

SOIL SURVEY OF PIKE COUNTY, MISSOURI.

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DESCRIPTION OF THE AREA.

Pike County lies in the northeastern part of Missouri. It is bounded on the north by Ralls County, on the east by the Mississippi River, on the south by Lincoln and Montgomery Counties, and on the west by Audrain and Ralls Counties. It extends along the Mississippi River for nearly 40 miles, and has an area of 668 square miles, or 427,520 acres.

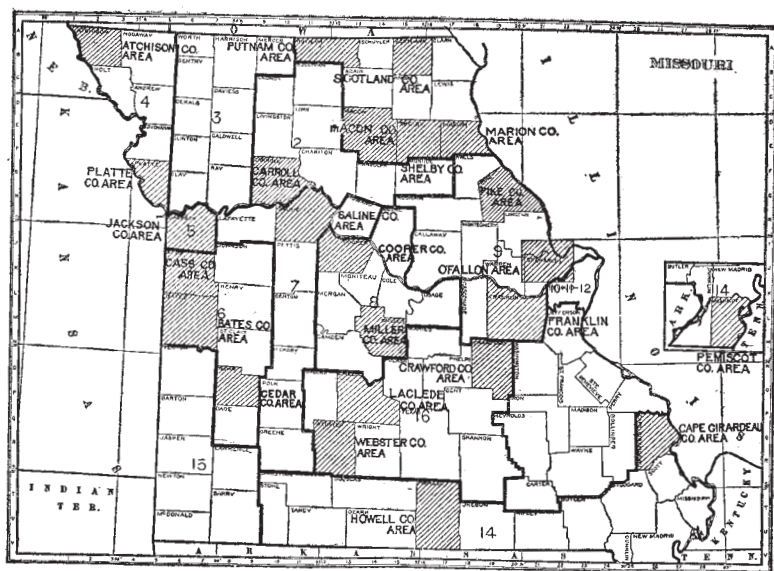


FIG. 46.—Sketch map showing areas surveyed in Missouri.

Topographically the county has three distinct divisions, the level and gently rolling uplands or prairies, the broken or hilly regions, and the river flood plains or bottom lands. Broadly, the uplands comprise the southwestern part of the county, the hilly regions the northeastern part, and the bottom lands narrow strips along the Mississippi and Salt Rivers. The hilly region, however, has encroached upon the uplands, working back along the stream courses, until only remnants or strips of the uplands are left, and these are being gradually reduced. The hills themselves are also being encroached upon by the streams and cut down into flood plains, so that a very gradual

but persistent transition from level uplands to hills and from hills to bottom lands is in progress.

There is a difference in elevation between the Mississippi River flood plain at Louisiana and the edge of the prairie at Bowling Green of a little more than 400 feet, and this represents the work of the streams. At one time the uplands extended beyond the eastern edge of the county. Conclusive proof of this is found in the nearly horizontal rock beds which outcrop along the streams in the central part of the county, just below the edge of the uplands, and also appear at about the same horizon in the ridges and knobs at Louisiana and Clarksville, and all along the eastern edge of the county. The same beds are found across the river in Illinois. The ridges, hills, and knobs are not the result of uplift and foldings, as might be supposed from their steep slopes and sharp crests, but are merely remnants of the old uplands which have not yet been cut down by the streams.

Although the upland region of Pike County is apparently level, it has a gradual slope to the west. The upland region of northeast Missouri as a whole, regardless of the stream valleys, forms a broad, very shallow trough, the southern part of which has a north and south trend. Pike County lies well on the eastern side of this trough, so that the main body of the uplands has a gentle slope to the west and southwest, Bowling Green, Cyrene, and Eolia having elevations somewhat greater than those of the extreme western and southwestern parts of the county. Bowling Green, on the extreme eastern edge of this trough, has at the Chicago & Alton depot an elevation of 878 feet above sea level. Curryville, 8 miles farther west, has an elevation of 830 feet, while Vandalia, 9 miles west of Curryville, in Audrain County, has an elevation of only 770 feet, thus indicating a general slope to the west of over 6 feet to the mile.

The main body of the upland region extends from Eolia, in the southeastern part of the county, northwest to Bowling Green, and thence due west to the county line. It forms the divide between the streams which flow north and east into Salt River and into the Mississippi and those which flow south and southeast into Cuivre River. Branches of varying lengths extend north and northeast from the main divide between the principal stream courses. Some of these branches, however, have become so narrow that they are a part of the hilly region rather than of the level upland. South of the main divide branches extend out between the numerous tributaries of Cuivre River and Indian and Sulphur Creeks. In the southern and southwestern parts of the county there are numerous small detached upland areas.

The greater part of this upland region was originally prairie and is now under cultivation. In topography it varies from almost per-

fectly level to gently rolling or undulating. The level areas occur near the center of the upland region and are often poorly drained, while the surrounding undulating areas are usually well drained but are not seriously eroded.

North and east from the main body of the upland region is the principal hill region of the county. This extends to the river flood plains and has a width ranging from 9 to over 12 miles. In the northern part of the county a narrow but rough extension of the hilly region forms the divide between Salt River and the Mississippi.

The hilly region is characterized by rocky ledges and steep, rock-covered slopes near the edge of the uplands. These slopes and ledges also occur along the narrow ridges or divides between the main streams, in places extending to the river flood plains. Good examples of such developments are found between Grassy Creek and Noix Creek and between Noix Creek and Buffalo Creek. In the southern part of the county these ridges in places have become so narrow that there remain only chains of high sharp-pointed hills or knobs. These give to this region a strikingly picturesque topography rarely seen in a country of horizontal rock beds. Away from the steep slopes bordering the uplands and the hills and ridges the slopes become much more gentle. Each large stream occupies a broad basin. In the southeastern part of the county these basins have been extended until, with the ridges and chains of hills already mentioned, they occupy the entire area. The slopes of this lower hilly region are very gradual, and almost all of the area is used for agriculture.

The lowland region lies along the Salt and Mississippi Rivers, but not as a continuous body. The northern area of lowlands begins near Busch, on the Mississippi, and extends to the mouth of Salt River, and thence up that stream to the county line. This lowland has a maximum width of over 3 miles. It is about a mile wide where Salt River enters the county. In the southern part of the county the main body of lowlands begins at Clarksville and, gradually widening, attains a width of over 5 miles at the southern boundary.

The northern part of the county is drained into Salt River by Spencer, Peno, and Grassy Creeks, the eastern part into the Mississippi by Noix, Buffalo, Little Calumet, Calumet, Ramsey, Gwins, and Bryants Creeks, and the southern part into Cuivre River by Sandy, Indian, and Sulphur Creeks. Where the numerous tributaries of these creeks extend into the level uplands they have broad gently sloping valleys bordered by low gradual slopes with few rock outcrops. As they enter the hilly region the slopes become steeper and the valleys narrower and more rocky.

Along the course of nearly all the eastward-flowing streams of this region the valleys have long gradual slopes on the north side of

the streams and short, steep, and frequently rock-covered slopes or rock ledges on the south side. This is probably due to the more favorable conditions for soil formation afforded by the south slope, where climatic changes are more frequent and rock disintegration is more rapid. The soils are washed into the streams, crowding them toward the south bank. As the slopes become longer tributaries are developed, larger amounts of soil are carried into the valleys, and the main streams are pushed southward at a more rapid rate.

Permanent settlement in the region now occupied by Pike County began about a hundred years ago, the earlier settlements being made in the forested regions, especially along the stream courses. Before this time, however, numerous Spanish grants, some of which dated far back into the eighteenth century, had been made within the present limits of the county. Some of these grants included the most productive parts of the county, and many of the old grant boundaries still serve as land lines.

The early settlers came largely from Kentucky and Virginia. The prairie lands were for a long time supposed to be of little value except for grazing, and the principal part of the upland prairie region has been under cultivation for only about 40 years. During the past 15 years there has been an important immigration of people from the East, mainly from Illinois, and the effect of this on agriculture has been rather beneficial. There has also been, in the tobacco-growing section, a small immigration of tobacco growers from Kentucky and Tennessee.

A population of 22,556 is reported for Pike County in the census for 1910. Of this number, 20 per cent are colored. A large number of the inhabitants are direct descendants of the early settlers.

Louisiana, the largest town in the county, has a population, according to the 1910 census, of 4,454. Bowling Green, in the central part, is the county seat, and has a population of 1,585. Clarksville, on the Mississippi, south of Louisiana, and Frankford, in the northern part of the county, are important towns, the former having a population of nearly 1,000 and the latter about 800. Eolia, Curryville, Ashburn, and Annada are railroad towns of importance. Ashley, Paynesville, Spencerburg, and New Harmony are inland towns which were at one time of considerable importance, being located in good farming sections, but since the advent of the railroads much of their business has gone to the railroad towns. Other trading points are Edgewood, Cyrene, and McCunes Station, on the St. Louis & Hannibal; Busch, on the Chicago, Burlington & Quincy; and Gazette, Farmer, Estes, and New Hartford in the southwestern part of the county. There are important manufacturing industries near Ashburn and at Louisiana.

Pike County is well supplied with transportation facilities. The Mississippi River offers cheap transportation to and from St. Louis. The Chicago, Burlington & Quincy Railroad follows the eastern boundary of the county for a distance of nearly 40 miles. The St. Louis & Hannibal, or "Short Line," extends northwest and southeast through the center of the county, while the Chicago & Alton crosses the county centrally in a general northeast-southwest direction. These lines furnish direct and rapid transportation to St. Louis, Chicago, and Kansas City, the three principal stock and grain markets of the Middle West.

The county has for many years been noted for its excellent gravel roads. Such roads extend from Frankford to Louisiana, and from Louisiana to Bowling Green. Ashley and New Hartford, Louisiana, Clarksville, and Paynesville are also connected by gravel roads. Practically all of these roads are under county control and maintained by a toll assessment. Under recent provisions of the State-road law the building of new roads in Pike County is being encouraged. When a certain amount of money has been raised by private subscription for this purpose the county agrees to pay a like amount. Under this provision the building of new gravel roads is receiving considerable attention and roads are now under construction from near the southwest corner of the county to New Hartford, from Farmer to Bowling Green, from Curryville to Bowling Green, and from Annada to Paynesville.

Every part of the county is reached by the rural free delivery and by local and long-distance telephone lines.

The houses and other farm buildings throughout the greater part of the county are large and well kept, and give the impression of general prosperity.

CLIMATE.

The climate of Pike County does not differ essentially from that prevailing over all of northern Missouri, and is well suited to the character of agriculture followed. Serious injury to crops or stock from severe climatic conditions is of rare occurrence.

The average annual rainfall at Louisiana from records covering a period of 30 years is 34.62 inches. This is well distributed throughout the season, the heaviest precipitation occurring during the months of May, June, and July, when it is most needed. Injury in the spring through excessive rains followed by a few weeks of very dry weather and periods of drought during July and August sometimes cause diminished crop yields. Injury from both causes may be largely prevented by proper drainage and through the conservation of the soil moisture by careful cultivation. Frequent losses occur in the bottom lands from floods in the spring.

The average date of the last killing frost in the spring, estimated from records covering a period of 11 years, is April 22, and of the first in the fall, October 12. The last date of killing frost recorded in the spring is May 7, and the earliest in the fall, September 13. There is an average growing season of 173 days. This affords ample time for the maturing of all ordinary farm crops, and also permits the growing of a crop of cowpeas following wheat or oats or very early potatoes. Alfalfa can usually be cut three times, and bluegrass often affords excellent pasturage until the last of November or first of December. Fruit, while sometimes injured by heavy frost following periods of warm weather in the late winter or early spring, is rarely a total failure, and when failures do occur these are more often due to lack of proper care than to climatic conditions.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation recorded at the United States Weather Bureau station at Louisiana.

Normal monthly, seasonal, and annual temperature and precipitation at Louisiana, Pike County, Mo.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December.....	30.7	68	-22	1.91	1.60	2.44
January.....	27.4	74	-20	2.05	0.95	7.06
February.....	27.4	70	-23	2.42	0.35	2.22
Winter.....	28.5			6.38	2.90	11.72
March.....	42.3	94	0	2.60	1.18	5.08
April.....	53.3	92	19	2.94	3.40	4.78
May.....	63.7	93	26	4.40	0.92	3.04
Spring.....	53.1			9.94	5.50	12.90
June.....	71.3	100	40	4.26	1.70	7.52
July.....	76.1	98	48	3.50	2.10	9.97
August.....	74.7	104	40	2.99	2.45	1.48
Summer.....	74.0			10.75	6.25	18.97
September.....	67.9	105	25	3.23	1.65	0.75
October.....	56.3	95	19	2.13	2.05	0.69
November.....	43.5	78	4	2.19	3.20	3.57
Fall.....	55.9			7.55	6.90	5.01
Year.....	52.9	105	-23	34.62	21.55	48.60

AGRICULTURE.

Pike County is primarily a stock-raising country. The early settlers brought cattle with them and found conditions favorable for the continuation of the industry in which they were most interested. For many years cattle were sent directly from the great open range to the markets, but as settlement increased and the outlying range was used for cultivated farms, methods were changed, but the stock-raising industry increased rather than diminished, and to-day Pike County is one of the foremost stock-producing counties of the State and of the Middle West. In the grade of cattle as well as in the large numbers raised the county ranks high. On the markets of St. Louis and Chicago Pike County stock often commands fancy prices.

Cattle, including the Shorthorn and other breeds, mules, driving, saddle, and draft horses, hogs, sheep, and poultry, all receive the attention of breeders and fanciers.

Domestic animals, having an aggregate value of \$3,409,578, are reported on 2,721 of the 2,773 farms of Pike County by the 1910 census. There are 22,833 head of cattle, 12,853 horses, 4,702 mules, 66,281 hogs, and 22,563 sheep reported in the county, and the number of poultry of all kinds is given as 229,987, with a value of \$131,064.

In the year 1910 there were produced in the county and shipped out by freight and express 9,415 head of cattle, 49,038 hogs, 1,756 horses and mules, 10,041 sheep, 1,262 goats, 29 jacks and stallions, 454,230 pounds of live poultry, 195,291 pounds of dressed poultry, and 759,180 dozen eggs.¹

To a system of agriculture in which stock raising is combined with grain farming Pike County owes its prosperity. Through the feeding of stock and the returning to the soil of the manure produced on the farm the land has been maintained in a much higher state of fertility than would have been possible under a system of grain farming.

The principal crop of Pike County is corn. In 1911, 85,163 acres were devoted to this crop, with an average yield of 33 bushels per acre, or a total production of 2,810,379 bushels.² Although the production of corn is large, and this grain is sometimes shipped out of the county, some corn is also shipped into the county from western markets for cattle feeding.

In many parts of the county, especially in the prairie sections, the productiveness of the soil has been seriously impaired by the continuous growing of corn. Farmers have come to realize, however, the serious results which must follow such methods, and the practice of planting corn not more than two, or at the most, three years in

¹ Missouri Red Book, 1911, p. 429.

² Missouri Crop Review, December, 1911.

succession on the best soils, and not more than one year on the thinner lands is becoming popular.

The bottom-land soils, the loess and limestone soils, and the upland prairie soils are all, when properly handled, well suited to corn. The light-brown soils along the breaks bordering the prairie and the gray and white ridge soils are not so well adapted to this crop, but by the use of legume crops and manure fair yields may be produced.

The second most important crop in Pike County is wheat. According to the Missouri Crop Review, 46,978 acres were devoted to wheat in 1911. An average yield of 18 bushels per acre, or a total production of 845,614 bushels, is reported.

The loess and limestone soils in the eastern and southern parts of the county are the best wheat soils, and some of these have been used almost continuously for this crop for many years. The bottom lands are also used to a large extent, and during recent years wheat has been grown on the prairie uplands. Through continuous cropping the soils of the principal wheat-growing sections of the county are believed by many farmers to have been materially weakened, but this has in part been offset by the use of commercial fertilizers.

Although the average yield of wheat in Pike County is somewhat higher than that of the greater part of the State, the crop as a whole is not a very profitable one. It is important, however, on account of its place in the crop rotations, its use as a nurse crop for clover, and the comparatively small amount of work necessary to handle it.

The principal factors in the maintenance of a good wheat soil are the thorough preparation of the soil, the use of proper fertilizers, the selection of good seed of the variety best suited to local conditions and free from smut, and the sowing of the crop at the proper time.

Fultz is the principal variety grown, although a number of other varieties have been found on the experiment plots at Columbia to give better average yields for an eight-year period. Among smooth wheats, Poole, Beechwood Hybrid, and Hickman have given good results; among bearded wheats Fulcaster, Dietz, and Mediterranean. The time of sowing wheat in this section is usually from September 15 to October 1, but varies somewhat with the season.

Oats formerly occupied a large acreage in Pike County, especially in the prairie sections, but owing to injury from rust the crop became so unsatisfactory that the acreage was greatly reduced and many farmers abandoned it.

During the last few years, however, through the use of varieties, which are more or less rust resistant, such as the Texas Red, and the use of complete commercial fertilizers, more satisfactory results have been obtained, yields of 40 to over 60 bushels per acre being reported where conditions are favorable. According to the 1910 census, 460,454 bushels were produced on 19,032 acres in 1909.

Aside from the corn and wheat, the most important crop of the county is red clover. It is valuable for hay and for pasturage and is of even greater value for its beneficial effects upon the soil.

Clover can be grown successfully on practically all of the soils of the county. The limestone and loess soils and the well-drained bottom soils are, however, best adapted to this crop. It does fairly well on the deeper, better drained prairie soils and on the brown prairie border soils. The flat, poorly drained prairies are least favorable to this crop. Where a soil is poorly drained the freezing and thawing of early spring causes the clover to "heave," or push out of the ground. Acid soils are also unfavorable for clover, but the acidity can be corrected by the use of lime. Alsike sometimes gives good results in areas which are too acid and too wet for the common red clover. In some places, too, where clover does not do well when first grown, persistent efforts in seeding often result in its becoming a fairly satisfactory crop, probably through inoculation of the soil.

Clover produces from 1 to 2 tons of hay per acre, and the seed crop is often an important one. In addition to clover, timothy and red-top are used extensively for hay. The 1910 census gives an acreage of 3,363 acres for clover alone, with a production of 3,572 tons of hay. A total of 10,182 acres was devoted to timothy and clover, mixed, in 1909, with a production of 10,078 tons of hay. Timothy alone was grown on 16,075 acres, 16,069 tons of hay being produced. In addition to these crops, tame or cultivated grasses were grown on 30,374 acres, producing 30,876 tons of hay.

The growing of alfalfa is receiving considerable attention in Pike County. On account of its large yields and its ability, when well started, to resist drought, its production, wherever the soils are adapted to it, is profitable. The soils best suited to it are the Knox soils and deep, well-drained silt loams of the bottoms. Next to these the limestone soils of the uplands are fairly well adapted to the crop where they are fertile. Where none of these soils are available the brown prairie border soils and narrow strips of wash along the small streams offer the best opportunities for growing this crop. On the flat prairies and on all thin lands it has little chance of success. In order to obtain a satisfactory stand of alfalfa the soil must be rich and free from weed and grass seed and alkaline or neutral in reaction. In 1909, according to the census for 1910, only 184 acres were devoted to alfalfa. From this acreage 426 tons of hay were produced.

A crop which is receiving well-deserved attention in Pike County is cowpeas. It is especially valuable on the poorer hill soils, on the prairie border soils, and on the flat prairie.¹ Soy beans are preferred by some farmers to cowpeas and are equally beneficial.

¹ "Growing Cowpeas in Missouri," a bulletin issued by the Missouri State Board of Agriculture, gives valuable information with respect to this crop.

Bluegrass seems to have become indigenous to this region, for when timothy or redbud mowing lands are allowed to stand for some time, especially when pastured, or when woodland is cleared, bluegrass soon appears and gradually spreads over the entire area. This grass and white clover, which is often mixed with it, thrive on all soils of the county, and it is to this fact, very largely, that the success of the live-stock industry is due. While bluegrass makes a good growth on the uplands, the belief is held by many that stock makes greater gains in weight on the limestone soils of the hills.

During recent years methods have been adopted which are gradually changing low-priced and unproductive forested hill lands into valuable pasture lands. The timber is cut and sold as cordwood, posts, and crossties, and the land pastured closely with goats to keep the sprouts down until the roots are killed. No seeding is needed, and a good stand of bluegrass is obtained in the course of a few years. It is said that there is little profit in the goats, aside from the work they do in clearing the land. Where the steep slopes are cleared they erode badly, so that it is more difficult to obtain a good stand of bluegrass.

A large acreage of steep and often rocky hill slopes, now unproductive and covered with small white oak and post oak, is being thinned out and used as permanent forest reserves or cleared and used for pasture. Such lands can be bought at prices ranging from \$15 to \$30 an acre, while the better prairie lands are held at prices ranging from \$50 to \$80 or more, and the best limestone and loess soils are valued at \$75 to \$100 an acre.

Tobacco was originally grown in all the older settled portions of the county, but its production, except in a few small areas for local use, was practically abandoned many years ago. A few years ago the industry was revived in this part of Missouri, and it has increased in importance. The principal tobacco-growing sections are in the vicinity of Frankford and McCunes Station, the red and brown limestone soils being used principally for this crop. The White Burley variety is grown almost exclusively. Yields of 1,000 to 1,800 pounds of good quality per acre are produced. Some areas of bottom land are used, on which the yields are satisfactory although the quality is not so good. In other tobacco-growing sections of Missouri the yellowish-brown loess soil like that in the vicinity of Clarksville is the principal soil used for this crop. Should prices justify the extension of the tobacco industry, Pike County has many thousands of acres of land well suited to this crop.

In 1910 there was shipped out of Pike County 21,598,165 pounds of nursery stock and 22,905 pounds of cut flowers. This stock was grown principally on the Knox silt loam on the wash from this soil,

and on the lighter silt loam and very fine sandy loam bottom-land soils.

After the completion of the field work of the soil survey, lists of questions were sent to a number of farmers in the county with a request for specific information concerning crop yields, rotation, etc., on their own farms, giving an average for the five years preceding the date of the inquiry. The answers received represent approximately 17,700 acres of land well distributed over the county and including all of the principal soil types.

The average yield of corn for all of the farms represented for the period of five years is $44\frac{1}{2}$ bushels per acre. The average for the rough and leached hill lands is about 26 bushels, for the prairie and prairie-border soils 42 bushels, for the better hill and limestone soils a little over 45 bushels, and for the loess and bottom-land soils 52 bushels. About 64 per cent of the farmers believe the yield is increasing. Only $8\frac{1}{2}$ per cent report that the yield is decreasing, and the remainder report that it is about stationary or that they are unable to determine whether it is increasing or decreasing. The principal reasons given for increase are the increasing use of clover, the more extensive use of manure and of commercial fertilizer, the selection of better seed, and the thorough preparation of the seed bed, followed by careful cultivation. Reids Yellow Dent is grown by about 75 per cent of these farmers either exclusively or for a part of the crop. The next most popular variety is the Boone County White. Other varieties grown are the Leaming, Iowa Silver Mine, Long John, St. Charles White and St. Charles Yellow, and Funks Yellow Dent. About half of the farmers grow corn on the same ground for only two years in succession, approximately one-third grow it for only one year, while the remainder use it for three or more years in succession. On river-bottom lands, subject to overflow, corn is grown continuously for many years.

About 90 per cent of the farmers grow wheat, and the average yield is a little over 17 bushels per acre. A smaller percentage of the farmers on the prairie soils than on other soils grow wheat, but the average yield reported by these farmers is practically the same as that for the entire area represented. Less than 40 per cent of the farmers believe the yield is increasing. Nearly 25 per cent believe it is decreasing, and about 30 per cent report that it is about stationary. Some farmers are unable to determine. The principal reason given for the decrease is the depletion of the soil through continued cropping to wheat. The Fultz variety is grown by nearly 60 per cent of the farmers, either exclusively or with other varieties. The Red Cross is the most popular of the other varieties, being grown by about 20 per cent of the farmers reporting. The Beardless Mediterranean is grown by a few.

Only 60 per cent of the farmers reporting grow oats, the percentage on the prairie soils being larger than on the other soils of the county. The average yield is 33 bushels per acre. Nearly one-half of the farmers who grow this crop report that the yields are increasing. The Texas Red variety is used more extensively than any other.

Other crops reported are alfalfa, which produces 3 to 6 tons of hay per acre; cowpeas, producing 1 to $1\frac{1}{2}$ tons; millet, $1\frac{1}{2}$ tons; soy beans and millet, 3 tons; and tobacco, 1,000 to 1,800 pounds.

The proportion of each of these farms devoted to corn varies from one-eighth to one-third, to small grain from one-tenth to one-third, and to pasture from one-fourth to over one-half.

Horses, cattle, and hogs are kept on all of the farms represented, but less than half of the farmers reporting raise sheep. The number of head of live stock if apportioned to 160-acre farms would furnish to each such farm 9 head of horses, 17 cattle, 41 hogs, and 14 sheep.

Manure spreaders are reported on one-fourth of the farms. No farmer reporting the use of a spreader reports a decrease in the yield of corn, and a large number of such farmers report an increase. The manure is generally hauled directly to the field and used on the corn ground, on thin spots, on mowing or pasture land, or on the wheat. About 65 per cent of the farmers use commercial fertilizers and report good results. Bone meal and steamed bone are in most general use, but complete fertilizers of various grades are also applied. Commercial fertilizer is used principally on wheat, but it is also applied to corn, oats, and grass soils. Lime is used to only a small extent, and many farmers report that their soils do not need it.

The most popular form of crop rotation consists of corn one year, oats one year, and clover or clover and timothy one or two years. Some farmers extend the corn period to three years, and when a good stand of grass is obtained after wheat or oats, pasture the land two or more years before again breaking the ground. The small grain often consists of oats followed by wheat or of wheat for two or more years in succession.

The use of commercial fertilizers is increasing rapidly, and this increase is responsible for a corresponding increase in crop yields. In this region fertilizers were first used for wheat, then for oats, and now extensively for corn. Increased yields have been the result, and the tendency is for the farmers to depend more and more upon the fertilizer. In doing so they often fail to make the best possible use of stable manure. In many cases the growing and plowing under of clover and cowpeas is discontinued, and nitrogen, which could be produced at little cost on the farm, is purchased at a high price. The humus in the soil is permitted to burn out, so that the land falls into a poor state of tilth and crops can not use the fertilizers to advantage even when applied in a readily available form. In general, fertilizers

produce immediate results, but must be renewed from year to year, since an application does not permanently improve the soil. Unless the humus supply is maintained, the soils will gradually cease to respond to applications of fertilizer.

No general statements can be made with respect to the use of commercial fertilizers, as the form of fertilizer, the methods of applying it, etc., must depend wholly on local conditions. The use of fertilizers on any particular field must depend upon the soils which it contains, the length of time it has been under cultivation, the treatment it has received, and the crops grown. To obtain the best results it is necessary for the farmer to understand the underlying principles and then by experimenting and observing results make them applicable to his own needs.¹ Fertilizers alone will not maintain soil fertility, but if intelligently used in connection with a good system of crop rotation, legume growing, and humus building, the soil will not be injured and crops may be made more profitable.

Practically all of the prairie soils, and the light-gray ridge soils, are acid, and much of the prairie-border soils, the poorer drained areas in the small valleys, and even some of the hill soils are more or less sour. These sour soils are unfavorable for the best development of most crops, especially clover and alfalfa. Lime or ground limestone may be used to correct the acidity. Even some of the limestone soils have been leached to such an extent that an application of lime would be beneficial. Ground limestone of very good quality is bought in carload lots at Elsberry, Mo. Best results are obtained where this material is applied to all strongly acid soils at the rate of 1 to 3 tons to the acre and thoroughly worked into the soil, such an application being necessary only once in every 6 or 8 years. Since limestone acts slowly, the benefits from such a treatment may not be noticeable for a year or two, and where immediate results are desired the burnt lime, which is somewhat more expensive, is used, care being taken to work it into the soil.

Few farmers appreciate the extent to which their soils are being injured by erosion. The same agencies which have cut down the uplands into hills and valleys are still active and their progress gradually becomes more rapid. Before the land was cleared the tree and grass roots protected the slopes and held the soil in place, but now that this protection has to a great extent been removed, the bare fields, often with corn rows extending down the slopes, offer but little resistance to the washing of winter and spring rains. A great amount of material is carried down by the small streams and deposited out in the larger valleys each year. During some seasons this material

¹ "The Principle of Maintaining Soil Fertility." Circular No. 38, Missouri College of Agriculture, gives detailed information on this subject.

covers many acres to a depth of several inches. During a single rain more plant food may be lost through erosion from a slope than is required to produce an entire crop, for it is always the best soil that is washed away first. The most serious results of erosion are not always to be seen in the deep, rugged gullies, as the "clay points," "breaks," and "scalds" are often even more serious. In these places the entire surface has been removed by sheet erosion.

The best methods of preventing erosion are deep plowing, which will make the soil capable of absorbing the water, to be supplied to the crops as needed, the improvement of the soil texture by the incorporation of manure and lime, and the maintenance of a surface covering on the soil as much of the year as possible. Wheat and rye used for winter and early spring pasture are useful for this purpose. They afford considerable pasture and when plowed under add humus to the soil.

Much land in Pike County can be greatly improved by more thorough drainage. A large drainage district has recently been established, covering a considerable area of lowlands in the southeastern part of the county, and there are other large areas which need drainage and protection from overflow. These large areas can be drained only by the united efforts of several landowners. There is, however, scarcely a farm in the county which does not include land which needs drainage. In most cases drainage can be accomplished by the use of open ditches. In other places tiling is needed. The best yields can only be obtained when the soil is freed of surplus ground water, when the moisture necessary to crop growth is conserved by cultivation, and humus is liberally supplied.

SOILS.

The geology of Pike County¹ is comparatively simple. Although there is a slight slope to the west, and also some evidences of slipping or faulting of the rock beds, for all practical purposes any underlying formation may be considered as made up of alternating horizontal beds of limestone and shale. The principal rock beds are seen only along the stream courses and on the steeper hill slopes, but they probably extend under the greater part of the entire county. Owing to the ease with which the shale is eroded and the greater resistance offered by the limestone, the latter is often exposed in conspicuous, almost perpendicular bluffs, while the shale beds of greater thickness form steep, soil-covered slopes on which the underlying shale is seen only where recently exposed by the cutting of a stream or in other excavations.

¹ The Geology of Pike County, by R. R. Rowley, Missouri Bureau of Geology and Mines, Vol. VIII, 2nd series.

The lowest of these rock beds is the Trenton limestone, a hard, light-yellowish or bluish-gray to lead-colored limestone, which is easily recognized by its peculiar form of weathering. Large holes or perforations appear after it has been exposed to the weather for some time. The main exposures occur in the northern part of the county along Peno and Sugar Creeks, but smaller exposures occur in the southern part, along Sulphur Creek and its tributaries. Perpendicular or overhanging bluffs of this formation 15 to 25 feet in height are common. The total thickness of the bed is about 40 feet.

Immediately above the Trenton limestone is a shale bed about 100 feet in thickness. This material is dark to light blue in color and is usually clayey, but in some places it contains fine and very fine sand. It is composed of alternating beds of hard and soft shale, which in places have a very regular, rather artificial, appearance. This is the Hudson River shale. It is exposed in the beds or along the banks of all of the streams in Pike County which empty directly into the Mississippi or into Salt River.

Overlying the Hudson River shale is a formation known as the Niagara limestone. At Louisiana this consists of two beds, the lower being light gray to almost white in color and about 7 feet thick. Above this is a yellowish-brown massive limestone bed about 2 feet in thickness. As these beds extend west the lower seems to thin out and the upper becomes thicker, or else the lower takes on the characteristics of the upper bed, until in the vicinity of Bowling Green the lower bed is absent and the upper brownish bed has a thickness of 25 feet or more. This bed of yellowish-brown massive limestone is one of the most conspicuous in the county, in some places appearing as the top or capping formation of the ridges and in other places appearing on the sides of the slopes as outcropping ledges or as massive detached fragments.

Above the Niagara limestone is another shale bed, the Hamilton, which varies in thickness from only a few feet to 50 feet or more, and above this is a bed of Louisiana limestone which varies in thickness from only about 2 feet at Ellick, in the northwestern part of the county, to 35 or 40 feet along the river front. This is a thin-bedded, close-grained limestone, which breaks down easily into angular fragments, so that outcrops are not often seen, although on many slopes the sharp, angular, almost white fragments are quite conspicuous.

Immediately above the Louisiana limestone is the Hannibal shale, a dark bluish to greenish gray clayey shale 60 to 70 feet in thickness. A few feet of the upper part is somewhat sandy and in a few places approaches a sandstone in structure.

Above the Hannibal shale there are three limestone beds, the Choteau, Burlington, and Keokuk, which have a total thickness varying from about 100 feet to over 150 feet. These beds outcrop

along the slopes around the heads of all the streams in the county and form the capping or protecting rock of the principal ridges and hills. These upper beds are closely related, and it is often difficult to distinguish one from another. As a whole, they are the most conspicuous and, as regards their influences on the topography, the most important in the county. In many places along South Spencer Creek and Indian Creek they form perpendicular bluffs 50 to 75 feet in height and are responsible for the development of the peculiar knobs south of Clarksville. The Burlington is quarried extensively at Louisiana for building stone, for ground limestone, and for lime. All of these beds in places are banded with chert, which often remains in the soil after the breaking down of the limestone.

In manner of formation the Pike County soils are of four distinct groups—residual, glacial, loessial, and alluvial. The residual soils have resulted from the breaking down and weathering of the rocks. The glacial soils were laid down by an ice sheet. The loessial soils are made up of wind-blown material, while the alluvial soils have been deposited by the rivers and creeks over their flood plains.

The character of the topography, the cutting of the alternating rock beds by the streams, and the prominence of the limestone beds have given rise to a general impression that the soils of the county are mainly residual and largely of limestone origin. In fact, all of the soils except those of the prairies and bottom lands are spoken of as limestone soils. The area of residual soils, however, is smaller than is popularly supposed. They are derived from both shale and limestone, the former frequently being quite as important a factor as the latter. The area of residual soils has been reduced by the encroachment of both the loessial and the glacial soils. These have been deposited over the surface, thus forming a covering of different material. In some places this layer is thick, in others thin, and in many places the material has been mixed with the underlying soils through the gradual movement of soil particles down the slopes or through erosion and subsequent deposition.

Only four types of residual soils have been recognized in this county—the Hagerstown silt loam, the Leslie silt loam and clay loam, and the Rough stony land. All of these are more or less mixed with both the loessial and glacial soils. In fact, it is often difficult and sometimes impossible to determine their exact origin or even the predominating factor in their origin. During Pleistocene times a large part of Pike County is supposed to have been covered by glaciers, which entered this region from the north. This is indicated by the presence of well-rounded gravel and boulders of material entirely unlike any rock formation found in place in this region. A large part of this foreign material consists of quartz, quartzite, red and gray granite, and diabases the nearest sources of

which are in Minnesota, Wisconsin, and Canada. Mixed with this foreign material are many fragments of local origin, which have been moved but a short distance. These consist largely of sharp or only slightly smoothed chert fragments, but some limestone fragments are also found. In many places this local material has been moved such a short distance and modified so slightly that it differs but little from the residual material. It can usually be distinguished from the latter by the rather even distribution of the chert fragments throughout the soil. In the residual soils the chert occurs in rather heavy beds. This soil of local origin is usually somewhat browner in color, more granular in texture, and more nearly free from sand than the purely glacial soils.

Only one soil entirely of glacial origin, the Shelby loam, has been recognized in this county, while two soils, the Putnam silt loam and the Marion silt loam, are believed to be of both glacial and loessial origin.

In many places on the uplands adjoining the Mississippi and Missouri Rivers there is a formation known as loess. Where of good depth and free from mixture with other materials the loess is readily recognized by its light-brown or buff color, by its freedom from rocky material, and by the peculiar way in which it weathers and erodes. It stands in steep bluffs when cut into and forms steep banks with a somewhat jointed structure where gullied. It is uniform in color and texture throughout the upper 3-foot section. The deposit is usually deepest near the river front, thinning out away from the river. It is developed as a belt varying in width from 3 or 4 to 20 miles or more. It has a maximum width in the southern part of the county of about 10 miles. Good exposures of the loess are to be seen in the town of Louisiana a short distance south of the high school, along the Frankford gravel road about 2 miles northwest of Louisiana, at the brickyards a mile southeast of Louisiana, along the Paynesville road a mile south of Clarksville, and in many other places, where it has a depth of a few feet to 20 feet or more.

The origin of the loess is not definitely known, but its position near the large river flood plains, its distribution over hills and valleys regardless of topography, and its greater depth and slightly coarser texture on the riverside seem to indicate that it is made up of material which has been carried down and deposited by the streams at some earlier stage in their development and later spread in a thin sheet over the uplands by the winds. The soils derived from deposits of this character are among the most productive in the United States. In Pike County they are commonly spoken of as the red-clay soils and are popularly supposed to be of residual limestone origin.

Two types of loessial origin are mapped in Pike County, the light yellowish brown, or Knox, soil and the darker colored, slightly heavier Marshall soil.

The prairie soils and the white soils, mapped as the Putnam silt loam and the Marion silt loam, respectively, seem to be made up of a very thin layer of loess deposited over glacial till and modified by the subsequent percolation of water.

The fourth group of soils is the alluvial or bottom-land group. When it is remembered that the entire land surface of this region once had an elevation equal to that of the highest hills and that the present topography is the result of stream action, the eroded material having been carried away by the streams, the extent of their work, which is still in progress, can be appreciated. As the streams increase in number and size they develop valleys in the bottom of which is a flood plain which is inundated during periods of high water but at other times forms a level or gently sloping body of arable bottom land. The alluvial soils of the smaller streams have been derived from material eroded from the prairie soils, the glacial soils, the residual shale and limestone soils, and from the loessial soils, and vary widely in composition. They are alike, however, in having a rather high percentage of organic matter and in being generally productive. The soils of the small stream valleys vary in color from dark brown to light yellowish brown or gray. They are mapped as Genesee soils.

In the flood plains of the Mississippi and Salt Rivers the alluvial soils occur in wider areas. The material has been more thoroughly sorted and influenced by flood waters, and is as a whole darker in color and heavier in texture than that of the soils along the smaller streams. These soils are mapped as the Wabash.

In several places near Salt River, and in a few places adjoining the alluvial lands of the Mississippi and some of the smaller streams, there are high table or bench lands of varying width and separated from the lower lying bottom lands by steep terraces from 15 or 20 to over 50 feet in height. The soils of these bench lands are either of alluvial or glacial origin. They have a level or nearly level surface, and occupy the position which would be occupied by an abandoned flood plain. They are much above any recent stages of high water, and where cut into by gullies glacial material is encountered. From their position adjacent to the present flood plains and from their level surface these benches have the appearance of fragments of old and higher flood plains representing some former stage of the stream along which the material was deposited. From an examination of the material as seen in gullies and along the edges of the terraces, however, it appears that they are glacial rather than stream

terraces. The soils of these benches are classed as the Jackson series, including the loam, silt loam, and clay types.

Two other alluvial and partly alluvial soils have been recognized in this county. In the valleys of all the smaller streams, on the long slopes adjoining some of the larger ones, and at the edge of the large bottoms where bordered by steep slopes there are areas of soils which have been deposited in their present position after being carried short distances by running water or wind, by the gradual movement or creep of the soil down the slope, due to gravity, or by cultivation. These wash or colluvial soils are classed as the Genesee.

Along their upper course the small streams have considerable velocity and carry much soil material in suspension. When they reach the broad valleys the velocity is checked by the lower grade, and the soil is deposited as fan-shaped deltas or as long, narrow strips along the meandering stream courses. This material, owing to the high percentage of loess soil which it contains and its deposition over the surface of a different soil, is mapped as the Lintonia silt loam.

The following table gives the actual and relative extent of the several soils mapped in Pike County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Shelby loam.....	75,968	20.0	Wabash silty clay loam.....	3,904	2.2
Silty phase.....	9,408		Poorly drained phase.....	5,504	
Putnam silt loam.....	76,416	17.9	Leslie silt loam.....	7,616	1.8
Knox silt loam.....	57,600	13.5	Genesee very fine sandy loam...	4,288	1.0
Rough stony land.....	48,640	11.4	Lintonia silt loam.....	4,224	1.0
Hagerstown silt loam.....	42,624	10.0	Jackson silt loam.....	1,920	.4
Genesee silt loam.....	21,120	8.3	Waverly silty clay loam.....	1,344	.3
Poorly drained phase.....	14,336		Leslie clay loam.....	960	.2
Wabash clay.....	17,280	4.0	Jackson clay.....	448	.1
Marion silt loam.....	12,672	2.9	Jackson loam.....	256	.1
Wabash silt loam.....	10,624	2.5			
Marshall silt loam.....	10,368	2.4	Total.....	427,520

PUTNAM SILT LOAM.

The surface soil of the Putnam silt loam is a light silt loam to a very fine sandy loam, grading at a depth of 3 or 4 inches into a slightly heavier silt loam which is fairly uniform to a depth of 8 or 9 inches, where the clay content becomes slightly higher, gradually increasing with depth. The soil varies from light ashy gray to gray when dry and from gray to dark gray or almost black when wet. In fiat and poorly drained areas the lighter colors predominate, while in areas in which the soil is deeper and drainage is better the soil is darker, owing largely to the accumulation of organic matter. In such areas

the soil becomes faintly mottled with light gray at ordinary plow depth and at 10 or 11 inches it is light ashy gray in color.

At 15 to 18 inches a heavy, compact impervious clay is encountered. The clay layer varies from 6 to over 12 inches in thickness, grading into a heavy silt loam or silty clay loam in the lower part of the soil section. The clay varies in color. In the flat, poorly drained areas it is dark brown or almost black, while in areas of better drainage, particularly near the adjoining Shelby soil, it is mottled with reddish brown and in places with gray and yellow. Below the clay the material is mottled gray, yellow, and brown.

Under proper moisture conditions the surface soil is loose and friable and easily cultivated. Where cultivated or trampled by stock when too wet it becomes compact, refractory, and cloddy. This is especially true of fields which are badly run down through continuous farming to corn. The structure of this surface soil can be greatly improved by the use of manure, green crops plowed under, and by growing clover and cowpeas. The underlying gray layer when dry is loose and fluffy but when moist or wet becomes very plastic and puttylike. For this reason it is better on this type of soil to deepen the plowing gradually than to bring too much of this gray subsoil to the surface at one time. The clay layer cracks when exposed to the weather, as along ditch banks, and has a gumbo or adobe structure. The fact that crops sometimes suffer from drought on this type is largely due to this clay layer, which prevents the moisture of the deeper subsoil from rising to the surface soil. The lower subsoil is much more friable than the clay layer. When brought to the surface it soon weathers and becomes almost as productive as the surface soil. The depth of the dark surface soil is approximately the depth to which the type is cultivated.

The largest continuous body of the Putnam silt loam extends from the west county line to Curryville, then east and southeast to Eolia. From this main body other areas extend both north and south, fingering out along the divides between the drainage courses. Other detached areas occur in the southwestern part of the county.

The topography of the Putnam silt loam varies from almost flat to gently rolling, the flat areas usually occurring along the tops of the divides between the drainage courses, or in areas in which definite drainage courses have not yet developed. Small areas of this character occur west of Curryville along the county line, a short distance west of Booth, southwest of Union School on West Prairie, and in a few other places. The natural surface drainage in these areas is very poor. The soil is also slightly shallower and the subsoil somewhat more impervious than in the undulating areas. The surface soil is frequently lighter in color than in the better drained situations, and

"glady" and "crawfishy" spots are common. Unless seasonal conditions are very favorable these poorly drained areas are less productive than the well-drained soil. Even in the areas having better surface drainage, however, there is considerable variation in productivity.

This type is largely glacial in origin. Evidence of this is found in the heterogeneous mass of waterworn erratics, sand, gravel, silt, and clay which make up the subsoil. The upper layers are probably derived from the outwash of the retreating ice sheet, modified by a thin surface deposit of loessial material. The dark-gray color is due to a rather high percentage of organic matter resulting from the decay or partial decay of grass roots. The heavy clay layer has no doubt resulted from the accumulation at this depth of clay particles from the overlying soil, which have been carried down by percolating rain water. This layer is not a true hardpan, because it lacks the cementing material, but it is so nearly impervious as to have practically the same effect as a hardpan.

The Putnam silt loam formerly supported a dense growth of native prairie grass or bluestem, and some of the ridges were forested with pin oak. Practically all of the type is now in farms. Since the land has been under cultivation wild cherry, elm, honey locust, and pin oak have grown up in places along the sloughs and fence rows.

The type is used principally for corn and oats, and for timothy, clover, and redtop mowings and bluegrass pasture. Some wheat is grown, and the acreage is increasing. Although clover is grown to a considerable extent on the poorly drained areas, owing to the acidity of the soil and also to its tendency to injury by freezing, it is not a very satisfactory crop. Although the acidity is greater in the poorly drained areas, both the soil and subsoil of practically all of this type are more or less sour and may be greatly improved in condition by the use of ground limestone. In places this type has suffered from being used continuously for corn, but since large areas of it are in pasture it is as a whole in a fair state of productiveness. The average yield of corn on the better portions of this type is between 35 and 40 bushels per acre. By an improvement in farming methods the yield can be greatly increased. Wheat yields from 15 to 18 bushels per acre when commercial fertilizers are used and oats from 30 to 50 bushels, depending largely on the season. The type can be improved by making the corn-growing period shorter—three years at most—by more thorough drainage of the level areas, by growing cowpeas and using manure, and by more thorough cultivation.

The price of land of this type ranges from about \$60 to something over \$80 an acre. Some of the improved prairie farms are held at about \$100 an acre.

MARION SILT LOAM.

The soil of the Marion silt loam consists of a very fine sandy loam or light silt loam to a silt loam. It is ashy gray, yellowish gray, or almost white where cultivated and subjected to leaching, although when first cleared it is somewhat darker. This material becomes heavier with increasing depth, and is underlain at about 6 to 14 inches by a yellowish-brown and in places mottled, stiff, tenacious clay, which at 24 to 30 inches changes gradually into a more strongly mottled gray and brown silty clay, extending to depths of over 3 feet.

The Marion silt loam is slightly heavier than the Putnam silt loam. Small round iron concretions are scattered over the surface and throughout the soil section. When dry the soil is loose and friable, and is easily cultivated. Owing to its clay content it puddles if cultivated when too wet, and bakes and cracks on drying, forming hard clods. The tenacious clay subsoil is almost impervious. Both soil and subsoil are as a rule strongly acid.

The principal areas of the Marion silt loam occupy the crests of narrow ridges and projecting points of uplands near some of the large drainage ways, where conditions are favorable for thorough leaching. Small, detached areas occur in many other places in the county. A rather large area in the vicinity of Smyrna Church is known as the "barrens." The surface drainage is excessive, but conditions are unfavorable for underdrainage.

The Marion silt loam is believed to have the same origin as the Putnam silt loam, except that in this type conditions have been favorable for the removal and leaching of the dark surface layer. Its lighter color is also due in part to its having been forested. Portions of the type have been cleared and farmed, but large areas are still forested with post oak and small white oak. In some areas there is a thick growth of black oak and in places clumps of blackjack. While a large part of this type is not under cultivation, the cultivated area is steadily being extended. In the vicinity of McCunes Station it is being used to a considerable extent for fruit and berries, and some of the recently cleared areas for tobacco. Owing to its low organic content and the ease with which it erodes, great care is necessary in cultivating this soil. The second or third successive crop of corn rarely proves profitable. The growing of cowpeas and clover is beneficial. Corn yields on this type are usually rather low, ranging from 15 to 35 bushels per acre. Wheat yields from 8 or 10 to as high as 15 bushels per acre. The most profitable use of a large part of the type is for bluegrass pasture.

The Marion silt loam ranges in value from \$15 or \$20 an acre for the forested and more rough and broken areas to \$40 or \$50 an acre for the cleared and improved land.

SHELBY LOAM.

The soil of the Shelby loam ranges from a sandy loam, fine sandy loam, or loam to a silt loam or clay loam, varying in depth from only a few inches to 12 or 15 inches. The soil becomes heavier with depth and varies in color from gray or dark gray where it adjoins the Putnam silt loam to light brown, yellowish brown, or reddish brown, being reddish and yellowish near the residual soils and on the breaks along the small streams where the subsoil has been exposed by erosion. The subsoil is usually a light-brown or yellowish-brown sandy clay loam or sandy clay to a depth of over 3 feet. In places the subsoil is lighter in texture in the lower part, and it is frequently mottled with gray or dark brown, and in the upper part with red or reddish brown, the lower part usually being gray or yellowish gray.

No other soil of the county is subject to so great variation in texture as is this type. This variation is both regional and local. As a whole, the Shelby loam in the western and especially in the southwestern part of the county is more sandy than are the areas farther east and nearer the residual soils. Some particularly sandy areas occur between New Harmony and Estes. This regional variation is probably due to the fact that the Shelby loam in the western part of the county carries a very much higher percentage of foreign glacial material, consisting of quartz sand, gravel, and pebbles, while that of the eastern part has a higher percentage of local material or ground-up limestone and shale. Sand, waterworn gravel, and pebbles and fragments of chert in greatly varying amounts distributed through both soil and subsoil and also large masses of iron concretions are characteristic of this type. Locally the Shelby loam varies in texture with the drainage. Where small streams head well out on the prairie narrow strips of Shelby loam occur along the slight slopes near the stream. As these streams become larger the areas of Shelby loam become wider, extending up all of the small tributaries until the type forms a complete border around the Putnam silt loam or prairie soils. It may thus be considered the prairie border soil of the county. On account of this position there are in nearly all fields occupied by this soil three local variations in texture. Where it adjoins the Putnam the soil is quite silty and varies but little from the latter at the surface, but the subsoil is more open and the gray silt and heavy clay layers found in the Putnam are either absent or are only slightly developed. On the lower slopes the surface soil has been wholly or partly removed by erosion, so that the sandy clay subsoil is exposed or is very near the surface. These areas form the "scalds" and "clay points" where crop yields are always light and are the first to suffer from drought. The narrow strips below these eroded areas have received a surface deposit of wash. Many of the

smaller areas of the wash are mapped with the Shelby loam. Away from the prairie the Shelby loam is often considered a residual limestone soil because of the proximity of limestone outcrops, the occurrence of sinks, the presence of chert, and sometimes limestone fragments and the good drainage and productiveness of the type. The boundary between the Shelby loam and the Putnam is clearly marked by the change in color, but this is not true of the boundary between this type and the adjoining residual or loessial soils. Where the soil of lighter texture is of sufficient depth it is loose and friable and easily cultivated. The subsoil, although heavy, contains sufficient sand to make it much more pervious than is the subsoil of the Putnam silt loam.

A silty phase of this type is developed in narrow strips which in places occupy the upper part of the slopes adjoining the Putnam silt loam and extend across some of the divides comprising the latter soil. This phase differs from the typical Shelby loam principally in the higher percentage of silt in the surface and in a more pronounced development of the gray silt and the heavy clay layers in the subsoil.

The Shelby loam has the widest distribution of any soil in the county. In a general way it extends in a broad belt across the county, separating the prairie soils on the southwest from the residual and loessial soils on the east and northeast. Irregular areas of the type are encountered within the prairie soils on one side and the hill soils on the other.

The topography varies from gently undulating in the areas adjoining the prairie to very undulating and broken near the large stream courses. Surface drainage is good and in some places excessive. Underdrainage is better than in the Putnam.

The Shelby loam is a glacial soil, modified by thin surface deposits of loess and by being mixed with residual limestone and shale soils through cultivation and the gradual movement of soils down the slopes.

The entire type was originally forested, the edge of the forest growth practically marking the boundary between this type and the Putnam. Near the prairie the native growth consists of hickory, pin oak, hazel, sumac, and grape vines, with some elm, wild cherry, honey locust, and other trees and shrubs. As the residual soils are approached, black oak, post oak, and white oak become more common. Where not eroded this type is a fairly productive, easily cultivated soil which requires care in handling. It can be greatly improved by increasing its humus and nitrogen content through the use of manure and by growing cowpeas and clover. The yields of corn are somewhat lower than on the Putnam silt loam, but on account of better surface drainage and a more pervious subsoil this

type is better suited to wheat and clover. Corn yields 25 to 35 bushels and wheat 10 to 16 bushels per acre.

Land values on this type also average somewhat lower than on the Putnam silt loam, but are higher than on the Marion silt loam or the Rough stony land.

HAGERSTOWN SILT LOAM.

The Hagerstown silt loam is a light-brown or yellowish-brown light silt loam. When first cleared the surface is darker brown or gray, and where leached on the ridges it is almost gray. The material becomes heavier with depth, grading at 6 to 8 inches into a heavy silt loam of lighter color with splotches of gray and brown, which is underlain at about 18 inches by a clay. Below a depth of 24 inches the clay is lighter in texture and changes from a reddish brown to yellowish or mottled yellow and brown. Near limestone outcrops the soil has a bright reddish brown color, grading into a dark brown or almost black in areas where organic matter is abundant.

The Hagerstown silt loam differs from the Shelby loam in being slightly heavier in texture and free from sand or pebbles of foreign origin and fragments of chert, but in cultivated fields it has a similar color at the surface. It differs from the Knox silt loam in being more plastic and sticky and in lacking the velvety feel of the latter, but at the surface it has practically the same color. In many places, however, especially on the tops of ridges, it is modified by thin deposits of loess, these loess-covered areas being more productive than the typical soil. Rock fragments are sometimes encountered in the subsoil. In places near the steeper slopes the surface soil has been almost or entirely eroded away, while the areas below carry large quantities of shale fragments.

The tendency of this soil is to be rather sticky and gummy, especially when not in good moisture condition. Where exposed along cuts and gully banks it shows a peculiar flaky structure not possessed by the other soils of the county.

The Hagerstown silt loam has a rather wide distribution in Pike County. Areas of it extend around the principal drainage courses and usually separate the Shelby loam and Knox silt loam from the Rough stony land.

All of this type occurs in the hilly region, and the topography varies from very rolling to rough and broken. Surface drainage is good and in many places excessive. Wet areas on the slopes, due to seepage water, are common.

The soil is residual in origin and has come from the weathering of alternating beds of limestone and shales. Where the soil is reddish brown in color and granular in structure, it is derived largely from the limestone, but where it is yellowish gray or drab in color and

sticky and plastic it contains more shale. In many places the type is modified by glacial material and by thin surface deposits of loess. In general, the least productive part of this type is that near the steep hill slopes, where it contains a high percentage of soil from the Hannibal shale. The most productive areas are on the lower hill farther east, where there is generally a covering of loess.

The native forest growth on this type varies from post oak, small white oak, and black oak on the less productive soils, or those largely of shale origin, to walnut, large white oak, elm, and hard maple on the reddish soils, or those covered with loess. In the better areas this type is well suited to wheat, clover, and general farm crops, although it is not quite so good a corn soil as the well-drained bottom lands or the loess. In the vicinity of Frankford and McCunes Station it is used extensively for tobacco. Yields of 1,200 to over 1,600 pounds per acre of White Burley tobacco of good quality are secured. The type is also used for orchard sites and for growing small fruits, but not on an extensive commercial scale.

This type ranges in value from \$30 or \$40 an acre for the poorer lands to \$60 or \$75 for improved land.

ROUGH STONY LAND.

The lands of the county which are unfit for agriculture because of the presence of rocky material or because of steepness of slope are classed as Rough stony land. The greater part of the type is non-arable for both reasons. With the areas mapped as Rough stony land many small tillable areas, too small to be shown on a map of the scale used, have been included. On the other hand, numerous small areas of Rough stony land too small to be mapped separately are included with surrounding areas of other soils. The largest part of this soil consists of gray or yellowish-brown silt loam in which sharp fragments of chert and limestone are so abundant that cultivation is difficult or impossible. The rock content increases with depth until the underlying parent rock is encountered. The Rough stony land, however, includes limestone ledges and bluffs which in places have an elevation of 50 to 100 feet, shale-covered slopes, and a few slopes on which there is a soil covering but which are too steep for cultivation.

The principal forest growth on this type is post oak, black oak, and small white oak. Near the loess-covered areas hard maple, walnut, and papaw grow on steep slopes where there is a sufficient amount of good soil. Small, well-selected areas of this type can be used profitably for orchards and for small fruits, but in general it is best adapted to bluegrass pasture. A large total acreage of this low-priced land which is producing but little revenue in its present condition if put into permanent pasture would have a value equal, or almost equal, to that of the better soils.

LESLIE SILT LOAM.

The soil of the Leslie silt loam consists of a medium-textured silt loam at the surface, becoming heavier with depth and grading into a heavy silt loam to silty clay loam. The subsoil is a silty clay loam or clay containing large quantities of iron concretions. The lower subsoil is slightly lighter and more silty in texture. The soil is dark gray when dry and almost black when moist, the color becoming somewhat darker with increasing depth to about 20 inches, where it becomes distinctly mottled with yellow and gray, with splotches of brown.

In the lower subsoil the mottlings are usually somewhat less pronounced. In some places a distinct layer of gray silty material, usually only 3 to 6 inches in thickness, is encountered at a depth of 18 or 20 inches and is underlain by a dark-brown layer, which grades into the mottled subsoil. In other places the subsoil is light brown or yellowish brown, quite similar to the Marshall and Knox silt loams. When in good moisture condition this soil is fairly friable and easily handled, but if plowed when too wet it becomes very hard and cloddy. This is especially true of the heavier areas. Although the subsoil is quite heavy, the underdrainage is fair. The heavier areas, however, can be improved by tiling. In having in certain areas a fairly well defined heavy clay layer overlain by a thin layer of light-gray silt the type resembles the Putnam silt loam. In topography and in productiveness it resembles the Marshall silt loam. This type, however, was formerly forested, while the Putnam is a prairie soil, and in this type the clay layer is deeper and less sharply defined, the layer of gray material being in many places almost or entirely absent. The type as a whole has a heavier and more mottled subsoil than the Marshall.

The principal area of this soil in the county is a few miles east of Frankford.

This soil is essentially residual in origin, being derived from the Niagara limestone and the underlying calcareous Hudson shales. In small areas the material may have been slightly shifted by ice and may contain a small amount of foreign material, but if so the amount is too small to change the essential nature of the soil material.

This type was formerly heavily forested with pin oak, white oak, and some walnut. It is now under cultivation and is generally considered the best corn and wheat soil in the county. Corn yields from 40 to over 60 bushels, and wheat 18 to 30 bushels per acre. Clover does well. This soil is well suited to all crops grown in the county. Land values range from \$70 to \$100 an acre.

LESLIE CLAY LOAM.

The Leslie clay loam at the surface ranges from a very heavy silt loam to a clay loam. At a depth of 3 or 4 inches it becomes heavier,

grading into a sticky, waxy, silty clay loam. At a depth of 16 to 20 inches the soil is underlain by a heavy tenacious clay loam or clay, which generally extends to a depth of 3 feet or more, but which in places is underlain at a depth of less than 3 feet by shale. The surface soil is very dark gray to black in color and the subsoil mottled yellow, gray, and brown, like the subsoil of the Leslie silt loam. This soil bakes and cracks and is rather refractory, especially where there is no surface covering of lighter soil.

The principal areas of this type occur 3 to 5 miles southeast of Frankford, near Elclick, 1 mile west of Love Station, and near Three Churches, northwest of Louisiana.

The Leslie clay loam occupies the hill slopes, where the topography is rolling, and the edges of the broader valleys, where the surface is almost level and drainage in places is poor.

The soil is residual in origin, resulting largely from the weathering of the Hudson River shale. It has been influenced by weathered material from the Niagara and Louisiana limestone beds.

A part of this land is in cultivation and produces good yields of corn.

KNOX SILT LOAM.

The Knox silt loam to a depth of 16 to 18 inches is a light yellowish brown to buff very light, smooth silt loam with a velvety feel unlike that of any other type in the county. This is underlain by a slightly heavier silt loam grading into a heavy silt loam. At a depth of 24 to 28 inches the material becomes lighter in texture. The color of the soil is uniform throughout the soil section, and even where the material at a depth of 15 or 20 feet is exposed the color is the same.

When forest land is first cleared, where the type has been used for pasture for a long time or where conditions are favorable for the accumulation of wash and the increase of organic matter, the soil is darker in color, but upon being cultivated and given an opportunity to leach it soon assumes the characteristic yellowish-brown color. In some places extreme leaching results in an ashy-gray color resembling that of the Marion silt loam. The subsoil is slightly brighter as a rule or has more of a yellowish tinge than the surface soil, and in places along planes of fracture very thin gray layers are often encountered. Where exposed to the direct action of running water or to travel, as along the public roads, this soil erodes badly, but it stands perpendicularly in bluffs or gully banks. As it weathers the material develops a system of perpendicular and horizontal cracks, which give it a somewhat columnar structure. It is loose, friable, and easily cultivated, and absorbs and retains moisture better than any other soil in the county. The deeper and more typical loess occurs on the side of the area nearest to the river.

As the opposite side of the loess-covered area is approached the soil is more or less mixed with the limestone and shale soils. It also becomes heavier in texture, especially in the subsoil, slightly brown, shallower, and less productive. This condition has resulted from the sorting of the loess as it was deposited, the coarser material being dropped near the river flood plains while only the finer silt and clay were carried farther inland toward the tops of the higher hills. In an adjoining county this heavy subsoil phase has been separated from the typical soil.

This soil taken as a whole is correlated as the Knox on the basis of its color, texture, and structure rather than on the basis of origin. Along the river, occurring chiefly as a capping on top of the high hill belt extending from the mouth of Salt River to the south county line, there is a deposit that is probably wind blown in origin. In character, however, many areas of this material are leached and weathered until they are less productive than the typical Knox. Within the lowland belt extending from Sledd by way of Paynesville, Calumet, Stark, and Three Churches to the Salt River, the topography and agricultural value of the soil are more like the typical Knox. These characteristics, however, are not uniform throughout this entire stretch. In the southern part of the belt, in the neighborhood of Paynesville and Turpin, the soil is brownish in color, tending to reddish in the subsoil. It is a highly productive soil, seemingly somewhat more productive than the same soil farther north.

North of Calumet Creek the color is a shade less brown, tending either to gray, black, or yellow in the soil and in the subsoil to yellowish or reddish yellow. It is an excellent soil for corn, wheat, and clover and comprises well-improved prosperous farms.

In the extreme northern end of the belt, especially west of Three Churches, and probably in places along the western side of the belt, the color becomes decidedly gray, and in patches there is a tendency toward poor drainage. The change in color seems to be accompanied by a slightly lower productiveness. The soil is productive, however, and is devoted to corn and wheat.

In origin the extreme southern end of the belt is mainly residual from Trenton limestone. The slight admixture of material from glacial drift and the overlying shale has modified it to a slight degree. It is essentially like the Hagerstown soils in this respect.

In the central part of the belt the soil is mainly residual from the Hannibal and Hudson shales, calcareous shales, and various limestones. There is an undetermined influence from glacial material, but this is local in character and the areas affected do not differ essentially from the areas of residual material. There are occasional boulders of foreign rock, but these are extremely scarce. The influence of wind-blown material or true loess in this part of the belt is slight.

The Knox silt loam occupies a broad strip of gently rolling uplands, extending from Louisiana on the north to the county line near Sledd on the south and from the Mississippi River on the east to an irregular line from 1 to 3 miles west of Aberdeen, Calumet, Stark, and Buffalo Church on the west. The type also comprises a large part of the hill region north of Salt River.

The topography varies from gently rolling to very hilly. Some areas of this soil on account of steepness of slope have been included with the Rough stony land. Drainage is good, and in some places excessive.

All of the type was originally forested. On the typical soil the growth consisted mainly of walnut, elm, hard maple, large white oak, and papaw. The heavier phase was forested largely with post oak and small white oak. This type embraces the most productive, highest priced, and most improved land in the county. Not only is the soil highly productive, but it is suited to a wide range of crops. It is durable, easily cultivated, and retains moisture well. The type is used extensively for wheat, which yields 15 to 30 bushels per acre. Corn yields 40 to 60 bushels. Clover and alfalfa do well, and the soil is especially suitable for tobacco, apple orchards, small fruits, and for gardening. The lowest yields are obtained on the heavier phase.

In price this land ranges from \$50 an acre in the more hilly sections to as high as \$150 an acre for the more desirable and improved land.

MARSHALL SILT LOAM.

The Marshall silt loam consists of dark-gray to almost black silt loam which is slightly heavier in texture at the surface than the Knox silt loam. It becomes slightly heavier with increasing depth. The upper part of the subsoil at a depth of 18 to 24 inches is a lighter gray heavy silt loam, below which it grades into a silty clay loam. The subsoil is slightly mottled with yellowish brown. At about 24 inches the mottlings become more pronounced and more yellowish, the lower part of the soil section being yellow with dark-brown to almost black mottlings. Owing to its heavier texture, and especially to the heavier subsoil, this type is not quite so friable as the Knox silt loam. Where cultivated while too wet it tends to bake and form clods and to crack when dry.

The type occupies small areas, usually in the valleys of small streams or on the long slopes of some of the larger valleys. The topography is almost level to gently rolling. The origin of this soil is the same as that of the Knox silt loam, except that conditions have been more favorable for the accumulation of organic matter over this type. The Marshall silt loam, especially in the subsoil, closely resembles the Leslie silt loam, and in places it is undoubtedly mixed with that soil.

In agricultural value this type differs but little from the Knox silt loam, being perhaps a little better for corn, but in places not quite so well suited to those crops which require a soil with a deep, well-drained subsoil.

GENESEE VERY FINE SANDY LOAM.

This type is a light-brown to dark-brown or grayish-brown very fine sandy loam grading at a depth of about 16 inches into a light silt loam, which is underlain at about 30 inches by a light very fine sandy loam or very fine sand. The subsoil is less uniform than the soil, some areas having a rather heavy subsoil, while others are underlain at 30 inches or less by sand or gravel. The color is usually about the same throughout the soil section. The lower subsoil is in some places, however, a light and somewhat mottled gray. This soil is loose and friable and easily cultivated. As a whole it is not very uniform in texture, color, or crop value. The soil of some areas is considerably mixed with soils of coarser texture and with sand and gravel. The subsoil, however, lacks uniformity. In some places it is rather heavy, while in others it is underlain at 30 inches or less by sand or gravel. The type is developed as long narrow strips which usually adjoin the channels of the principal small streams of the county. It is usually slightly higher than adjacent areas of the silt loam, but is subject to frequent or occasional overflow. Except during periods of high water, it is usually well drained.

This soil is made up of material washed from the other soils of the county, principally the Shelby loam, and deposited near the stream channels during periods of overflow.

Some areas are cultivated in connection with other soils and are used for corn, grass, and truck crops. This is not a very good corn soil except where the silt content is high; but it is well suited to melons, sweet potatoes, and truck crops. The type occurs only in small detached areas.

No estimate of yields or agricultural value can be given for this soil separately.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Genesee very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
342425.....	Soil.....	0.0	0.1	0.2	13.3	26.4	52.4	7.4
342426.....	Subsoil.....	.0	.0	.4	16.2	19.5	55.6	7.9

GENESEE SILT LOAM.

The surface soil of the Genesee silt loam is a light-brown to grayish-brown or dark-gray light silt loam to silt loam, which is generally somewhat lighter in color below a depth of about 6 inches, and usually becomes heavier with increasing depth, until at about 15 inches it is distinctly heavier, the heavy texture often continuing throughout the remainder of the soil section. The lower part of the subsoil, however, is subject to considerable variation, frequently being sandy or gravelly. At a depth of 20 to 30 inches the material is distinctly mottled with gray and brown. In some of the large valleys, like that of South Spencer Creek and Peno Creek, these alluvial soils are quite dark, often almost black in color, closely resembling the Wabash soils. In other small areas in which drainage is deficient the soils are gray and rather heavy in texture, being somewhat similar to the Waverly soils.

Areas of this type occur in practically all of the principal valleys of the county. Some of the type is subject to overflow and much of it could be greatly improved by providing good surface drainage and tiling. Its origin is the same as that of the Genesee very fine sandy loam except that the finer soil particles washed from the upland types have been sorted out and deposited farther away from the stream channels.

These valley soils were originally heavily forested with elm, sycamore, walnut, and white oak, with an undergrowth of vines and brush. The greater part of this type has been cleared and is under cultivation. It is used largely for corn, but is well suited to clover, alfalfa, and wheat, and especially to potatoes and other garden truck. Corn yields range from 40 to as high as 75 bushels per acre.

Where this type occurs in large bodies and is in a good state of cultivation it is classed among the higher priced lands of the county, but where it is subject to overflow or deficient in drainage it has a lower value.

Genesee silt loam, poorly drained phase.—The surface soil of the Genesee silt loam, poorly drained phase, ranges from a gray to brown or black light to heavy silt loam, the texture becoming heavier with increasing depth. The subsoil is quite variable, consisting in places of a heavy silt loam or clay loam which at a depth of 24 to 30 inches is usually underlain by a lighter textured material. In places a layer of ashy gray silt loam about 6 to 8 inches in thickness and corresponding to the gray layer in the Putnam silt loam is encountered at a depth of about 10 inches. This is underlain by a layer of heavy black clay loam which extends to a depth of 24 to 30 inches.

Narrow strips of this phase are developed along all of the streams of the county. Even the smallest streams are bordered by narrow strips of wash, which in many cases are too narrow to be shown separately on the soil map. Along the outer edge of many of the

larger valleys the phase is developed as narrow strips immediately below the steeper slopes, and where small tributary streams enter these larger valleys it occurs as alluvial fans.

The topography is level or almost level, and the drainage of much of the phase is poor. A large part of this phase is practically waste land, because of its poor drainage and because it is badly dissected by small streams and gullies.

The Genesee silt loam, poorly drained phase, is largely colluvial in origin, having resulted principally from the gradual movement down the slopes of material from adjoining types. Weathering, poor drainage, and the accumulation of organic matter have assisted in changing this material to its present condition. On the prairie the phase is derived mainly from the Putnam silt loam. Farther down the streams a larger part of it is contributed by the Shelby loam, and still farther down the valleys it comes from the residual and loessial soils. Much of the darker colored soil is forested with a scattering of water oak. In some places, where areas of poorly drained, light-gray soil occur, the principal growth is post oak. The phase is best suited to corn. Where well drained and properly handled crop yields are about the same as on the better prairie soil.

LINTONIA SILT LOAM.

The Lintonia silt loam consists of a light yellowish brown silt loam, slightly darker in color than the Knox silt loam, from which it has been largely derived. It has been reworked and deposited in layers, varying in thickness from only a few inches to 3 feet or more, over some other soil, the underlying soil consisting usually of Wabash material. It is loose and friable and easily cultivated.

The principal areas of this type occur in the broad valley of the Mississippi along the meandering courses of Bryants, Gwins, Ramsey, Calumet, and Grassy Creeks. Smaller areas are deposited in many places where very small streams enter the broad valleys and deposit the loess wash in the form of overlapping, fan-shaped deltas, thus forming a narrow valley margin of loess wash. Some of these areas are too small to be shown separately on the soil map.

The surface is almost level, but slopes gently from the stream channel. Much of the type is subject to overflow, but is being protected by ditches and levees. Many areas are in need of more thorough drainage.

The Lintonia silt loam consists of material, almost entirely loessial in origin, which has been carried down by the swift currents of the small streams and deposited with the checking of the currents when the lower grade of the broader valleys is reached. These streams frequently overflow and deposit some material near the stream channels, carrying smaller amounts, including the finer silt and clay,

farther away from the stream. In this way artificial levees have been built up, which are highest next to the streams and slope gently away from them. Frequently the stream courses become so obstructed by this deposition of material that the streams form new channels, leaving long strips of overwash.

Where this soil is of good depth, well drained, and protected from overflow, it is probably the most productive soil in the county. Corn produces 50 to 75 bushels per acre, and other crops give correspondingly large yields. Wheat, clover, and alfalfa do well. The type is well suited to potatoes and other truck crops.

WABASH SILT LOAM.

The Wabash silt loam shows considerable variation. In many areas the soil is rather light, resembling closely the loess overwash by which it has been modified. In other areas it contains appreciable amounts of fine to medium sand, and in still others it is a heavy silt loam. The subsoil ranges from a silt loam to heavy silt loam or silty clay loam. The soil is dark gray, brown, or dark brown to black. The material is often uniform in color to a depth of 3 feet, but in many places it grades into a gray or dark-gray subsoil at depths of 12 to 18 inches.

This type occupies the greater part of the flood plain of Salt River, and several smaller areas occur in the Mississippi flood plain. South of Annada a large area of the type has been modified by wash from a narrow glacial terrace. In this area it is almost black in color, and in places contains a high percentage of sand.

The type is nearly level and is in need of protection from overflow and better drainage. In many places small, poorly drained areas have an ashy-gray color, show a strong acid reaction with litmus paper, and are rather unproductive. When thoroughly drained and properly cultivated for some time these soils become more productive and lose to a considerable extent their gray color.

The Wabash silt loam is alluvial in origin, having resulted from the reworking and deposition by flood waters of the material of many different soils. The greater part of the type is under cultivation, and good yields of corn, wheat, and clover are secured.

WABASH SILTY CLAY LOAM.

The surface soil of the Wabash silty clay loam is a grayish-brown to black heavy silt loam to silty clay loam, carrying an appreciable amount of medium to very fine sand. It becomes slightly heavier with increasing depth to about 16 inches, below which it is somewhat lighter in texture and has a slightly lighter brown color, grading in

places into a sandy clay, of similar color in the lower subsoil. Although this is a rather heavy soil, owing to the presence of sand it is friable, and when in good moisture condition it is fairly easy to cultivate.

This soil is typically developed on the islands in the Mississippi River, many of which are extensively farmed, and in long, narrow strips adjoining the river. The entire type is subject to overflow.

The Wabash silty clay loam is formed by deposition from flood waters, the coarser material being deposited by the swift currents near the stream channel.

The type is forested with pecan, hickory, walnut, sycamore, cottonwood, maple, and other trees. Large areas are under cultivation, but some areas have never been cleared. The type is used almost exclusively for corn, and good yields are obtained.

Owing to its position and to danger from overflow, this type has a lower value than soils which are no more productive but which have a better location.

Wabash silty clay loam, poorly drained phase.—The poorly drained phase of the Wabash silty clay loam is developed mainly in the southeastern part of the county. The soil is a dark-gray to bluish-black, rather heavy and tenacious silty clay loam, the color becoming lighter with depth. The subsoil is a mottled bluish-gray and brown, tenacious, almost impervious clay. This soil is difficult to cultivate except when in just the right moisture condition. The greater part of the phase is cultivated, and under favorable seasonal conditions fair crops are produced. The soil is in need of drainage, is strongly acid, and is much less desirable than the soil nearer the river or the better drained Wabash silt loam.

WABASH CLAY.

The Wabash clay is a black, dark grayish black or brownish-black, heavy, tenacious clay, the subsoil being mottled with gray, drab, and brown. It breaks and cracks when dry and is refractory and difficult to cultivate. The type is poorly drained, subject to overflow, and strongly acid. Little of it is cultivated, and the results are unsatisfactory. Much of the type supports a natural growth of coarse grass and is used for pasture and the production of hay. Some of it is forested principally with water oak, hickory, elm, and pecan.

Large areas of this soil occur in the Mississippi River flood plain, and in places its reclamation is being undertaken. It is not only necessary to protect the areas from overflow and to establish thorough drainage, but the soil requires lime to correct the acidity. The texture can be improved by thorough cultivation and the incorporation of large quantities of organic matter.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Wabash clay:

Mechanical analyses of Wabash clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
342410.....	Soil.....	0.0	0.7	0.6	3.1	5.3	51.9	38.4
342411.....	Subsoil.....	.0	.5	.4	1.4	3.8	60.1	33.6

WAVERLY SILTY CLAY LOAM.

The Waverly silty clay loam is a light-gray heavy loam which becomes heavier with increasing depth. In the lower part of the soil and upper part of the subsoil the material has a rough structure peculiar to poorly drained soils. At depths of 12 to 16 inches the subsoil grades into a bluish-gray or drab, very sticky, and impervious clay. Iron concretions are abundant, and in places a somewhat incoherent iron hardpan occurs in small areas.

The type occurs in the poorly drained sections of the Mississippi and Salt River bottoms, and smaller areas are encountered in the bottom lands of the other streams, many of these being too small to be shown separately on the soil map. In the Mississippi bottoms the poorly drained phase of the Wabash silty clay loam differs but little in places from the Waverly silty clay loam.

This soil can be greatly improved by drainage, by thorough cultivation, and the use of lime and stable manure or the turning under of green crops.

JACKSON SILT LOAM.

The Jackson silt loam consists of a dark-gray to lighter gray or yellowish-gray light to heavy silt loam, the color becoming lighter with increasing depth. The subsoil is a heavy, sticky clay, or silty clay loam. At from 10 to 15 inches the light-gray color changes abruptly to a brown or yellowish brown, usually mottled with gray, yellow, or black. Mottlings in the lower subsoil are less pronounced. In places this soil resembles the Putnam silt loam in color, texture, and arrangement of the layers, but in most places the surface soil is lighter in color and not so deep, and the subsoil is more yellowish and less silty in the lower part of the section. Where of good depth and well drained this is an excellent soil, well suited to all crops grown in the county and producing good yields of corn and wheat. In some areas the soil is strongly acid and in need of drainage.

This is the most important type of the Jackson series in the county. The largest areas of it occur along Salt River about 3 miles west and from 2 to 3 miles south of Ashburn.

JACKSON CLAY.

The surface soil of the Jackson clay to a depth of 2 or 3 inches is a very dark gray to black silt loam or loam. This grades quickly into a clay loam or clay, which is slightly grayer below 12 to 15 inches. At a depth of 15 to 18 inches a mottled yellow, gray, and brown, tenacious silty clay is encountered.

The Jackson clay differs but little in appearance from the Wabash clay, but owing to its surface covering of lighter soil, better drainage, and freedom from overflow, it is a much more valuable soil. From the occurrence of this type at about the same level as the shale and limestone beds in the adjoining bluffs, it is believed that the dark color and heavy texture of the soil are due, in part at least, to these beds.

The type is used for corn and wheat, and good yields are obtained.

JACKSON LOAM.

The Jackson loam is generally a yellowish-brown heavy sandy loam to loam, grading at a depth of 12 to 15 inches into a heavier, more compact loam to clay loam, which is usually lighter in color.

The soil varies in color from a yellowish gray to a rather dark brown, and in texture from a sandy loam or fine sandy loam to loam or silt loam. In some places the lightest soil occurs on the crests of the ridges and on the lower parts of the slopes. In other places the heaviest soil is on the tops of the ridges.

The type resembles rather closely the Buckner loam mapped in Jackson County, Mo. It is a rich, productive, well-drained soil, but is unimportant on account of its small total area.

The type is developed in small areas mainly near the edge of the terraces on which the Jackson silt loam and clay occur, where it occupies ridges and elongated mounds. Some areas of this soil are too small to be shown separately on the map.

SUMMARY.

Pike County is situated in northeastern Missouri. It has an area of 668 square miles, or 427,520 acres. The topography includes level and gently rolling uplands or prairies, broken or hilly regions, and river flood plains or bottom lands.

The northern part of the county is drained by the tributaries of Salt River, the eastern part drains into the Mississippi, and the southern part is drained by Cuivre River and its tributaries.

Permanent settlement has existed for about a hundred years. The 1910 census reports the present population as 22,556. Bowling Green, with a population of 1,585, is the county seat. Louisiana, with a population of 4,454, is the largest town in the county.

Although there are numerous important manufacturing and other industries in Pike County, agriculture, consisting mainly of stock raising, is by far the principal occupation.

Good transportation facilities are furnished by several railroads and the Mississippi River, and excellent gravel roads have been constructed throughout the county. Every part of the county is reached by rural free delivery and by telephone lines. The farm buildings are well built and kept in good condition, and indicate the general prosperity of the farmers.

The agriculture of Pike County consists mainly of stock raising combined with grain farming, the county ranking high among the stock-raising counties of the Middle West. Cattle, horses, mules, hogs, and sheep are raised. Poultry raising and dairying are also followed by some farmers.

Corn is the principal crop of the county. It is used largely for cattle feeding. Next to corn, wheat is the most important crop. Oats are grown to some extent, while large acreages are devoted to red clover, timothy, and tame or cultivated grasses, either separately or mixed, for hay or for grazing. Alfalfa and cowpeas are receiving considerable attention. Tobacco is being grown in a small way, and in places trucking and the production of fruit and small fruits are profitable.

The form of agriculture practiced in Pike County tends to maintain the fertility of the soils, though the soils have suffered some from continuous cultivation to a particular crop.

There is a wide range in the soils of Pike County. They may be classed broadly in four groups, based on origin, viz, residual, glacial, loessial, and alluvial. Nineteen types are mapped in the county. Of these the Putnam silt loam, the Shelby loam, and the Knox silt loam are the most important.

The Putnam silt loam, the prairie soil of the county, is largely glacial in origin. It is in a fair state of productiveness, and is used mainly for the production of corn and oats, for timothy, clover, and redtop meadow, and for bluegrass pasture.

The Marion silt loam has about the same origin as the Putnam silt loam. It is generally forested and contains less organic matter than the grass-covered Putnam soil. The type occupies narrow ridges and steep slopes. A small but increasing acreage is cultivated to tobacco, apple and pear orchards, small fruits, and berries. It is also adapted to wheat, clover, and cowpeas. The soil is subject to erosion and requires great care in cultivation.

The Shelby loam is the most widely distributed soil in the county. It is glacial in origin. Where not eroded it is easily handled and fairly productive. It seems best suited to wheat and clover.

The Hagerstown silt loam includes the principal areas of tillable residual soil in the county. The better areas are used for wheat, clover, the general farm crops, and to some extent for corn, orchards, and small fruits. Tobacco does well. The soil is derived from limestone and shale, but is modified by admixture of both glacial and loessial material.

All of the lands of the county which are nonarable because of the presence of rocky material or the steepness of slope are classed as Rough stony land. Small areas can be used for orchards and small fruits, but the best use of this type is for bluegrass pasture. Some areas are best kept in forest.

Two types of the Leslie series are mapped. The silt loam includes areas of both glacial and loessial origin, though influenced by admixture of material from the underlying shale and limestone. It occupies undulating to rolling uplands and the valleys and slopes of some of the small streams. It is well suited to all of the crops of the region. Many farmers consider it the best corn and wheat soil in the county. The Leslie clay loam, locally known as gumbo, is residual from shale and limestone. A part of the type is cultivated and produces good yields of corn. Other areas are used for bluegrass pasture and clover.

The Knox silt loam occupies gently rolling uplands, and comprises the most productive, best improved, and highest priced land in the county. The soil consists of loessial material, mixed in places with materials from adjoining limestone and shale soils. It is adapted to a wide range of crops.

The Marshall silt loam is closely related to the Knox. It is darker in color, however, containing more organic matter, and occupies more nearly level areas. It corresponds with the Knox silt loam in crop value.

The Genesee soils, the very fine sandy loam and silt loam, include the stream valleys in the county. They are strong, productive soils, used largely for corn, but adapted to clover, alfalfa, wheat, and particularly to potatoes and garden vegetables. They generally need protection from overflow, and some areas need drainage.

The Lintonia silt loam is almost entirely loessial. It is developed in the broad valley lands adjoining the Mississippi and Salt Rivers. The deep, well-drained areas protected from overflow are probably among the most productive in the county. Corn, wheat, clover, and alfalfa do well. The type is adapted to potatoes and other truck crops.

Three types of the Wabash series are mapped, the silt loam, silty clay loam, and clay. The soils are extensively farmed and are generally productive. They occupy the flood plains of the Salt and Mississippi Rivers and the islands in the latter stream. They need protection from overflow and artificial drainage.

The Waverly silty clay loam is developed in the poorly drained areas of the Mississippi and Salt River bottoms. It is in need of drainage, better cultivation, and of lime and stable manure or green crops turned under.

The Jackson soils, including a silt loam, a clay, and a loam, are developed along the valley of Salt River and along the edge of the Mississippi bottom lands. They are probably glacial rather than stream terrace soils. The deep and well-drained areas are strong and productive. All of the crops common to the county do well. Good yields of corn and wheat are obtained.

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