good average conditions during a term of years.

The climate is an important factor in determining the type of agriculture, and in influencing the yields. Since snow does not stay on the ground all winter, the growing of winter wheat and red clover is discouraged on lands where the alternate freezing and thawing might damage these crops. Before so many ditches were dug and lines of tile laid, spring rains sometimes delayed

corn planting until June, and the work in some fields is still retarded in this way. This fact, together with the possibility of damage from August droughts or early frosts, has probably discouraged the greatly increased use of silos for storing the corn crop. In spite of these possible drawbacks, the warm summer nights and abundant rainfall help make this a great corn country. The climate is also very favorable to the oat crop.

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

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

AGRICULTURE.

The soils of White County were first put to agricultural use by white men about 1820. The first land entered in this area is said to be at the Wolverton farm, 2 miles east of Chalmers. This and other early settlements were made in or near the timber land, as the trees were necessary for house building, firewood, etc., and the forests furnished the game which constituted a large share of the pioneers' food supply. Also the cleared timber land was easier to cultivate with the early tillage implements than was the tough prairie sod. The drainage conditions were also better.

Trees were girded to form deadenings, or else felled in windrows to make room for little fields of Indian corn, which was the main crop. "Log rollings" were great social events at which the whole neighborhood helped some settler roll logs from his fields for burning. In this way much fine walnut, oak, hickory, elm, etc., timber was destroyed.

The pioneer usually raised a little flax for cloth making, but abandoned this crop as soon as he was able to protect a flock of sheep from the beasts of prey, and then used wool instead of linen. Wheat began to be grown generally as soon as grist mills were provided to grind the wheat to flour.

Under that system the timbered portion of the county was gradually settled, and the main crops are still corn and wheat, although the latter has been replaced by oats to some extent.

The better-drained prairie land intermingled with the timbered ridges was first farmed in the 30's, but the "Grand Prairie," which extends unbroken westward into Illinois was left unsettled until the 50's. Then only the boldest pioneers dared venture far from the shelter of the timber to brave the prairie fires or cold winter gales. At that time much of the prairie was quite marshy during the rainy seasons, and a solid sheet of water often covered the land west of Chalmers for several miles. The slight elevations in the prairie were first broken and planted to corn. The crops were likely to be drowned out in the flatter fields.

Thousands of cattle were grazed on the prairie, but not in large herds. Each farmer owned from 300 to 800 head, which were herded on the unfenced ranges.

At that time even the poor sandy timbered land near West Point was valued at $20 per acre, while the broad fertile prairie could be bought for $8 per acre.

Although fencing and farming had been gradually increasing

on the prairie, the big crops and good prices of 1874 were largely responsible for the building of miles of three-board fence and the breaking of much virgin sod. Other changes came fast. In the same period the introduction of barbed wire made fencing an easier task. The land was being drained by dug and scraper ditches so that crops were surer. With the advent of the self-binder, oats became an important crop on the prairie, second only to corn, and as a natural result the cattle industry passed away.

Dredged ditching began about 25 years ago, and several of the main outlets have been deepened three times. The system of laterals is well developed, and of late years many miles of 24-inch and 30-inch tile have been laid in the open ditches and covered over so no land is wasted and farming operations are not hindered. In some sections the drainage outlets have cost over $20 per acre, and an equal amount has been expended for 4-inch, 6-inch, and 8-inch tile, which are laid in strings 50 to 100 feet apart. In this way much marshy land has been reclaimed and good crops are insured every year.

About 1895 an influx of Illinoian farmers into White County began, and a few are still coming each year. As a rule they use good farming methods, and are well-to-do. They created a demand for the black prairie lands, so that land values have risen to $200 or more per acre.

At the present time livestock feeding and all grain-growing types of farming are practiced, but in either case the growing of corn is the dominant industry on most farms. This crop has always led all others in acreage planted, and since 1900 has occupied about 100,000 acres each year, or nearly one-third of the total area of the county. The variations in acreage and in yields from season to season are wide. The Census of 1910 reports that 93,653 acres yielded 3,418,196 bushels, or about 36 bushels per acre. The corn crop is utilized in many ways. It is an important source of cash when sold direct to the elevators. It is fed the work animals, and to hogs, cattle and sheep, and the fodder is a most important roughage for horses and cattle. Corn silage is extensively fed to dairy cows and to beef cattle. Yellow varieties are planted almost to the exclusion of white kinds.

Since the introduction of self-binders and improved drills, oats has become a crop second only to corn in total acreage and yields. Only 13,628 acres were sown in 1879, but this was gradually increased to 57,532 acres in 1909. The average yields per

acre range from 28 to 37 bushels. This grain is partly fed on the farms to work stock, and the surplus is sold for cash. The straw is used for bedding or sold in towns. The wasteful practice of burning straw and stubble is seldom observed.

More wheat (16,052 acres) than oats were sown in 1879, but both the acreage and average yields have declined since that time. Many farmers believe that wheat is seldom a profitable crop, but others obtain returns which encourage them to sow this cereal every year. Wheat is strictly a cash crop. In 1909, 10,385 acres sown yielded 17 bushels per acre, which is better than the average.

Rye is of minor importance, though the acreage has been gradually increased. In 1909 2,775 acres sown returned about 11 bushels per acre. This crop is usually sown in small fields where special soil conditions prevail.

Buckwheat was sown on 744 acres in White County in 1909, and yielded about 11 bushels of grain per acre. When fields cannot be prepared in time to plant corn, they are often sown to buckwheat rather than to let the land lie idle.

No other cereals than those herein mentioned are grown in White County in noticeable amounts.

Hay has always been an important crop in this area. The Census of 1890 reported an acreage of 36,500, yielding about 1.18 tons of hay per acre. Probably much of this was wild prairie or marsh hay. In 1909 about 25,000 acres were devoted to hay and coarse forage, all except 2,437 acres being in tame crops. Timothy exceeds all other hays with an acreage of 15,429 and average yields of 1.16 tons per acre. Most of it is consumed by horses on the farms or in the local towns. An average yield of 1.18 tons per acre was obtained when timothy and clover were sown together on 3,823 acres in 1909. Clover was sown alone on only 791 acres in 1909, with average returns. Red clover is the variety most grown, and it often yields a seed crop as well as the hay. Big English and Alsick clovers are occasionally grown. Millet and grains cut green are unimportant hay crops. In 1909 45 acres in alfalfa yielded over 2 tons per acre. The acreage of this valuable hay has increased somewhat recently, but is far from being a general crop There is a considerable acreage of permanent blue grass pasture besides marshes and woods which are used chiefly for hay and pasture.

Within the last few years some cowpeas and soybeans have been grown, principally on the sandy soils. The value of these

crops for hay, grain and soil improvement is well known by the farmers with similar sandy soils in northern Indiana, and they will doubtless become more widely used in White County.

All farmers and many townspeople raise sufficient vegetables for home use, but none for shipping. Irish potatoes are grown in quantities about sufficient for the home markets. In 1909 705 acres yielded 90 bushels each.

Apples and peaches, also a few pears and cherries, are grown on a majority of the farms, but both the trees and fruit receive little attention. One commercial orchard near Monticello seemed likely to become a profitable investment.

Grapes, berries of different kinds, melons, etc. are grown in quantities for local use, but much early truck is shipped in from the south.

While 54.6 per cent. of the total value of White County products in 1909 was derived from cereals, about 35.7 per cent., or $1,666,640, was the revenue from livestock and products. Animals sold and slaughtered brought $1,255,709. About 30 per cent. of this amount was due to 37,318 hogs, while 65 per cent. is the value of about 2,500 calves and 11,000 other cattle. The remaining 5 per cent. was derived from 1,395 horses and 6,277 sheep.

Over 6 per cent. of the farm income is "poultry and egg money," while about 2.6 per cent. comes from the cream, milk and butter sold from the farms.

The crop adaptation of the soils of White County is well recognized and observed by the farmers, as is shown by the local distribution of crops in the area. Of course corn is grown on all types of soil, but it is well known that the deep black lands when not too wet or mucky usually give the best results. The reclaimed marshes produce good crops of corn. Oats is adapted to the same soils and conditions as corn, and does very well on the wetter lands. The prairie is almost ideal for grain farming, and will probably always be used for that purpose, although some livestock should be fed to help keep up the productiveness. Wheat is confined almost entirely to the light-colored soils. It also does well on the black sandy lands in the northern half of the county. Red clover gives better average yields of hay and seeds on the light "clay" lands, as it is somewhat subject to winter killing on black lands.

Rye is usually grown on poor, thin ground where other crops would not thrive. It is used to protect slopes which might wash,

and is the best crop for the sand dunes in the northern part of the county. It is often plowed under as a green manure, with good results. Its place on the sands may well be taken by cowpeas, which improve the soil by the addition of nitrogen and humus, and furnish a good leguminous hay. This change now seems to be imminent.

The adaptation of the sandy lands of the lake plain and stream bottoms to melons and other truck crops is well known, but lack of markets prevent the development of this industry.

The average farm in White County embodies very good equipment and farming methods. The farm homes are usually comfortable, and many have most of the conveniences of town. The telephone, Rural Free Delivery, and motor cars have removed the element of isolation from farm life.

The barns for horses and other stock are usually adequate. Granaries and cribs are provided for that portion of the crops consumed on the farms, but there is little storage room for grain which might be held for better market conditions.

Farm implements are of the most improved types, and constituted almost 27 per cent. of the farm values in 1910.

Part of the corn land is broken in the fall, and the remainder in the spring during April and May, according to the weather. Single and gagg (mould board) plows of the riding type are most used, though some disc plows are encountered. The land is broken to an average depth of 6 inches. Subsoiling implements are rarely used. The clods are disced and harrowed down to a good seed bed. Most of the crop is put in during May. The seed is planted by machine, with a fertilizer attachment, which applies from 100 to 200 pounds of commercial fertilizer per acre. It is drilled or put in check rows averaging $3\frac{1}{2}$ feet square. From 1 to 3 grains per hill are planted, according to the strength of the land. Often a roller or weeder is run over the field before the corn is up or when the first leaves appear. The first cultivation is usually deep and close to the row. Clod fenders are used to prevent covering the small corn. Subsequent cultivations are shallower and farther from the rows to avoid injury to the roots. The sweep type of cultivator is often used at this stage. The field is cultivated *across* each alternate time, and is usually kept very free from weeds unless wet weather interferes. After 3 to 5 cultivations the crop is laid by in July. The corn is harvested in a variety of ways. Probably the largest part is husked from the stalks in the field and hauled direct to elevators or to cribs,

which are slatted to allow drying Some farmers cut and shock the corn and husk it during the winter. The corn binder is used to aid in that operation, and also in gathering corn for silage. In some cases, especially when the corn is badly blown down, cattle and hogs are turned into the fields to harvest it. The practice of picking seed corn for next year at harvest time is not as general as it should be. More often the seed is picked from the cribs just before planting time.

The soil is seldom as well prepared for oats as for corn. The land is broken or only disced and harrowed if the weather is wet in the spring. It is seeded by drills at the rate of 1½ to 2 bushels per acre. The time of sowing is early in March. About the time corn is laid by and hay making is over, oats are put out with self-binders and shocked. Threshing begins as soon as the straw is dry, and most of the grain is hauled direct from the machine to market. Part of the crop may be saved for horse feed and seed. The straw is used for bedding, winter roughage, and roofs of winter shelters Much of it becomes incorporated with the manure and is returned to the fields, so is an important source of humus and potash.

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

The hay crops are sown on oat or wheat ground early in the spring, and occupy the land after the nurse crop is removed. Sometimes the fields may be pastured in the fall. The following season the hay crop is cut. Timothy is usually allowed to stand several years until it becomes thin. When timothy and clover are sown together the first crop is largely clover, but it dies out and leaves only timothy for succeeding crops. Red clover alone is cut for hay in June, and if the growth warrants it is cut again in the fall for seed.

The most common rotation on the prairie land is corn and oats, or corn, corn, oats. Sometimes they grow corn, oats, and clover. If a good stand of clover is not obtained, it is plowed up and put in corn, which then gives increased yields. On the "clay" lands corn, wheat, and clover are often a successful combination. The growth of legumes on such land is a vital need, but clover is not certain to "catch." Other rotations include timothy in place of clover.

White County farmers use all of their manure and feed live-

stock on land to build it up, but use relatively small amounts of commercial fertilizers. In 1910 23 per cent. of the farms reported an average expenditure of $48 for fertilizers. On the mucky or black "chaffy" lands of the lake plain region it is the general practice to use potash in some form on corn. It supplies a needed plant food, and kainit, especially is thought to prevent the attacks of certain insects.

White County farmers realize the advantage of feeding as much as possible of their corn to livestock. Better prices are obtained when corn is marketed as pork or beef. Nearly every farm raises enough hogs for home-killed meat and an excess of shipping. Corn is usually supplemented with a little bran, shorts, tankage, clover or blue grass pasture, etc.

Cattle feeding is even greater than the hog industry. Many calves are dropped by the general purpose cows found on all farms, but the bulk of the feeders are shipped in from the West or Chicago. These may weigh 900 or 1,000 pounds when put on feed, and are finished and shipped when weighing 1,200 to 1,400 pounds. They are often bought and sold on a narrow margin. The profit from feeding cattle lies principally in the gains made by hogs following them, and in the soil improvement. The principal feeds are corn, corn stover and silage supplemented by bran, shorts, etc. Winter feeding is most general, but some of the big feeders find it most profitable to feed in the summer so the cattle can be marketed at a season when the prices are highest.

A few sheep—mostly Shropshires—are raised in the county, but several thousand western feeders are imported each year. They are pastured on stubble, etc., and may be finished with a little grain. They make quick and profitable gains, and at the same time clean up the weeds in fence corners, orchards, etc.

There are several breeders of registered stock in the area. They breed good lines of Shorthorn and Hereford cattle and Duroc Jersey and Poland China hogs, etc. Most of the sires used in all stock breeding are pure bred.

Pure bred flocks of most important kinds of poultry are to be found in the county. Farm chickens are mixed, but are almost clear profit to the farmer, as most of their food is gleaned in the fields and around granaries. Hucksters gather poultry and eggs throughout the country and carry them to the towns. A packing plant at Monticello ships such products to the cities.

All the towns are supplied with milk from local dairies and nearby farms. Some cows are of the dairy breeds, but more are

of the general purpose type. Milk is collected by wagons for several creameries and ice cream factories in the county. A milk train on the Monon Railroad collects milk and cream along the line for the Chicago markets. A co-operative creamery was established at Reynolds a few years ago, but failed because of mismanagement.

Farm labor has become a large item of expense in White County. In the Census of 1910 48 per cent. of the farms reported that help was hired at an average cost of $236 per farm. Good laborers receive $30 to $35 and board per month, or about $1.00 per day for ordinary work. During harvest and hay making wages of $1.25 to $2.00 per day are paid. Many farmers exchange labor, especially at threshing time.

In 1880 the average size of farms in White County was 117 acres, 79 per cent. of which was improved land. The size has increased so that the average farm in 1910 contained 150.4 acres, of which 132 acres were improved.

While 65 per cent. of the farms were operated by owners in 1890, there has been a gradual growth of the tenant system, so that 44.3 per cent. of the farms are now operated by tenants and 2.2 per cent. by farm managers. There is a tendency for the land to pass into large holdings, and several individuals and companies now own 2,000 to 7,000 acres.

Land values gradually increased from about $20 an acre in 1880 to $38 in 1900. In the next decade there was a rapid rise to an average value of $77 per acre. Many farms in the prairie section are now valued above $200 per acre, and those of the light-colored "clay" lands at $125 to $175 per acre. Part of the increased value is due to the great improvement in ditches and roads, etc.

Soils.

The area of White County is approximately equally divided between an old glacial lake plain, known as the Kankakee basin, in the north, and a comparatively smooth hill plain in the south.

The underlying rocks of the area have contributed only indirectly to the formation of the soils, as they are usually deeply covered by glacial deposits. According to maps of the Indiana Department of Geology, the southwestern portion of the county is underlain by a dark-colored shale rock at depths ranging to 100 feet or more. Between Chalmers and Wolcott it may generally be found between 15 and 50 feet below the surface. A

sandstone formation occurs at some depth near Wolcott, and was formerly a source of sand for glass making. Only one outcrop of shale rock was observed in White County. It is found in the north bank of the Tippecanoe River, a few hundred yards above the mouth of Pike Creek and about 50 feet below the general level of the land. A line running northwest from that point is, in a general way, the limit of the shale deposits. Northeast of this line the land is underlain by the Niagara limestone. This formation outcrops in the bottom of the Tippecanoe River a short distance south of Monticello, and at a number of points along the Monon creeks. In the vicinity of Monon and Lee a pre-glacial limestone hill comes within 2 to 20 feet of the present land surface. Along the general line of junction of the limestone and shale deposits wells have been driven 140 feet deep without striking rock. This fact suggests the presence of a pre-glacial valley of considerable depth.

According to the glacial theory, this portion of the country was covered by a great glacier or ice sheet ages ago. It crept slowly down from the north, and at one time probably approached the Ohio River. It melted back and advanced several times. Each time the great mass of ice brought down soil and rock from the north, smoothed down the hills, and filled up the valleys in its path. The underlying rocks and those far to the north were ground, and the material was mixed and transported by the ice and the water formed by the melting ice. The old soils gave way to a heterogeneous mixture of material from limestone, shale, sandstone, and crystalline rocks ranging in texture from the finest clays to huge boulders weighing many tons. Where the material was laid down under the ice rather level land was left after the recession, but along the fronts of the glacier terminal moraines of comparatively rough topography were formed. In such places large boulders were frequently strewn thickly over the surface, but most of them have been removed from the fields in White County. The southern portion of the county has a very uniform silty covering from 1 to 3 feet deep, which, no doubt, is the result of the weathering of the glacial till.

When the ice sheet was melting the major streams carried larger volumes of water than at the present time. The great swift currents carried coarse sands, gravels, and stones, which were deposited in the bottom lands. Later the channels were eroded down to lower levels, leaving these gravel beds 5 to 40 feet above overflow. As with the till uplands, the material in

these terraces is of mixed origin, but a large proportion of the gravel is limestone.

Upon the last retreat of the great glacier, areas in northern Indiana were left in a marshy condition, and lakes occupied many of the depressions. This condition prevailed until about 1855, when great dredging operations were begun, which are rapidly making this land fit for agriculture. The marshes were typically developed in the Kankakee basin, but the same conditions continue to and terminate in White County, which is drained largely by the Tippecanoe River. The soils of this region are characterized by the very large percentage of fine sand particles which they contain, entire absence of stones and rather coarse material. In places the fine sand has been heaped into distinct dune forms, which have been protected from recent wind erosion by trees and other vegetation. Some of the sand ridges are supposed to be based on morainic cores. Recent alluvium in comparatively narrow strips occur along the Tippecanoe River and the other well-defined streams in the county. In permanent marshes the heavy growth of water-loving vegetation gives rise to muck beds. In a number of marshes there are local deposits of bog iron ore from a few inches to several feet below the surface. It is said that ore was dug and carried to the Wabash Canal in pioneer days, but the deposits are too small to be used or to influence the value of the land for agriculture very much.

In the southern and western sections of the county where the soil-forming material is unassorted glacial debris or till, four distinct series of soils are developed. Where this material existed under prairie conditions, it gives rise to the Carrington soils; when well drained and timbered, it gives the Miami soils, and in marshy areas it gives the heavier types of the Clyde series. The terminal moraines with more gravelly subsoils are better drained and oxidized, and are sources of the Bellefontaine soils.

The sand deposits spread over the northern part of the county give light types of the Clyde series in the flat, poorly-drained areas, and the Dunkirk series in the better drained, nearly level, and distinctly ridgy areas. All of the terraces are classed in the Fox series, and the first bottoms in the Genesee series. In all, eight series, including fifteen types besides the miscellaneous type, muck, were recognized and mapped.

The Miami series includes light grayish-brown soils resting upon heavier compact yellowish-brown subsoils, which usually are somwhat calcareous in the lower part of the 3-foot section.

They are gently undulating to rolling in topography, and have fair to good drainage. In White County the series is represented by the silt loam, loam, and fine sandy loam.

The soils in the Bellefontaine series are brown to slightly reddish-brown. The subsoils are yellowish-brown to reddish-brown, rather compact, and resting upon a porous mass of stone and gravel at shallow depths. They are smooth, rolling to very irregular morainic in topography, and usually well drained. The soil and subsoil are not calcareous, or only slightly so, but the underlying material is strongly calcareous, a large proportion of the material being from limestone. The loam and silt loam are represented in the county, these being confined to pronounced morainic ridges.

The Carrington series is characterized by dark-brown to almost black soils, with heavier-textured yellowish subsoils. They are nearly level to rolling in topography, and have fair to good natural drainage. They are derived from a moderately calcareous glacial till which has existed mainly under prairie conditions. The silt loam with a flat phase, which is intermediate in its properties between the Carrington and Clyde soils, is extensively developed in the western part of White County, and the loam in a shallow and flat phase development is of considerable importance in the northern part. The fine sandy loam is only limited in extent.

The Clyde series is characterized by dark brownish-gray to black surface soils, and gray or drab mottled subsoils. The different members of the series are flat in topography, usually occupying a depressed position with reference to the better-drained associated types, and they are naturally poorly drained. The heavier members of the series are derived from glacial till, the same as giving rise to the Miami and Carrington soils under better drainage conditions, while the lighter types through the lake plain area are from water-assorted material. The Clyde soils are extensive and widely distributed over the county, and have an important influence in the agriculture.

The Dunkirk series includes brownish-gray to brown or yellowish-brown to grayish and brown mottled subsoils of similar to somewhat heavier texture. The surface features are level to undulating and gently rolling, and the drainage is fair to rather excessive. The Dunkirk soils are derived from sedimentary deposits laid down on the floor and along the shores of glacial lakes, the soil-forming material being essentially noncalcareous. The

fine sand is the only member of the series occurring in White County.

The soils of the Fox series are grayish-brown to brown in color, and the subsoils are yellowish-brown to slightly reddish-brown resting upon stratified beds of gravel and sand, a large per cent. of which is limestone.

They occupy terraces and outwash plain areas level to undulating in topography and naturally well drained. The underlying gravel and sand beds carry a high percentage of limestone material.

The Genesee series consists of dark-brown to grayish-brown soils, with somewhat lighter-brown subsoils. The soil-forming material is recent alluvium occupying a first bottom position along streams.

In all, 16 types and four phases were recognized and mapped. Their names and relative and actual extent of each are given in the following table:

AREAS OF DIFFERENT SOILS.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Carrington silt loam....	12,607	23.7	Miami silt loam.....	16,128	5.0
Flat phase.....	64,256		Clyde loamy fine sand	6,656	2.0
Clyde fine sandy loam..	54,784	16.9	Miami loam.....	5,248	1.6
Plainfield fine sand....	9,536	14.2	Carrington fine sandy loam.....	4,352	1.3
Rolling phase.....	36,608		Bellefontaine silt loam	4,288	1.3
Clyde silty clay loam ..	33,472	10.6	Muck.....	3,520	1.1
Heavy Phase.....	832		Genesee fine sandy loam.....	3,328	1.0
Miami fine sandy loam	24,064	7.4	Bellefontaine loam....	1,856	.6
Carrington loam.....	3,904	7.2	Fox fine sandy loam..	1,664	.5
Flat phase.....	19,328				
Clyde loam.....	18,048	5.6	Total.....	324,480	.....

Miami Silt Loam.

The soil of the Miami silt loam to a depth of 6 to 10 inches is a light grayish-brown silt loam. It is smooth feeling and has a fairly friable structure. The subsoil is a yellow or light yellowish-brown silt loam grading into silty clay loam at about 20 inches. This in turn becomes a compact, gritty, yellowish-brown clay loam at some point above three feet. The lower subsoil and substratum are moderately calcareous. The substratum to great

depths consists of unconsolidated and unweathered glacial debris containing boulders, rocks, sands, and clays.

Two phases of this type exist in White County, though not in sufficient areas to warrant separation. One phase occurs in flats, and is characterized by the light gray color of the soil. When dry the surface is almost white. The subsoil is mottled with gray and yellow, and often becomes a compact, impervious silty clay at 24 to 30 inches. The other phase is noted along the valley slopes where the topography is more rolling and the soil is oxidized to greater depths. The color becomes as that of the Bellefontaine soils.

Miami silt loam is confined to the southern half of the area, and occurs along the Tippecanoe River and the lower courses of the larger creeks. It includes part of the land east of Monticello and south of the Pennsylvania Railroad, as well as a few isolated areas in the southwestern corner of the county. All of the type formerly supported a growth of hickory, oak, maple, walnut, etc. timber.

The typical topography is gently undulating to rolling. There are ridges with intervening areas of black land and level land dissected by streams.

This type has better natural surface drainage than any other soil in the area except the Bellefontaine types. All of the rainfall can readily flow into adjacent depressions or into the streams.

Miami silt loam was the first soil put to agricultural use in White County. While not very extensive in this area, it includes some of the best farms, and is valued highly. About 90 per cent. of the type is cultivated, and the remainder is a valuable asset for the firewood and pasturage it furnishes.

Corn is the principal crop in this soil, but it is recognized to be one of the best soils for timothy, wheat and clover. Oats are also largely grown. These five constitute the only crops grown on a commercial scale. A number of apple orchards were observed on this type, but with one exception they are neglected and return little income. The trees make good growth and the indications are that fruit growing might be made profitable on this soil.

The light color of the Miami silt loam indicates that humus and nitrogen are probably lacking. The practice of keeping livestock to help supply these elements is general. The usual quota of hogs are found, and more cattle are fed on "clay" land farms than elsewhere. The farmer tries to raise clover and pas-

ture cattle periodically, and spreads all the manure from barns and feed lots on the thin land. Some of the rougher areas of this type along streams are in permanent blue grass pasture. Some sheep are raised and fed. Several of the dairies supplying milk to Monticello and other towns are located on Miami silt loam.

Where the growth of legumes and feeding of stock have kept up the fertility, the Miami silt loam produces larger crops than the average of the county. Corn will average 35 to 40 bushels per acre, and may range to 75 bushels in extra good seasons. Wheat produces about 20 bushels under average conditions, and occasionally doubles that amount in some fields. Oats usually return 35 bushels, but the strength of the soil was shown in the exceptional season of 1915. Then some fields of Miami silt loam yielded over 75 bushels per acre in spite of severe damage in the shock. Hay yields of both clover and timothy are usually one ton per acre. Rye is occasionally sown, and returns about 15 bushels. One field of rye and vetch was observed on Miami silt loam. When cut to hay it yielded over two tons per acre. Most of it was plowed under to improve the soil.

Miami silt loam requires and receives rather careful treatment. Although the natural surface drainage is good, the subsoil is tight, and tile drainage pays. The land will clod if trampled by stock or plowed when too wet, but can be kept in good tilth when rightly cultivated. Some commercial fertilizer is used with corn or drilled in with wheat or oats. From 100 to 200 pounds are used of mixtures containing 2 per cent. nitrogen, 8 per cent. phosphoric acid, and 4 per cent. potash. Other formulas are 2–10–2, 2–10–4, 2–8–2, etc. Most farmers prefer to build up their land by legumes and manure.

Miami silt loam is worth from $125 to $300 or more per acre, according to farm improvements and distance from town. Little land of this type is now changing hands. Two farms containing this soil sold in 1915 at $145 and $150 per acre.

Further improvements of this type of land can be brought about by more general extension of the methods used by the better farmers. Some of the flat fields would be benefited by tile drainage. Even more livestock should be fed and dairying engaged in when possible. The manure is a cheaper source of nitrogen than commercial fertilizers, and also supplies organic matter and potash. It also has some effect in correcting soil acidity. Tests by the Indiana Experiment Station show that this type is usually slightly acid. Application of 1,000 pounds or

more per acre of agricultural lime should help the land, especially in insuring a "catch" of clover. It is very necessary if alfalfa is to be grown. Cowpeas and soy beans might be used where clover fails. Experiments at Purdue indicate that stubble ground can be disced or plowed immediately after wheat cutting, and sown to cowpeas. They usually will yield nearly a ton of hay in the fall or can be pastured and plowed under. Fertilizer tests show that phosphoric acid is the element most needed in Miami silt loam. Potash is usually beneficial, and nitrogen may be so on thin soils. Wheat nearly always yields good returns from applications of 200 pounds per acre of 4–8–4 or 0–8–4 goods, but the results with corn are variable. Its yields are more often limited by factors other than the amount of plant food in the soil.

Miami Loam.

The soil of the Miami loam to an average depth of 8 inches is a light grayish-brown loam or silty loam. The subsoil is a light yellowish-brown heavy loam, grading into silty clay loam or clay, usually somewhat mottled with gray and brown. The substratum is unweathered glacial till somewhat calcareous. As it occurs in White County, this type is transitional between Miami silt loam and the sandy soils of the county, and is quite variable in color and texture. The surface soil ranges from gray to brown, and includes small areas of fine sandy loam and silt loam. The subsoil is always heavy, and sometimes is very compact and impervious and gray in color. The areas with a light grayish soil and a gray subsurface layer are really the Crosby loam, but they are too limited in extent to justify a type designation.

The largest amount of Miami loam is found in a large irregular body just northeast of Monticello. Other areas are located throughout the timbered land south of Monticello, and also along the junction of the sandy and "clay" lands. Hardly any of this type occurs in the northern half of the county.

The topography ranges from level to gently rolling. Some narrow belts of steep valley slopes are included. It often occupies slight rises above the adjoining types of soil.

The natural surface drainage of this soil is good to fair because of its elevated position or proximity to water courses. The flat areas with tight subsoils have been much improved by open ditches and tile drains.

The Miami loam comprises a small per cent. of White County, but is well improved and fully utilized.

It corresponds closely to Miami silt loam in almost every detail of use, needs, yields, etc. Corn is the principal crop, and oats, too, are grown, but wheat and clover do better on this soil than on black land.

Considering the small extent of this type, it is relatively important in the livestock business. Hogs and cattle are fattened, and several dairies are located on this type. The manure is a large factor in keeping up the fertility of this soil.

The crop yields about equal those of Miami silt loam. Corn and oats will average 35 bushels, wheat 20 bushels, and clover 1 ton of hay and a bushel of seed per acre, but these yields are occasionally doubled in good seasons.

Miami loam is probably slightly easier to cultivate than the silt loam, because of the more sandy surface soil, but is handled, fertilized, etc. in practically the same way.

This is a valuable type of land because of its productiveness, and since much of it is located close to towns. Not much of such land is on the market. Two farms consisting of this type and some black land sold for $111 and $150 per acre in 1915.

Some well-improved places near town could not be bought for $200 per acre. Many areas of this type are small, and their value depends much on the value of the surrounding types.

The suggestions for the improvement of Miami silt loam apply equally well to the loam.

Miami Fine Sandy Loam.

The surface of Miami fine sandy loam to an average depth of 7 inches is a grayish-brown fine sandy loam or loamy fine sand. The first inch or two is often dark colored. The subsoil is light brown or yellowish-brown fine sandy loam passing at about 18 inches into yellowish-brown, sticky, fine sandy loam or clay loam. In some places the substratum is heavy glacial till and elsewhere it consists of sandy materials. In a few instances this soil may be derived from the weathering of sandy till, but in most instances seems to be the result of sands from the lake region drifting over the heavy glacial ground moraine. Many of the areas in the northern part of the county have deeper sandy soils, sandy clay loam subsoils and deeper sand substratum. A few such areas might have been mapped as Dunkirk fine sandy loam if they had occurred more extensively.

The most extensive development of this type occurs along the southern border of the lake plain and along the upper courses of

the Tippecanoe River. Some areas are found in the timbered country south of Monticello, and small ones are scattered throughout the northern portion of the county. The topography of this type is level to undulating, and the areas are elevated slightly above the adjoining black land. The natural drainage is fair and artificial drainage has usually been supplied where necessary.

This soil is fairly extensive and important in the northeastern quarter of the county, as it is the best of the light-colored sandy soils. Probably 85 per cent. is cultivated.

Corn, wheat, and oats are the principal crops grown on this soil. It is often difficult to get a good stand of clover on such land.

Some of the Miami fine sandy loam is included in stock farms, and is much benefited by the manure dropped in the fields or carried and spread from the barns.

Fair average yields of corn and oats are 30 bushels per acre, though in the best seasons some fields produce 50 bushels per acre. Wheat will average 15 bushels and sometimes does much better. When a growth of clover is secured, the hay yields approach 1 ton per acre.

This type of land is easy to cultivate, and does not clod or get in bad condition when plowed wet. It responds quickly and greatly to applications of manure and to plowing under of any kind of organic matter. Rye is sometimes used as a green manure. Applications of 100 pounds to 150 pounds of complete fertilizer are generally used with wheat and corn. It helps give the corn a good start, especially if planting has been delayed.

This type is usually intermingled with black sandy land, so the land values depend on the relative proportion of the two and the distance from town. Ten farms in the county containing more or less of Miami fine sandy loam were sold in 1915. The average size of the farms was 116 acres, and the average price was $120 per acre.

Practices recommended for other Miami soils would be equally beneficial on the fine sandy loam. The abundant growth of red sorrel on much of this type indicates an acid condition, which is borne out by analyses made at Purdue. Tests show that from 300 to 4,000 pounds of ground limestone would be required to neutralize the acidity of an acre-foot of some light sandy soils. Liming would aid the growth of leguminous crops which should furnish humus and nitrogen to the soil. Limited amounts of soluble phosphoric acid and potash should prove profitable.

Bellefontaine Silt Loam.

The soil of the Bellefontaine silt loam is a brown, friable silt loam grading at about 10 inches into bright yellowish-brown to reddish-brown silt loam, which passes in turn into reddish-brown silty clay loam. Between 20 and 30 inches the subsoil becomes a compact gritty or gravelly clay loam and the substratum is quite gravelly or stony till, carrying a high percentage of limestone material. Sometimes it is partially stratified. Gravel pits are often located in it.

Bellefontaine silt loam is confined to the timber belt east of Brookston and Chalmers. The topography ranges from smooth rolling to undulating. Although uneroded, the surface is more uneven than that of other land in the county. The drainage and aeration of this type are good because of the topography and the gravelly substratum, besides a general proximity to streams. The gravel is not near enough the surface to make it droughty.

This type is derived from the weathering of glacial debris piled in terminal moraines, and from ground moraine in advanced stage of oxidation. It was originally forested.

This is commonly called "chocolate clay land," and is generally valued more highly than "white or yellow clay" soils classed in the Miami series. Eighty-five or 90 per cent. of the type is cultivated, and the remainder is in woodlots and pastures. The total acreage in White County is relatively small.

This soil is handled in practically the same way as the Miami silt loam. Corn, oats, wheat, and clover are grown, and livestock business is relatively important. The natural productivity and value of the Bellefontaine silt loam may be slightly greater than that of the Miami.

Although this land is well improved, it might be further improved along the lines suggested for Miami silt loam.

Bellefontaine Loam.

Bellefontaine loam is a light brown to reddish-brown loam or silty loam 10 inches deep. The subsoil is a reddish gravelly clay loam or clay, becoming more gravelly and looser in the lower subsoil. The substratum is gravelly or stony till like that underlying the Bellefontaine silt loam. The land was timbered.

The principal areas of the type are scattered through the rougher timbered land around Brookston and Chalmers. The long and very narrow strips mapped along some creeks and the

Tippecanoe River, as far north as Norway, represent erosional belts of very steep topography sloping from the plains to the stream bottoms. Other areas occur on the rougher slopes of the moraines, and a few are relatively smooth, but with light-textured surface soils. The surface drainage of this type is good to excessive, and some steep slopes are subject to erosion.

The type is very limited in extent, and about 50 per cent. of it is not cultivated.

Corn, wheat, oats, and rye are grown on the smoother areas of this type. The steep stream slopes are in timber and brush or pasture.

About half of this type is better suited to pasture than any other. All classes of farm animals range on it.

Corn and oats yield 20 to 25 bushels per acre under average conditions. Wheat and rye average 10 or 12 bushels.

Areas of Bellefontaine loam are usually so small that they are handled and fertilized just like the adjoining soils if they are cultivated at all.

This type usually forms a small proportion of farms, so is included in a general valuation of $100 to $150 per acre.

Most areas of this type might best be devoted to grasses, hay and wheat and rye, rather than corn and oats. Alfalfa or rye and vetch would protect the land from erosion and improve the soil. Some areas would make good locations for woodlots or orchards.

Many gravel pits are located on this and other Bellefontaine soils. The gravel contains considerable clay, and makes better roads than that from "white gravel pits," but is usually not so well adapted to concrete.

Carrington Silt Loam.

The soil of the Carrington silt loam is a dark brown to nearly black mellow silt loam, averaging 10 inches deep. When wet it is black, and the dry surface of plowed ground is quite brown. The subsoil is a brown silt loam passing into lighter yellowish-brown silty clay loam, which becomes slightly gritty below 30 inches. The substratum is grayish, slightly calcareous boulder till, with local spots of sand and gravel.

This type of soil is found only in the prairie region of White County, the principal areas occurring on the smooth, morainic ridges of Round Grove, Prairie, West Point, and Big Creek townships. The topography varies from gently undulating to rolling,

but is all well adapted to use of farm machinery. The type is naturally very well drained, although the flatter areas have been improved by tiling.

This is the first type of soil which was farmed in the prairie, as there was no danger of crops drowning out even before ditches were dug. Probably every acre of such land is in cultivated fields or farm yards.

Corn and oats are the principal crops grown on Carrington silt loam. Clover is sometimes sown and cut for hay if a good stand is secured. Wheat and other crops are rarely seen on this soil.

Hogs are kept on most farms, and some cattle and sheep are being fed in larger numbers than formerly. Dairying is undeveloped.

Corn and oats will average over 35 bushels per acre on Carrington silt loam. These two crops have been grown exclusively on some fields for over 50 years, with no commercial fertilizer and little manure or clover. In such cases the average yields have decreased 5 or 10 bushels per acre. On farms raising livestock and sowing clover occasionally the crop yields are maintained at a high level. Farmers are beginning to realize that this land can wear out, and are making efforts to bring up their crop yields in proportion with the high valuation of the land. Some commercial fertilizer is applied to the corn crop by means of the planter attachment.

An average valuation of Carrington silt loam is from $150 to $250 per acre, according to improvements and location. Few farms are being sold. Two tracts transferred in 1915 brought $140 and $217 per acre respectively. Some other types of black prairie land were included in these farms.

Carrington silt loam should and could be made more productive than it is on many farms. Although the land is black and contains much organic matter, either livestock or clover should be used to put available nitrogen into the soil. Fertilizer tests as well as analyses indicate that phosphoric acid is the most deficient plant food in these soils. One hundred to 200 pounds of fertilizer containing 8 to 10 per cent. phosphoric acid and 2 to 4 per cent. of soluble potash will usually give a profit with corn. While the same fertilizer will increase oat yields, the value of oats per bushel is not great enough to insure a profit over the cost of the fertilizer. However, it will aid in getting a stand of clover on the oat ground. Raw rock phosphate gives

fairly satisfactory results two or three years after it is applied. Acidity tests show that this soil is neutral or only slightly acid. Limestone would not be needed for most crops, but in the thinner ground would benefit clover or alfalfa.

Carrington Silt Loam—Flat Phase.

This phase differs from the typical Carrington silt loam by having blacker soils of greater depth, which averages 14 inches. The subsoil is grayish-brown or mottled brown, gray and yellow heavy silt loam or silty clay loam. The brown mottlings usually become more distinct and plentiful with depth, and the texture lighter and slightly gritty below 30 inches. Although the mechanical analysis shows little difference between soil and subsoil, the latter has a stiff and semi-plastic structure like a silty clay. The substratum is a stony till, and in places there are strata of sands, gravel, blue clay, etc. As mapped in White County, this classification includes small or indefinite areas of Clyde silty clay loam and also slightly better drained spots where the subsurface is solid brownish-gray and the deeper subsoil is mottled with gray. It is seldom possible to draw a sharp boundary between this phase and the typical Carrington silt loam on the one hand and the Clyde silty clay loam on the other.

The type is limited to the prairie region of the southern half of the county, and also around Wolcott, where it resembles and blends into the Carrington loam. The topography is very flat to very gently undulating, with a few small rises and depressions. The drainage is naturally quite poor. Some areas were quite marshy in rainy seasons. Now the type is well provided with dredged outlets and with thousands of rods of tile drains, so that crops are in no danger of drowning out.

This is the most important and extensive soil type of the prairies, and one of the most important in the county. It is entirely utilized for agriculture.

This phase of Carrington silt loam is devoted to the production of corn and oats. Only a few farmers attempt to grow clover or any other hay crop. Sometimes small pastures are provided for work stock, but they are usually turned out on stubble or in stalk fields.

For some years the livestock business was neglected on the prairie, but there is a tendency now to feed more cattle and sell less of the crops.

This type of soil yields 40 bushels of corn and oats under

average conditions, and many farmers are not satisfied with less than 60 bushels. The season is the largest factor in determining results.

The average size of prairie farms is large and the land lies ideally for carrying on operations on a big scale. Gang plows, two-row cultivators, and other large-sized implements make up for the deficiency in labor. The land is broken deeply and well cultivated. Corn is usually kept clean, though this is difficult in very wet seasons. In a few fields, gopher vine, smart weed, and other bad weeds are giving much trouble. Commercial fertilizers are not used, and little effort is made to keep up soil fertility. Up to the present date, the crop yields maintain a very high average without applying any plant food. Because of the poor drainage in early days, much of this soil has not been farmed regularly over 25 years, and some virgin sod was broken less than 15 years ago.

In recent years the valuation of this land has risen to very high figures, and trading was brisk, though little prairie is on the market at the present time. Six farms consisting of Carrington silt loam—flat phase and Clyde silty clay loam were sold in 1915. They averaged 140 acres in size and brought from $97 to $228 per acre. Six farms containing flat phase associated with Carrington loam sold at lower average figures. Land values of this type in Round Grove township may be slightly lower by the distance from railroads.

Where the Carrington silt loam-flat phase has been well tiled, it is a fine soil needing little improvement. It is new land of great lasting qualities. However, experience proves that any soil will "wear out" if cropped exclusively to corn and oats, so sufficient manure and legumes should be put in the soil to keep it up. Since the land is valued so highly, ordinarily good crops do not return much interest on the amount of money invested. Therefore the land should be farmed more intensively and an effort be made to bring it up to the standards set by Boys' Corn Clubs, and so make farm operations really profitable.

Carrington Loam.

The soil of the Carrington loam consists of a black loam of variable texture about 12 inches in depth. The subsoil is yellowish-brown, brown and gray heavy loam or clay loam becoming lighter textured and brighter colored with depth. The surface soil may effervesce slightly with acid, while the subsoil usual y

gives a strong reaction indicating the presence of calcium carbonate in considerable quantities. In local spots the soil mantle is only 2 or 3 feet deep, and rests directly upon limestone, and throughout the type limestone forms a substratum at depths of 20 feet or less.

The main development of the Carrington loam is in Monon township. Between and along Big and Little Monon Creeks, where erosion has removed more of the old lake plain deposits, the bed rock is within about 8 feet of the surface. Experienced tile ditchers say that there are probably 100 acres of land in this neighborhood where the depth to rock averages 30 inches deep, but the substratum was very seldom encountered with a 3-foot soil auger. The rock is revealed in several dredged ditches, by outcrops along the creeks, and in the stone quarry just south of Monon. The rock does not seem to be weathered, and the overlying soils do not seem to be residual. Glacial boulders occurring on the surface of the land are granitic, not limestone.

The topography of this type is level to gently undulating. It was originally a moist prairie except for some thinly timbered areas near the creeks. The surface drainage was fair, and is now improved by dredged ditches and tiling. In places it was necessary to blast the limestone from the ditch bottoms, and rock sometimes interferes with tiling operations.

Although a prejudice exists against land with rock bottom, it seems that only a very small per cent. of it is really seriously injured by having too shallow a soil. Corn is the crop most likely to suffer. The type is mostly under cultivation.

Corn, oats, and some wheat are grown on this land. Probably more use is made of clover and livestock here than on the typical Carrington loam of White County.

Thirty to 35 bushels of corn and oats are considered average yields for a term of years. The better farms produce much larger crops. Twenty bushels is a fair yield of wheat, but some fields produced 40 bushels per acre in 1915.

This soil is handled like the other heavy-textured prairie types, but more commercial fertilizer is needed and used.

Most of the Carrington loam is located near towns, and the value is increased thereby. The farms are valued between $100 and $175 per acre.

Increased use of clover and livestock are the principal needs of this soil, but fertilizers containing soluble potash and phosphoric acid will doubtless be profitable.

Carrington Loam-Flat Phase.

The soil of the Carrington loam-flat phase is a dark brown to almost black mellow loam from 12 to 16 inches deep. The subsoil is a brown loam grading quickly into a yellowish-brown clay loam mottled with gray and brown. Sometimes there is a slight veneer of fine sand on the surface, and the sub-stratum may be sandy. This type grades gradual y into the adjoining Carrington silt loam and fine sandy loam, so that no sharp boundary can be drawn.

Carrington loam is a prairie soil occurring most largely around Wolcott, where it is partially surrounded by the fine sandy lake plain soils.

The topography is flattish to gently undulating. In this respect and in the gray mottling of the subsoil it is not typical of the Carrington series. The Carrington loam-flat phase occurs far from any natural waterways, and was once insufficiently drained, but all surplus water is now removed by tile drains and open ditches.

Apparently this loam was formed by the admixture of sand thinly spread over the formerly silty prairie. In a few areas scattered in the southern part of White County, it may be the result of weathering of sandy glacial till.

This soil type is quite important, though relatively inextensive in White County, and includes almost no waste land.

Like the other prairie soils, it is used principally for corn and oats, though a few farmers grow clover and raise livestock.

In crop yields it equals Carrington silt loam.

This type is handled like the other prairie sil. The sandy or loamy surface soil is easier to plow and cultivate but is practically as strong and lasting as the silt loam.

The value of Carrington loam-flat phase is slightly depreciated by association with poorer sandy lands, but 8 or 10 farms consisting largely of that type were sold in 1915 at prices ranging from $62 to $175 per acre.

On a certain farm near Wolcott one field of Carrington loam was reported to average 40 bushels of corn per acre after many years of cropping to corn and oats, and with the occasional application of manure. An adjoining field received no manure and now averages only 25 bushels of corn per acre. This case illustrates how this soil *should* and should *not* be treated. Suggestions offered for improving other Carrington soils apply also to the loam.

Carrington Fine Sandy Loam.

This type is a dark brown, mellow or loose fine sandy loam averaging 14 inches deep. The subsoil is a brown fine sandy loam or loam grading into a yellowish-brown fine sandy clay loam. Sometimes the sandy layer is over three feet deep before the heavy subsoil is encountered. The substratum is till, which is sometimes of a sandy nature. Some of the areas around Monon and Lee are underlain by limestone at shallow depths.

The Carrington fine sandy loam occurs around Wolcott and in some spots of well-drained sandy prairie scattered through the lake plain in the northwestern portion of the county. The topography is level to gently undulating. Some areas are low, gentle rises above the surrounding prairie, and others are transitional between the heavier prairie and the sandy lake plain soils. The drainage is usually good, due to its position and fairly porous structure.

This type is the most inextensive and poorest of the prairie soils, especially where the sands are deepest. Where it approaches and blends into the Carrington loam it has almost equal value. It is largely utilized for farming.

Corn, oats, and occasionally wheat and clover are the crops grown on this type.

Livestock raising and feeding and dairying are not important on Carrington fine sandy loam.

Crop yields will probably average somewhat lower on this type than on Carrington loam unless it is kept up by manure and legumes. The areas with a limestone substratum are slightly more productive than the general run of the type.

Land of this type is handled like other prairie soils. It is easier to cultivate under wet conditions than the heavier soils. Fertilizers and manure are not largely used.

The value of the Carrington fine sandy loam varies greatly with the character and proportion of associated soils. It ranges from $60 to $150 when mixed with Carrington loam.

This type of land is well adapted to corn, as it is warm, deep and mellow. However, it is more droughty and not so strong and lasting as other prairie soils. Yields could be profitably increased by use of manure or legumes and fertilizer containing soluble phosphoric acid and potash. This is a good trucking soil, and might be more used for potatoes, as the home markets could consume most of the crop. Purdue recommends 500 pounds of

fertilizer per acre for potatoes. It should contain 2 per cent. nitrogen, 10 per cent. phosphoric acid, and 6 per cent. potash.

Clyde Silty Clay Loam.

The surface soil of the Clyde silty clay loam is a black silty clay loam 16 inches deep. At the immediate surface it is usually friable to loose, due to organic matter, and just above the subsoil it typically becomes more densely black and slightly plastic. This passes quickly into a grayish silty clay loam to silty clay. The lower portion becomes mottled more or less with rusty brown and yellow. The substratum may be grayish heavy till or may be beds of brownish sands and fine gravel as shown at the clay pits west of Chalmers. The subsoil is somewhat calcareous, and small white lime concretions occur. Where associated with Miami soils, the boundaries of this type are usually sharp, its surface is rather grayish-black, and the average texture of the soil is heavy. In the prairie region the boundaries between the flat phase of the Carrington silt loam and Clyde silty clay loam are often arbitrary as they grade gradually into each other. There is often more structural than textural difference between them.

Most of this type is located in the southern half of White County, intermingled with the Miami and Carrington soils. Some areas occur north of Reynolds and elsewhere in the sandy lake plain. The topography is very flat and slightly depressed below the surrounding soils. The type was formerly marshy and covered with water a portion of the year, but most of it is now traversed by dredge ditches, open and tile drains, so that crops are insured in wet seasons.

The Clyde silty clay loam is one of the strongest and best soils of White County and all central Indiana. All of it is used for cereals, hay or pasturage.

Corn and oats are the main crops grown, with an occasional field of timothy and clover. Some of this type supports blue grass pasture, which is highly valued by stockmen. Animals are grazed and fed on this land, more because of the heavy growth of grass than for the purpose of improving the soil.

On well-tiled farms this type is expected to yield 40 bushels of corn and oats per acre. In exceptionally wet seasons it may not do so well as the Carrington silt loam. Clover does very well if a good stand is secured, and it does not winter kill. Sev-

eral fields of little red clover observed in 1915, promised to yield nearly 2 tons of hay per acre. Clover seeded the same spring caught very well. Timothy hay makes a rank growth and sometimes yields over 2 tons. Average yields of all crops may be doubled in best seasons.

Since Clyde silty clay loam has been generally drained it is handled like the Carrington soils. Great care must be taken to avoid putting it in bad physical condition by plowing when too wet. Cultural operations are more difficult than on lighter and more loamy land. Most of the land is new, and fertilizers are not used.

Well-drained Clyde silty clay loam is some of the highest-priced land in the county. It comprised part of 10 farms sold in 1915 at prices ranging from $100 to $228 per acre. Much of this soil lying west of Chalmers could not be bought for $250.

Some areas of this soil can be improved by more thorough drainage. Sometimes so-called "bogus" or "alkali" spots are found in this and other heavy prairie soils. They are characterized by white incrustations of salts on the surface, and by the poor growth of corn. The salt is probably lime sulphate in most cases. Chemical analyses and fertilizer experiments by Purdue indicate that the bogus condition is caused by acidity and lack of available phosphoric acid and sometimes of potash. These elements should be supplied in fertilizers. Applications of straw and manure and better drainage are also beneficial. Liming may be needed in these spots, but the bulk of Clyde soils are alkaline or neutral. A very good field of alfalfa east of Chalmers on this land suggests that a greater acreage of that valuable forage should be sown. All the farmers should follow the examples of the leaders and keep the land built up by legumes and livestock.

Clyde Silty Clay Loam—Heavy Phase.

This phase consists of black silty clay about 12 to 20 inches deep. Sometimes the immediate surface is slightly lighter textured. The structure is fairly plastic and smooth, and when dry the clay becomes very hard and cracks deeply. Sometimes it passes quickly from a very black soil into light gray subsoil, and again it grades through a drab silty clay into gray mottled with rusty or reddish-brown plastic, sticky clay. Lime concretions are usually found in the subsoil, which effervesces with acid. The substratum consists of gray clays, till, and often brownish sandy strata.

This phase differs from the typical Clyde silty clay loam only in texture and drainage conditions. It is found in a few small areas north and northeast of Chalmers. The topography is flat, as this soil occupies the lowest part of the depressions which are largely the silty clay loam. The drainage s not so good as on the silty clay loam, but much of it is ditched and tiled.

It is very limited in extent, but is valuable for corn, oats, and pasture. It is more intractable, but is priced as high, yields as much, and will probably prove more lasting than the silty clay loam. The crops grown and methods employed are common to the prairie land. Early maturing varieties of corn should be planted on this and all Clyde soils, because they are moist and rich in nitrogen, so that the growth continues dangerously near frost time, which comes early in low ground.

Clyde Loam.

The soil of the Clyde loam is a black loam of variable texture, and about 13 inches deep. Often the surface is a fine sandy loam, or may be slightly mucky. Below, the soil is a drab clay loam, passing quickly into light gray semi-plastic and sticky clay loam mottled slightly with brown. In areas of the southern and central portion of White County the deep subsoil and substratum are usually grayish mottled clay loam and clays and stony till. It is calcareous. In the northern portion of the county well within the lake plain the substratum is usually sandy.

Most of this type occurs north of the Pennsylvania Railroad and west of the Tippecanoe River, though some areas are found northwest of Idaville and also scattered in the southern part of the county. The topography is flat and the surrounding land is somewhat higher. The drainage was naturally poor, and some areas need an extension of the general system of ditching and tiling. The type includes typical lake marshes and also prairie land, which was veneered with a little sand and encircled by sand ridges so that rainfall could not escape. Some borings bore a close resemblance to Carrington loam—flat phase.

Clyde loam is often called "willow land." It includes much of the best soil of the lake plains, although thorough drainage was necessary before crops were sure. It is fairly extensive in Honey Creek township. It is all used for cereal and pasture.

Corn and oats are the principal crops grown on this type. The acreage of wheat and clover is very limited.

The type was formerly devoted to grazing and marsh hay, but

now only the wettest portions are generally used for those purposes. Some cattle are raised and fed on Clyde loam.

Very good average yields of corn and oats are now secured. In ordinary and dry seasons this land will surpass much of the prairie land, but excessive rainfall drowns out some of the lowest fields. Some of the best yields are 70 bushels of corn and oats and 35 bushels of wheat per acre, while half those amounts represent average conditions.

This type is handled and fertilized just like the other black lands of the county where grain growing is the dominant industry.

Trading in this kind of land was fairly brisk in 1915. Eight large farms consisting of this type and Clyde fine sandy loam sold at $90 to $210 per acre. In several other farms which included some light sandy land the prices ranged from $85 to $130 per acre, and two farms of Clyde and Miami loams brought $111 and $150.

Much of the Clyde loam could be further improved by deepening drainage outlets and laying tile 50 to 100 feet apart. "Bogus" spots and mucky areas should be fertilized with potash and phosphoric acid. Straw and manure are also useful, but they are needed more on light sandy land. Early maturing varieties of corn should be grown to avoid danger of early frosts. Seed should be selected from mature plants before the general harvest time, and stored in a dry place for the winter. It would doubtless be found profitable to grow more legumes and utilize more of the grain in the production of beef or pork.

Clyde Fine Sandy Loam.

The surface of this type is a black fine sandy loam or loamy fine sand 10 to 15 inches deep, and the subsoil is a light drab sticky fine sandy loam or loam mottled with brown and drab and grading into loose fine sands below 30 inches and in the substratum. Along the lower border of the lake plain the subsoil and substratum are often of heavier glacial till.

This type is confined entirely to the lake plain region of White County, where it is found in nearly every section of land. The surface is very flat and lower than that of the light sandy soils around it. The drainage is now generally good by means of many ditches and lines of tile. Some areas remain in the former marshy condition. Although the substratum is very porous, the water table stands near the surface and keeps the land from being droughty.

The Clyde fine sandy loam is the most extensive and important type of lake plain in White County as well as of northwestern Indiana. In this area probably 85 or 90 per cent. is cultivated, while the remainder is used for pasture and marsh hay. Eventually, all will be used for tame crops.

Corn and oats occupy the largest acreage of this type. It is about the best of the light-textured black lands for wheat, and some of that grain is sown. Clover, rye, timothy, and buckwheat are rarely sown.

Before the land was drained the Clyde fine sandy loam was used principally for marsh hay and pasture. It is still used for that purpose by a number of stockmen. Large herds of feeding steers were observed on this type in 1915. One farm was carrying 1,000 head of hogs besides several carloads of cattle.

It is claimed by some farmers that the black sandy land will give better yields than the prairie soils in dry seasons. However, they were never sure of a crop until the big dredged ditches were dug. Now corn and oats average 30 bushels, wheat 18 to 20 bushels, and timothy 1 ton per acre.

This land is handled like the other black lands devoted to corn and oats. The land used for cattle is usually in permanent blue grass or marsh grass pasture. The land can be plowed very wet without injury to the tilth. Potash fertilizer is applied to corn, especially where the surface soil is mucky. Kainit is preferred because it is thought to ward off certain insects.

Over 45 farms of White County which were sold in 1915 were partially comprised of Clyde fine sandy loam. Two farms composed entirely of this type brought $150 and $187 per acre. When associated with Clyde loam and a small proportion of light sandy land, a dozen farms sold for $90 to $210 per acre. Mixed with Miami fine sandy loam in 10 instances it brought from $50 to $163 per acre. In 20 farms it was mixed with Knox fine sandy loam, and in most cases the price per acre was $50 to $100, although several of the best places went at $125 or more. More trading is done in this than any other type of land.

In much of the Clyde fine sandy loam the prime need is still more thorough drainage. Experiments were made by Purdue on a somewhat "bogus" field of soil northwest of Monon. The result of fertilizing oats showed that potash was badly needed, and phosphoric acid was beneficial, but it was useless to apply nitrogen. Acidity tests show this black sandy land to be neutral or alkaline in most cases. Experiments with corn have shown

10 to 20 bushels per acre increase from use of potash on the mucky phases of this type. The quality of the grain is also greatly improved by proper fertilization.

Clyde Loamy Fine Sand.

The surface of this type is a dark gray to black loamy fine sand or fine sand averaging 14 inches in depth. It usually contains 6 per cent. or more of organic matter derived from marsh grasses. The subsoil is a gray or brownish gray loamy fine sand quickly becoming a light gray loose fine sand. The substratum is loose, grayish and brownish sands to considerable depths. Sometimes the better phases of this type have a silty layer a few inches thick in the subsoil.

An acid phase of this type is very slightly developed in White County. It occurs especially along the line of contact with Dunkirk fine sand and Knox fine sand. It is characterized by a more shallow and grayish soil and more brownish mottlings in the subsoil. Dewberries and huckleberries are commonly found on this phase, and there is often a thin growth of pin and black jack oak.

Clyde loamy fine sand is restricted to the northern half of the county in the sandy lake plain region. The largest and most typical areas occur in the northeastern corner of the county. This type is associated with Knox fine sand and Dunkirk fine sand.

The topography of Clyde loamy fine sand is flat to very gently undulating. This soil occupies slightly depressed areas or marshy flats surrounded by sandy ridges, so the natural surface drainage is quite poor. Although the subsoil and immediate substratum are quite porous, there are impervious strata at lower depths, which keep the water table near the surface (about 36 inches to 50 inches), and make this nondroughty soil. At the present time artificial drainage has been provided for most areas of Clyde loamy fine sand.

This type includes the poorest of the black lands, and is relatively inextensive in White County. Probably 60 to 70 per cent. of such soil is now cultivated, while the remainder is used for pasturage. This pasture land usually bears a growth of marsh grasses, and often pin and black jack oaks, quaking aspen, dewberries, blackberries, etc.

Corn and oats are the principal crops grown on this land. Wheat and hay are of secondary importance. Fattening cattle

and the general classes of farm stock are grazed to some extent on this type.

The crop yields on Clyde loamy fine sand have a wide range, according to season and minor variations of the soil. Corn and oats will yield from 15 to 40 bushels, with an estimated average of 23 bushels per acre. Wheat will average about 10 bushels, and hay returns something less than a ton per acre.

At the present time this land is handled and fertilized like the Clyde fine sandy loam.

Some of the better areas of this land are valued almost as highly as the Clyde fine sandy loam, while other areas of lower productiveness, located far from towns, are low-priced. This type comprises part of 11 farms sold in 1915, the prices of which ranged from about $25 to $150 per acre.

The suggestions offered for improvement of Clyde fine sandy loam apply also to the loamy fine sand. However, the latter classification includes more acid land, which requires special attention. Analyses and field experiments show that the sour land would be benefited by applications of limestone and also phosphoric acid. Analysis of a sample taken in S. W. Quarter, N. E. Quarter, Section 25, R. 2 W., T. 28 N. showed that the land was slightly acid and contained only 12 per cent. phosphoric acid and .05 per cent. potash (K_2O) soluble in strong acid. The soil contained 1.03 per cent. potash, but the land is improved by use of this element in a soluble form.

Dunkirk Fine Sand.

The surface of this type to an average depth of 8 inches is a grayish-brown or light-brown fine sand. Sometimes the first inch or two is dark-colored and loamy. The subsoil is a loose light yellowish-brown fine sand, with slight mottlings of gray, which usually become more pronounced with depth. Some spots of land are almost orange-colored. Rarely there may be a thin layer of fine sandy loam in the subsoil, but the loose sands extend to considerable depth.

The Dunkirk fine sand occurs only in the northern and sandy portions of White County. The areas of this soil are of small average size; seldom contain more than 300 acres, and are most abundant throughout Township 28 N. They typically occur in positions intermediate between the black lands and the sand ridges.

The topography is flat to very gently undulating. As the surface is elevated slightly above the marshy land, the type was naturally drained by run off and by downward percolation of water through the loose sands. In some of the flatter areas, where the water table formerly stood too near the surface, the land has been improved by ditching.

It is not so good as the black lands, but is better than the Knox fine sand. It was originally timbered with pin, black jack, red and white oaks, aspen, etc., with an undergrowth of briars, hazel brush, mosses, etc. Probably 80 per cent. of the type is now cultivated.

Corn, oats, and wheat are the main crops grown on Dunkirk fine sand. Livestock incidental to general farming are pastured on the uncleared areas of this type. In 1915 a number of small fields of cowpeas were observed, which were growing fairly well. Some rye is grown.

A fair average yield of corn and oats is 20 bushels per acre, but well handled and fertilized land will do much better. Wheat averages about 10 bushels, and rye about the same. Timothy hay yields about three-fourths of a ton per acre. Cowpeas are still in the experimental stage in White County, but often yield a ton of hay per acre.

Dunkirk fine sand is a very easy soil to cultivate, because it is loose and well-drained. The loose surface forms an effective mulch, which conserved moisture very well in dry weather. It is the general practice to put all the available manure on this land. Also fertilizer is applied for corn or wheat at the rate of 100 to 200 pounds per acre. It usually contains 2 per cent. nitrogen, 8 to 10 per cent. phosphoric acid, and 2 to 4 per cent. of potash. Rye is sometimes plowed under as a green manure.

Dunkirk fine sand sells from $25 to $150 per acre, depending on the proportion of black land and sand ridges in the farm, distance from town, etc. Alone, it should be worth $50 to $100.

Dunkirk fine sand is a soil which can be "built up" and improved in many ways, and could be used more for trucking, although there are no near city markets. According to acidity tests made by Purdue on land of this general character, applications of 300 pounds to 2 tons or more of ground limestone would be necessary to neutralize the acidity in an acre-foot of soil. The abundant growth of dewberries, red sorrel, and cinquefoil indicate the general sourness of Dunkirk fine sand. An analysis of a sample of this soil, taken in S. W. Quarter of N. W. Quarter,

Sec. 25, R. 2 W., T. 28 N., showed less than 2 per cent. organic matter, and .08 per cent. nitrogen. Strong acid extracts gave .06 per cent. phosphoric acid (P_2O_5) and .03 per cent. potash (K_5O), although there was 1.44 per cent total potash. There was .33 per cent. lime and magnesia, but they were not in the carbonate form, and 1,470 pounds of limestone would be needed to correct the acid in an acre-foot. These figures show the great need of organic matter and nitrogen. By liming the land, clover could be grown to supply this deficiency, but cowpeas can be successfully sown on acid land, and are good for hay, grain, pasture, or sil improvement. More use should be made of rye, or rye and vetch for green manure and hay. Where possible, livestock raising or dairying should be followed, and the manure carefully returned to the soil. It will be necessary to supply liberal amounts of phosphoric acid in order to make this soil very productive. Some soluble potash would probably be profitable, but this element is fairly abundant in the soil, and should be made available by the action of decaying organic matter.

Dunkirk Fine Sand—Rolling Phase.

This soil consists of a loose, incoherent light-brown or grayish-brown fine sand loam about 8 inches deep, underlain by light yellowish-brown, incoherent fine sand to considerable depth. It is very uniform in texture, containing over 50 per cent. of fine sand, and practically no particles coarser than medium sand. The surface may be dark in wooded and grassy areas, or light yellow where cultivated or disturbed by the wind. Sometime the subsoil is stained with iron to a reddish or bright orange color.

The Dunkirk fine sand—rolling phase—occupies the broken dividing ridge which separates the southern, silty half of White County from the northern or sandy half. It is found throughout the latter region. Some of the largest and most characteristic areas are situated in Cass township.

This soil typically occupies ridges from 3 or 4 to 40 feet or more above the surrounding land. One side of the ridge always is rather steep, and the other side is a more gradual slope. This type appears to have been formed by wind action from the same material as the Dunkirk fine sand at the time when the land surface was not protected by vegetation. Some of the larger ridges may have been glacial moraines, but such material is now deeply covered with loose fine sand, and no rocks or gravel are observed

on the surface. Topographically, this soil grades into the Dunkirk fine sand. Some of the broader areas of Knox fine sand are not distinct ridges, but rather a series of choppy or billowy knolls, which stand higher above the general water table than the typical Dunkirk areas.

On account of its porous structure and elevated position, this phase is well to excessively drained.

The droughtiness, roughness, and low fertility of this land make it the least desirable soil in White County. About half of it is cultivated, and the remainder is in scrubby oak timber and pasture.

Corn is the principal crop grown on this phase. Rye, wheat, oats, and cowpeas are also observed on the ridges. Rather poor pasture is afforded for all kinds of farm stock.

It is estimated that corn will average 10 or 15 bushels per acre, and other crops in proportion. On the flatter areas and in wet years the yields will almost equal the normal returns of Dunkirk fine sand.

This land is handled like the Dunkirk fine sand, though it is not thought worth while to expend much effort with it, and fertilizers are supposed to be depleted by leaching. More corn is grown because cultivation conserves the moisture very well. Rye is used to protect the land from blowing, and to furnish organic matter.

Small areas of Dunkirk fine sand—rolling phase—are valued for building sites on black land farms, but places composed largely of this type are worth from $20 to $75 per acre.

The practices suggested for the improvement of this phase would also help the Knox fine sand, although the latter would always remain rather droughty. However, even in dry weather a well-cultivated sand ridge seems to have plenty of moisture below the surface, so if the rains are well distributed the greatest need would be for organic matter and soluble plant food.

Genesee Fine Sandy Loam.

The surface of this soil is a mellow brown fine sandy loam averaging 10 inches in depth, and is underlain by light-brown or grayish-brown fine sandy loam slightly mottled in the lower depths with gray and brown. The substratum consists of alluvium ranging from clay to sands and gravel.

This type occurs as narrow strips along the Tippecanoe River

and some of the larger streams. The topography is level, but more or less cut up by old stream channels. Along Big and Spring Creeks this type is rather uneven in the surface, and includes more or less Fox fine sandy loam. Along the upper courses of Moots, Spring, Big, Honey, and Monon Creeks the bottoms become black enough to be classed with the Wabash series, but on account of their small extent are grouped with the Clyde soils, which they resemble and into which they grade.

The bottoms are subject to overflow at the time of the spring freshets or after very heavy rains. At other times the drainage is naturally good because of proximity to streams and fairly porous substratum.

The Genesee fine sandy loam is very inextensive in White County, and of little importance in the general scheme of farming. Probably 25 per cent. of the type still bears the original growth of sycamores, willows, water maples, elm, pawpaws, hackberries, oaks, etc., and the remainder is used for crops.

The principal use of this type is for corn, oats, and pasturage.

The yields of corn and oats may vary from 20 to 60 bushels, and probably average 30 bushels per acre.

This soil is recognized to be a good corn soil, and is planted to that crop most of the time. Careful cultivation is needed to keep the fields free from weeds, as they are seeded by the frequent overflows. Fertilizers are rarely used.

The value of this land depends on the character of the adjoining soils and location in reference to markets. One hundred dollars per acre would buy most of it.

The soil is quite sweet, and might be used for clover in the better-drained areas. Thorough cultivation and careful seed selection increase corn yields.

Fox Fine Sandy Loam.

The soil of the Fox fine sandy loam is a brown to light-brown, fine to medium sandy loam. At about 10 inches it grades into light-brown fine sandy loam, or loam which passes into light grayish-brown gravelly loam or earthy gravel. The substratum consists of loose gravel beds, with stones ranging in size up to several inches in diameter. A large share of the gravel is derived from limestone. The lower subsoil effervesces with acid.

This type occurs in a terrace position along the Tippecanoe River as far north as Wright's Ford, and along Moots Creek, and

in a few small areas along the other large creeks. It is above overflow, and is sometimes 30 or 40 feet above the streams.

The topography is typically flat, but some areas slope decidedly from the uplands to the first bottoms, and are of uneven surface, due to erosion.

The surface drainage is complete, and the gravelly substratum makes this land rather droughty.

Possibly 15 to 25 per cent. is in pasture and woods.

Corn, oats, and wheat are the main crops, and all farm animals graze on the pasture on this soil.

The average yields of corn and oats are 25 to 30 bushels, and wheat is about 12 to 15 bushels per acre. In wet seasons these yields may be much more.

Fox fine sandy loam is handled and fertilized much like the associated Miami soils.

This soil sells for about $100 to $125 per acre, except where it has a high value because of the gravel pits located on it.

This soil would be benefited by more thorough cultivation to conserve moisture, and by growth of legumes for the nitrogen and organic matter they will add to the soil.

Muck.

This soil is a black muck composed almost wholly of organic matter from 12 inches to 3 feet in depth. In the deeper phases it is underlain by brown fibrous peat or an ashy feeling loam where the muck beds have been burned out. The shallow muck is underlain by brownish and grayish fine sands, which also compose the substratum.

This soil is found in small areas throughout the sandy portion of the county, and in two or three large areas in Monon township. A few small spots are located in the southeastern part of the county.

The topography of muck is flat and depressed below the surrounding land. This type was formed from the heavy growth of marsh grasses, flags, rushes, and mosses in the old ponds and marshes, and was naturally covered with water most or all of the year. It sometimes has a sparse growth of aspens and willows. All but a few areas are now ditched and tiled, so that farm crops can be raised.

Muck is not extensive enough to play an important part in the agriculture of White County. Probably 75 per cent of it

is used for the production of cereals and the remainder for marsh hay and pasturage.

Corn and then oats are the important crops grown on muck. It is somewhat used by cattlemen for pasture and hay.

In one or two instances onions have been grown on muck in White County, with moderate success.

The average yields of corn and oats on muck are about 35 or 40 bushels per acre, with the usual fertilization.

Muck is handled like any of the black lands, and is often put in corn for several years in succession. Many areas become unproductive after several crops, and this land is usually treated with kainit, muriate or sulphate of potash or some mixed goods containing potash and phosphoric acid, with good results. This material is applied at the rate of 100 pounds to 200 pounds per acre by means of fertilizer attachment on a corn planter.

The value of muck varies from very little to over $150 per acre, according to drainage, distance from town, and the nature of the other soils on the farm.

Muck is adapted to a variety of special crops, as shown by the general practice on this type in northern Indiana. It is a first onion soil, and sometimes gives large returns from this crop. However, the crop yields and price per bushel are so underlain, and so much hand labor is involved that onion growing is a hazardous business. Mint growing is another special line of farming for muck, but there are no stills for the extraction of the oil in White County. Celery, hemp, sugar beets, and sunflower seed are often profitable crops on muck in other localities, and might be tried in White County if special knowledge and facilities were provided. Irish potatoes are a more practicable crop to be grown on muck in White County. Purdue recommends the application of 200 pounds acid phosphate and 200 pounds of sulphate of potash per acre for potatoes on this class of soil. Some muck is sweet and requires no lime, while other areas are sour, as shown by growths of huckleberries, dewberries, etc., and by acidity tests. Such land requires applications of ground limestone, and usually needs phosphoric acid even more than it does potash. The use of fertilizers not only increases yields, but improves the quality of corn wonderfully.

SUMMARY.

White County comprises an area of 507 square miles in northwestern Indiana.

It is a gently undulating plain lying 800 feet above sea level, with the narrow valleys of the Tippecanoe River and larger creeks cut 20 to 120 feet below the general elevation.

The northern half of the county is an old lake plain characterized by black, formerly marshy, sandy lands and light sand ridges. The southern half is a glacial plain with low moraines, and has both timbered and prairie lands.

The area is now completely drained by artificial outlets and tiling.

The inhabitants of the county were drawn from the eastern states, and a few from foreign countries, together with a recent influx from Illinois.

Monticello has a population of about 2,000, and is the county seat.

The county is very well improved in respect to schools, roads, drainage, telephones, farm buildings, etc.

The climate is temperate, though great and sudden variations occur. The growing season is nearly six months between frosts.

This area was first farmed by white men in the 20's. Timber lands were used before the prairie and marsh lands.

Since 1875 the predominant type of agriculture has been based on the production of corn and oats. Wheat and clover are important on the lighter-colored lands, and hog and cattle have been extensively fed by many farmers.

The average value of land for the county is $77 per acre.

The Miami soils of White County include the light-colored timbered lands of glacial origin, and are used for corn, oats, wheat clover, and livestock feeding.

The Bellefontaine series includes the "chocolate clay" lands, and correspond closely to the Miami soils.

The Carrington soils are deep black, with brown or mottled brown and gray subsoils. This land was originally prairie, and includes some of the best land in the county. The silt loam and its flat phase are the main types.

The Clyde series includes land which was originally marshy but is now well-drained. The soils are black and subsoils gray or gray mottled with brown. Textures range from loamy fine

sand to silty clay, but the fine sandy loam is the most extensive type.

Some muck is found in White County, and is a good corn soil when fertilized with potash.

Dunkirk fine sand is the flatter and better kind of deep light sandy land found in the northern half of White County.

Dunkirk fine sand—rolling phase—includes the deep droughty sand ridges of the old lake plain region.

The overflowed bottoms along the larger streams were mapped as Genesee fine sandy loam.

Second or nonoverflowed bottoms underlain by gravel beds were mapped as Fox fine sandy loam.

The recommendations for improvement of practice are based on two bulletins of the Indiana Experiment Station called "Unproductive Black Soils" and "Fertilizer Experiments on Clay and Loam Soils;" also on their acidity tests of soils all over the State. Some general points are based on information gained from talks with Purdue professors.