

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE UNIVERSITY OF MISSOURI AGRICULTURAL
EXPERIMENT STATION, F. B. MUMFORD, DIRECTOR;
M. F. MILLER, IN CHARGE SOIL SURVEY.

SOIL SURVEY OF RIPLEY COUNTY,
MISSOURI.

BY

F. Z. HUTTON, OF THE U. S. DEPARTMENT OF AGRICULTURE,
IN CHARGE, AND H. H. KRUSEKOPF, OF THE
UNIVERSITY OF MISSOURI.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1915.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., June 27, 1916.

SIR: During the field season of 1915 a soil survey was made of Ripley County, Missouri. This work was done in cooperation with the University of Missouri Agricultural Experiment Station, and the selection of the area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this work and to request their publication as advance sheets of Field Operations of the Bureau of Soils for 1915, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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MAP.

Soil map, Ripley County sheet, Missouri.

SOIL SURVEY OF RIPLEY COUNTY, MISSOURI.

By F. Z. HUTTON, of the U. S. Department of Agriculture, in charge, and H. H. KRUSEKOPF, of the University of Missouri.—Area inspected by HUGH H. BENNETT.

DESCRIPTION OF THE AREA.

Ripley County is located in the southeastern part of Missouri, on the eastern border of the Ozark region, about 200 miles south of St. Louis and the same distance northwest of Memphis, Tenn. It is bounded on the north by Carter County, on the east by Butler County, on the south by the State of Arkansas, and on the west by Oregon County. The county is rectangular in form, with a length of 30 miles from east to west and a width of about 21 miles from north to south. It embraces an area of 624 square miles, or 399,360 acres.

All of Ripley County, except approximately one township in the southeastern corner, lies in the Ozark Plateau. This part of the county consists of the remnant of a former plain that sloped gently southeastward. The existing topography has been produced by the erosion of this plain, and it is rough or smooth in proportion to the depth and thoroughness of dissection. That part of the county lying along the Current River is roughest on account of both complete and rather deep dissection. A belt ranging in width from 2 to 5 miles has been thoroughly cut to pieces, the valley ranging in depth from about 400 feet in the northern part to 200 in the south. This part of the county contains no area of smooth upland larger than a few acres at the most. The greater part of it is too rough for cultivation.

West of the rough belt along the river the topography varies from smooth on the watershed ridges and rolling along and around the shallow valleys to hilly along the larger creeks, the roughness depending upon the distance from the stream and its size.

That portion of the rough land lying east of Current River and north of Doniphan averages 3 to 4 miles wide. It is deeply and completely dissected, and this condition, with the stony soil, makes it largely unfit for agriculture. East of the Current River, excepting the lowlands in the southeast corner and the hill belt along the river, the topography for the greater part of the region is level to gently rolling, but along the breaks of Little Black River and Beaverdam Creeks it is hilly and precipitous. Along the county line on the north the



FIG. 1.—Sketch map showing location of the Ripley County area, Missouri.

surface is rolling, with broad flats between the streams, but on the east county line north of Little Black River it is hilly and broken. Between this river and the St. Louis & San Francisco Railroad there is a broad, level to gently rolling plain, locally known as "flatwoods." The southern part of this region is gently rolling, especially along Logan and Harris Creeks and where the uplands pass into the lowland region.

Another topographic division comprises the southeastern corner of the county, extending from the Little Black River south and east to the county line. This area includes a part of the Mississippi bottoms, consisting of low, level flood plains, interrupted by somewhat higher land, with a level to hummocky surface, occupying a second-bottom position.

The drainage of the county conforms in general to the different physiographic divisions. The western part is thoroughly drained by the Current River, the main tributaries of which are Fourche, Hurricane, Briar, Buffalo, Little Barren, and Big Barren Creeks. All these creeks, except Hurricane, rise in the extreme western part of the county and flow in a southeasterly direction. Hurricane Creek rises in the vicinity of Poynor, in the southern part of the county, and flows eastward into the Current River. There is considerable good bottom land along most of these creeks. The breaks on the east side of Current River extend 1 to 3 miles back from the river, and the creeks are not nearly so long as those entering the river from the west. All the country north of Doniphan is deeply cut by draws and small, crooked creeks, a few of which, like Isaacs, Simpson, and Bills Creeks, have developed narrow bottoms along their courses. All the above-named streams have rapid currents and their channels are being graded to lower levels. South of Doniphan the creeks are somewhat longer and consequently do not have such an abrupt descent to the river. The slopes along the river here are more gradual and the country is more gently rolling. Dudley Creek and other smaller streams drain this part of the county.

The eastern part of the uplands is drained by Little Black River and a number of tributary creeks. The drainage of this part of the county is not so complete as that of the western part, and in some sections of the "flatwoods" it is rather poor.

The Little Black River forms the boundary in the southeastern part of the county between the upland drainage and that of the Mississippi bottom lands. In this smoother country the streams do not flow so rapidly as in the rough western part of the county, but they are all actively cutting down their beds. The drainage of the Mississippi bottom lands in the southeastern part of the county is poorly established, there being numerous sloughs and abandoned stream channels. Here the Little Black River is a tortuous, slug-

gish stream, which, during periods of high water, overflows all the land in this part of the county, except the sandy ridges. Artificial drainage is rapidly opening up these lowlands. A number of large canals have already been dug and others are under construction.

One of the pronounced peculiarities of the streams in Ripley County, with the exception of Current River and several of its larger tributaries, is that they carry water only immediately after heavy rains or during rainy seasons. Without exception the upland streams have coarse gravel bottoms, which permit the water to pass down and into the stone substratum underlying this whole region. At low levels the water comes to the surface as springs. These flow with great regularity and volume, and the water is of exceptional clearness and purity. By far the greater number of springs is found in the valley of Current River. Their large number and the great volume of flow indicate that much of the regional rainfall is removed by underground drainage.

Ripley County originally was covered with an open forest, consisting principally of red, white, and black oak, with walnut, hickory, and elm on the red limestone (Decatur) soils. In the northern and northwestern parts of the county yellow pine predominated, being found on all the drier and more cherty areas of the Clarksville soils, with red oak, white oak, and walnut on the lower slopes. Here there was very little undergrowth, the open woods supporting a heavy growth of bluestem and other wild grasses. All the merchantable pine timber, except over a few scattered areas, has been removed by lumber companies and the land is growing up in oak and other deciduous species. The Clarksville silt loam ("flatwoods") supports a growth of black and red oak, with hickory and white oak on the more level areas. Black walnut formerly grew in abundance on the Memphis soils and along all the streams of the upland region, as well as on the sandy ridges of the Mississippi bottoms. The poorly drained areas of the Mississippi bottoms supported a heavy growth of sweet and tupelo gum, elm, hickory, white oak, hackberry, and cypress. Most of the original timber has been removed, and a second growth consisting of oak is now being cut for crossties.

For many years the lumber industry was of great importance, but since 1910 it has declined rapidly. The pine forest has been entirely removed, and the hardwoods that remain are of poor quality. Only a few small portable sawmills are found, and these barely supply the local demand. The lumbering methods are destructive in nature, and no effort is made to use efficiently all timber that is cut. Other than railroad ties no lumber is exported. The native trees consist of slow-growing varieties, and are generally removed for ties as soon as they attain sufficient size.

Ripley County was organized in 1847. The early settlers came from the mountainous sections of Tennessee, Kentucky, North Carolina, and South Carolina, the bottom lands along the streams being first occupied. In recent years a number of German Poles have settled in the county, mainly in the flatwoods section east of Doniphan. In the early days Pilot Knob, 80 miles to the north in Iron County, was the nearest railroad point and freight had to be carried to that place by wagon or boat. After the building of the railroad from Neelyville to Doniphan, in 1883, the population increased rapidly until 1900, when according to the census, it was 13,186. Between 1900 and 1910, however, owing to the diminishing importance of the lumbering industry, there was a decrease in population. The entire population is classed by the census as rural, and the density is given as 20.9 persons per square mile. The county is most thickly settled in the southern part, south of Doniphan, and in the southeastern part.

Doniphan, the county seat, with a population in 1910 of 1,225; Naylor, with a population of 406; and Oxly, with 150, are the three largest towns in the county, and all of them are railroad shipping points. Doniphan is the main distributing point for the county and one of the largest railroad-tie centers in the United States, more than 800,000 ties having been shipped from there in 1912. Currentview, Poynor, and Burr, in the southern part of the county; Ponder and Gatewood, in the western part; and Bardley, Pine, and Bennett, in the northwestern part, are other towns of local importance.

The transportation facilities for Ripley County are poor. The Iron Mountain and Frisco Railroads cross the southeastern corner of the county. A branch of the former extends from Neelyville, in Butler County, to Doniphan. The wagon roads over the county are in poor condition.

CLIMATE.

There are no striking climatic differences between Ripley County and other parts of the Ozark region. There are, however, differences in the amount and distribution of rainfall and in the temperature which permit the successful growing in Ripley County of certain crops which can not be grown farther north, the growing of two crops in certain rotations in the same season, and the placing of certain crops on the market earlier than in the northern part of the Ozark region. The longer growing season prolongs the use of pastures, so that the storing of large quantities of hay, ensilage, and roughage is not so necessary as in the northern part of the State. The winters, though not severe, are often marked by sudden drops in temperature in connection with damp weather, so that it is necessary to provide shelter for stock at certain periods.

There are no Weather Bureau records available for any point within Ripley County, but the records kept at the Weather Bureau station at Poplar Bluff, Butler County, 20 miles from Doniphan, are representative of local climatic conditions. The following table gives the normal monthly, seasonal, and annual temperature and precipitation recorded at the Poplar Bluff station:

Normal monthly, seasonal, and annual temperature and precipitation at Poplar Bluff.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1901).	Total amount for the wettest year (1898).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	37.6	72	- 4	3.72	2.68	1.65	2.6
January.....	37.4	73	- 9	3.56	1.37	7.31	1.8
February.....	35.0	77	-25	3.66	2.74	3.13	3.5
Winter.....	36.7	77	-25	10.94	6.79	12.09	7.9
March.....	49.2	83	9	5.37	4.80	12.81	0.2
April.....	59.9	92	23	4.43	3.59	3.39	0
May.....	68.8	98	28	4.99	2.39	7.31	0
Spring.....	59.3	98	9	14.79	10.78	23.51	0.2
June.....	76.2	102	43	5.32	1.37	5.16	0
July.....	78.6	112	53	3.75	0.71	5.48	0
August.....	78.6	109	49	3.17	3.69	3.67	0
Summer.....	77.8	112	43	12.24	5.77	14.31	0
September.....	72.0	100	34	3.17	1.28	10.20	0
October.....	60.0	92	21	2.83	1.90	8.43	T.
November.....	47.0	83	10	3.48	2.00	1.98	T.
Fall.....	59.7	100	10	9.48	5.18	20.61	T.
Year.....	58.4	112	-25	47.45	28.52	70.52	8.1

The mean annual temperature at Poplar Bluff is 58.4° F., which is slightly higher than for the northern part of the Ozark region. The highest temperature recorded is 112° in July and the lowest -25° in February. The average date of the last killing frost in the spring is April 7 and of the first in the fall October 17. This gives a growing season of about 193 days. The spring season opens about two or three weeks earlier than in the northern part of the State. The latest recorded date of a killing frost in the spring is May 19 and the earliest in the fall is September 29.

The mean annual precipitation as recorded at Poplar Bluff is 47.45 inches. This is 12 inches more than the average recorded at Jefferson City, in the northern part of the Ozark region, and the additional

rainfall comes at a time when it does not interfere with the cultivation of crops. The total for the spring months averages 14.79 inches; for the summer months, 12.24 inches; for the fall months, 9.48 inches; and for the winter months, 10.94 inches. The total rainfall for the crop-growing season—April to September, inclusive—averages about 25 inches. The precipitation during the winter months is usually general in character, while during the summer months it occurs as local showers.

AGRICULTURE.

Agriculturally, Ripley County is one of the least developed counties in the State. Approximately 12 per cent, or 79,000 acres, of the total area is improved land, the remainder consisting almost entirely of cut-over timberland. The agricultural methods are not of the most improved type, but are rapidly improving. In general, the agriculture of the county can be said to be in a state of transition from that of stock farming to mixed farming, or the growing of grain in connection with stock raising.

The first settlers lived near streams. They grew corn on the bottom lands, ranged the cattle on the uplands, and spent much of their time hunting and trapping. Corn was the only grain grown, and dependence was placed on the sale of cattle and hogs for the farm income. The open timberlands were covered with a thick growth of blue-stem and other wild grasses for summer pasturage; acorns supplied mast during fall and winter. The raising and fattening of cattle and hogs was thus easily accomplished and required little capital. Most of the cattle were marketed at Pilot Knob, 80 miles away, the nearest railroad point. Large numbers of hogs were shipped down the Current River in flatboats to southern markets. After the completion of the railroad from Neelyville to Doniphan in 1883, settlement progressed more rapidly and more of the upland was cleared and put under cultivation. Lumbering had become an important industry, and many of the upland farmers spent most of their time working in the sawmills, growing small fields of corn to feed their work stock. As the lumber was removed they would frequently clear a new field for corn, allowing the old fields to lie idle. This type of farming is still followed, especially in the western part of the county, the farmer growing some corn for his work stock and depending upon the sale of cattle and crossties for revenue. In all parts of the county there are fields that have deteriorated through continuous cropping to corn, and are now lying idle.

At the present time the prevailing type of agriculture is general farming, in conjunction with the raising of cattle for market. Corn, oats, and wheat are the principal crops. The census reports 28,519

acres in corn in 1909, with a production of 603,127 bushels. There were 5,625 acres in wheat in 1899, from which 34,540 bushels were produced, as compared with 1,555 acres sowed and 12,626 bushels produced in 1909. The area in oats decreased from 4,408 acres in 1890 to 1,775 acres in 1909. This year (1915) the acreage in both wheat and oats is being largely increased.

The yield of corn on the uplands ranges from about 10 to 20 bushels per acre, while on the bottom lands the ordinary yield is about 40 bushels per acre, and as much as 75 bushels has been obtained under the most favorable conditions. Wheat generally yields from 5 to 10 bushels per acre on the uplands without fertilization, and from 15 to 22 bushels with the use of commercial fertilizer. On the bottom lands from 15 to 30 bushels per acre are obtained without fertilization. All the grains produced are used locally. Most of the wheat is grown on the bottom lands along the streams and on the Decatur soils in the southern part of the county. A relatively large acreage is also devoted to wheat on the Clarksville and Memphis silt loams in the eastern part of the county.

The prolonged droughts of 1913 and 1914 caused many farmers to try kafir, milo, and feterita and other varieties of sorghum, and all these crops have proved successful. This year (1915) they were grown extensively on the Decatur gravelly loam and the Clarksville gravelly loam in the western part of the county. Sorghum is grown mainly for the sirup, nearly every farmer making a supply for home use.

Sudan grass was introduced into the county in 1915, and a great many farmers grew small patches of it as an experiment. The grass did very well, in some cases growing to a height of 4 or 5 feet, and it seems to be well suited to the climate and soils of the county. The small stems and broad leaves make good hay.

Millet is an important dry-year crop. Cowpeas are grown to some extent on the upland for forage and as a green-manure crop, but are most extensively grown on the light sandy soils of the Mississippi-bottom region, where large yields of hay are obtained.

Clover is grown on the bottom-land areas along streams flowing through the uplands and on the Hagerstown and Memphis silt loams. Good yields of clover are also obtained on the Lintonia soils of the Mississippi bottoms. In 1909, according to the census, 906 acres were devoted to clover alone, from which 889 tons of hay were cut.

Alfalfa is not an important crop in this county. A few fields of it are grown on the Decatur gravelly loam and on the Current River and Buffalo Creek bottoms. Alfalfa does well on the Huntington soils, and should do well on the Decatur and Hagerstown soils under proper treatment.

Some cotton is grown on the terrace soils in the southeastern part of the county. The 1910 census reported 1,558 acres in cotton, producing 617 bales. In some years the cotton crop is injured by early frosts.

All the fruits common to this section of the country thrive in Ripley County. The Decatur gravelly loam and the Clarksville gravelly loam seem to be especially suited to the production of apples, peaches, and pears. Apples and peaches have succeeded with little attention. There are no commercial orchards of any extent in the county, but nearly every farmer has a small orchard. Few of the apple, peach, and pear orchards are cultivated. Because of lack of care the San Jose scale and various diseases are ruining many of the fruit trees. Wild grapes grow in abundance on the Memphis, Decatur, and Clarksville soils. The fruit is of exceptionally large size and high flavor, which would seem to indicate that the soil and climate may be suited to the growing of certain cultivated varieties.

Raspberries and blackberries grow wild along old fences and in abandoned fields. A few strawberries are grown for home use and for sale at Doniphan. Strawberries do well on the Clarksville gravelly loam.

The natural conditions of Ripley County tend to make the raising of live stock the most practical and profitable of the agricultural industries. The difficulty of cultivating most of the soils and the poor facilities for marketing the crops naturally turn the attention of the farmers to the raising of stock. The extensive areas of open range make it possible to raise stock at low cost. In the northern and western parts of the county the same agricultural conditions yet prevail that were practiced by the earliest pioneers. Practically every farm has a small herd of cattle. These are ranged for about 8 to 10 months of the year and fed during the winter months with the hay and fodder grown on the bottom lands. When feed is plentiful they are sometimes fattened before being marketed, but the majority are sold as feeders. Hogs, too, are ranged, and in general fattened for market. In the more thickly settled parts of the county, to the south and east of Doniphan, much of the live stock is kept on inclosed woods pasture, but even here chief dependence is placed on the open range to support the animals.

The grasses of the range consist mostly of bluestem and Japan clover (*lespedeza*). The former occurs most abundantly on the virgin forest lands, where there is little underbrush. In such places it makes a strong growth and covers the ground completely. In general the grass does not flourish as it once did, owing to the shading of the land by brush that has sprung up since the timber has been removed.

Lespedeza is not a native of this region, but was introduced about 10 years ago. Since then it has spread over the whole county. It

grows especially well on the silt loams and fine gravelly loams, and therefore thrives best in the eastern part of the county. On much of the forested land, where the brush is not too thick, it forms a dense mat over the surface of the ground. Both bluestem grass and Japan clover supply excellent pasturage, the former making its best growth somewhat earlier in the summer. Other wild grasses and annuals, many of which belong to the legume family, although not very abundant, furnish good grazing for cattle, especially during late summer and fall.

Of the cultivated grasses bluegrass does not do well, on account of the open and droughty character of the soil. However, orchard grass, Sudan grass, and Bermuda grass thrive here and doubtless are destined to become the important pasture grasses of the county. In addition, such grass and forage crops as redtop, Johnson grass, timothy, cowpeas, and sorghum can be grown successfully. With proper management and the mild climate, a 9 months' grazing period can easily be provided for live stock.

According to the 1910 census, 8,273 head of cattle, 27,141 head of hogs, and 2,118 sheep and goats were sold or slaughtered during the preceding year. Horses and mules are raised to supply the local demand. Only a few flocks of sheep and goats are kept in the county. Sheep do well where the land is cleared, but over most of the county there is such a dense growth of young oaks and underbrush that it is hard to take care of any considerable number of them. The character of much of the county makes it more suitable for raising goats than sheep. Many farmers use goats for clearing land of brush and weeds, and as the kids sell for almost as much per pound as lambs, goats are more profitable than sheep.

Little attention has been given to dairying, the conditions not being favorable for the profitable development of this industry. In many places there is a deficiency of good water and in hot weather the pasturage often becomes scanty. There is also a lack of adequate shipping facilities.

Poultry raising is an important industry. Nearly every farmer raises some chickens. The railroad towns afford a ready market for poultry and eggs. Large shipments of dressed poultry and of eggs are made from Doniphan.

One of the greatest difficulties in handling the Ripley County soils is the almost universal presence of stones, varying in size from gravel to large pieces weighing a ton or more. The soils of more than two-thirds of the county consist of gravelly loams or stony loams. Rock fragments constitute as much as 60 per cent of the soil material in places. On the gravelly loams most of the stony material is in the form of fragments less than 2 inches in diameter. Although the

quantity is rarely sufficient to prevent cultivation, it renders cultivation difficult. The expense of clearing the land of the larger stones is not prohibitive. In areas in which the gravel content is large, and especially on gravelly south slopes, crops suffer from drought. Droughty areas are numerous on the Clarksville gravelly loam, especially in the western and northwestern parts of the county, where the rock is near the surface. Usually crops that cover the ground well and that need little or no cultivation do best on such areas. One good feature of the gravel is that it makes the soil less susceptible to erosion.

The cultural methods in use in Ripley County are not of the most improved type. This is largely because of the inadequate farm equipment. The teams are light and the implements of poor type. In most cases the land is not deeply plowed, grass and weeds are not thoroughly turned under, and the subsequent cultivation is insufficient.

Not much attention is paid to crop rotation. The same field is often planted to corn two or three years in succession, and then allowed to lie idle for the next three or four years, after which it is put in corn again.

Fertilizers are frequently used for wheat and sometimes for corn, with good results. Little attention is given to the care of farmyard manure.

According to the census of 1910, there are 191,492 acres in farms in Ripley County, of which 78,990 acres are improved. The total number of farms in the county is given as 1,862, and their average size as 102.8 acres.¹ There are only a few holdings of more than 500 acres. Most of the large tracts belong to lumber companies. There are 461 farms containing less than 50 acres. Owners operate 1,401, or 75.2 per cent, of the farms, tenants 457, or 24.5 per cent, and managers the remainder. There was a slight decrease in the percentage of farms operated by tenants between 1900 and 1910. In general, the smaller farms and tenant farms are most numerous in the Mississippi bottoms.

Land values range from \$3 to \$100 an acre, the higher prices prevailing for the bottom lands in the vicinity of Naylor, and the lower prices for the rough land in the northern and northwestern parts of the county.

The agriculture of Ripley County is undergoing a gradual change. Better live stock and improved methods of farming are replacing the indifferent and sometimes crude practices of the past. There is yet much to be done, however, before the agriculture of the county attains the degree of perfection found in the northern parts of the State. With the rapid decline in the timber industry, more depend-

¹ Each tenancy is classed by the census as a farm.

ence is placed on the soil for a livelihood and greater effort is made to make it yield larger returns. Such changes, though imperative, must of necessity be slow.

The developing agriculture is based on live-stock farming with grain growing. Special industries, such as fruit growing and dairying, have been successfully tried by a few individuals. They will not, however, find a general application and will succeed only in so far as the other and main industry will succeed.

A considerable part of the area of Ripley County is not adapted to intensive crop production, but most of it can be made to yield a fair income. Forty per cent of the area of the county has either a rough topography or a very stony soil or both, and such areas will have to be utilized as forest land or pasture. A considerable part of the remainder of the upland soils are more or less stony. These stones may be removed, however, and in so doing the land becomes much more valuable.

The eastern and southern parts of the county, represented in general by the Memphis and Clarksville silt loams and the Decatur gravelly loam, have the greatest agricultural possibilities, and it is here that the greatest development is being made. The soil is fairly productive and for the most part is easily handled. The comparatively smooth surface permits of large and regular fields and the use of heavy farm machinery. The greater part of this region is as yet undeveloped, but rapid progress is being made in its development.

Attempts by land companies at colonization have in the main proved a failure. The colonists, mostly Poles and Austrians from northern cities, had little or no capital to pay expenses while they were clearing and otherwise fitting their land for cultivation. As a result, many of them became discouraged and left. The absence of local markets and the type of farming also added to the lack of success of these settlers. The few that remained are developing good farms.

SOILS.

The soils of Ripley County are very simple in origin and uniform or nearly uniform over wide areas. They fall into two main groups, residual and alluvial, with the exception of a relatively small area which appears to be of a loessial origin. The residual or upland soils represent the residual products, chiefly clay, silt, and chert fragments, left upon decay of the underlying limestone, which is predominantly a fine-grained magnesian limestone carrying a large percentage of chert. There appears to be considerable difference between the chert content of the beds in the southern part of the county and those in the northern part. The limestone in the southern half of the county seems to be more nearly pure and free from chert. Here the

predominating soils are the Decatur (brownish to red soil with red subsoil) and Hagerstown (brown soil with reddish-brown subsoil), with some Clarksville stony loam on the higher hills and ridges. Toward the north the country is more rolling and the soils more cherty, the Clarksville soils gradually displacing the Decatur until the roughest country is reached in the northwestern part of the county, where the Clarksville gravelly and stony loams and Rough stony land, the soil of which has the Clarksville characteristics, occupy all of the uplands.

The limestone from which the Clarksville gravelly and stony loams are derived is very siliceous, containing a great deal of flint and chert. It often occurs in beds of practically pure flint 10 feet or more in thickness. Since flint does not disintegrate into soil, but merely breaks up and remains in the soil as stone fragments, it tends to make the soil very stony. Aside from the flint, the limestone contains a relatively small amount of clay impurities, so that on decomposition a relatively small proportion of fine earth is formed. Disseminated through the flint layers are thin beds of sandstone, but these are not thick enough to have any marked effect on the character of the soil. On account of the somewhat higher altitude, the northwestern part of the county has been subjected to severe erosion and much of the fine soil material has been washed away. This increases the proportion of stone in the soil.

Over the smoother "flatwood" country lying east and northeast of Doniphan there is little gravel, except in the substratum and on the slopes, the principal soil being Clarksville silt loam. Here there is a compact silty clay stratum in the lower subsoil which impedes internal movement of moisture and air, and in which there is much grayish material and dark concretionary material, representing apparently the results of imperfect oxidation. Near the edge of the eastern lowlands there is a strip of silty soil over the uplands which has the characteristics of the Memphis silt loam, a loessial type of soil. While the upland soils have generally not been moved or have been moved only short distances from the place where they were formed, directly over the rock that has decayed, there has been some slope movement by creep and wash from higher levels to lower levels to form occasional rather thick layers of mellow colluvial deposits along the gentler, lower slopes.

The alluvial soils along the streams flowing through and rising in the uplands consist of material washed down from the upland soils (mostly limestone). These alluvial soils are restricted largely to first bottoms where they are subject to repeated overflows and therefore receive continual additions of sediments. Most of the soils of the upland streams belong to the Huntington series. In the southeastern part of the county there are second-bottom (Lintonia)

and first-bottom (Waverly) soils which are associated with the Mississippi alluvial region. The better drained alluvial soils are brownish in color and those that are poorly drained between periods of overflow are grayish and mottled.

In all 16 soil types, exclusive of Rough stony land, are mapped in Ripley County. These are grouped in 9 series.

The surface soils of the Clarksville series are gray, silty, and cherty, while the subsoils are yellow to somewhat reddish, especially in the lower part, and consist usually of silty clay. When the lower subsoil is compact and the surface drainage is imperfect, mottlings of gray are common in the deep subsoil. The substratum is characteristically a reddish clay. These soils are derived either from limestone, ranging from cherty to relatively chert free, or from relatively pure limestone associated with cherty beds. The cherty material usually is present in varying proportions, considerable areas being gravelly from the surface downward. In this county the Clarksville series is represented by three types—stony loam, gravelly loam, and silt loam, together with a slope phase of the silt loam.

The Decatur gravelly loam, the only type of the Decatur series encountered in Ripley County, is distinguished from the soils of the Clarksville series chiefly by its deep-red clay subsoil, which lies relatively near the surface. The material forming this soil is residual from limestone.

The Hagerstown series is characterized by brown surface soils and reddish-brown to dull-red clay subsoils. The material is residual from limestone. One type, the Hagerstown silt loam, is mapped in Ripley County.

The Memphis silt loam, the only member of this series mapped in the county, has a brown surface soil and a yellowish subsoil. It occurs as a strip in the uplands, along the edge of the bottoms in the eastern part of the county. The origin of the material is indefinite, but there are indications that it consists partly or entirely of wind-blown material.

The surface soils of the Huntington series are light brown to brown and the subsoils are yellowish brown to light brown. Frequently there is little change in the color or character of the material from the surface downward. These soils consist of materials washed largely or entirely from upland limestone soils. They are first-bottom soils, which have good drainage between periods of overflow. Three types of the Huntington series are mapped in this county—the gravelly loam, fine sandy loam, and silt loam.

The Holly series is characterized by the gray color of the surface soils and the mottled grayish and yellowish color of the subsoils. These soils occur in the first bottoms of streams and are subject to

frequent overflows. The drainage is poor between periods of overflow. The origin of the material is the same as that of the Huntington soils. The Holly silty clay loam is the only type of this series mapped in Ripley County.

The surface soils of the Lintonia series are light brown and the subsoils are slightly lighter in color and somewhat more compact in structure. These soils occupy second-bottom positions in association with the Mississippi alluvium. They stand above present overflows and are well drained. The surface is level to hummocky. In this county the Lintonia series is represented by two types—the fine sand and fine sandy loam.

The surface soils of the Waverly series are light gray in color, and the subsoils are gray or mottled yellowish and grayish. The series is alluvial in origin and occurs in the overflowed bottoms in the southeastern part of the county. The soils have imperfect drainage between overflows. Three types, the fine sandy loam, very fine sandy loam, and silt loam are mapped in Ripley County.

The surface soils of the Sharkey series are yellowish brown to drab and the subsoils are mottled rusty brown, bluish, and yellowish in color and plastic in structure. In the slight depressions where water stands for a large part of the year organic-matter accumulations impart a nearly black color to the soil. Both soil and subsoil contain a high percentage of clay. On drying the clay cracks readily, forming small aggregates, which give rise to the local name "buck-shot land." These soils represent alluvial lands of the Mississippi-bottoms region. They are poorly drained and subject to annual overflows when not protected by levees. The Sharkey series is represented in Ripley County by one type, the clay loam.

In the following chapters the various types mapped are described in detail and their relation to agriculture brought out. The following table gives the name and the actual and relative extent of each soil type mapped in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Clarksville gravelly loam.....	81,088	20.3	Waverly silt loam.....	7,232	1.8
Clarksville stony loam.....	79,104	19.8	Holly silty clay loam.....	4,480	1.1
Clarksville silt loam.....	68,352	18.3	Hagerstown silt loam.....	3,840	1.0
Slope phase.....	4,992		Huntington fine sandy loam..	3,776	.9
Decatur gravelly loam.....	43,200	10.8	Lintonia fine sandy loam.....	3,584	.9
Rough stony land.....	39,360	9.9	Sharkey clay loam.....	3,328	.8
Huntington silt loam.....	21,376	5.4	Waverly very fine sandy loam.	2,688	.7
Huntington gravelly loam.....	11,968	3.0	Lintonia fine sand.....	1,088	.3
Memphis silt loam.....	10,240	2.6			
Waverly fine sandy loam.....	9,664	2.4	Total.....	399,360

CLARKSVILLE STONY LOAM.

The Clarksville stony loam consists of a gray silt loam carrying large quantities of chert fragments, 15 to 20 inches deep, the color changing to pale yellow at a depth of 2 or 3 inches below the surface. The subsoil is a yellow to reddish-yellow silty clay loam, usually passing in the lower part of the 3-foot profile into a reddish-yellow to dull-red clay, often mottled with other shades of yellow.

The Clarksville stony loam has a rather wide distribution, but is most extensively developed in the western part of the county. None of the type is in cultivation, and practically all of it occurs in wild, open forest land. Large areas of it are owned by lumber companies. The forest growth consists mainly of pine, red oak, black oak, and blackjack, with some hickory and walnut on the lower slopes. The native bluestem grows luxuriantly on this type, in many places reaching a height of 4 to 6 feet and forming a compact sod between the rocks. The best use for such land is as pasture. In general, this is nonagricultural land and is little better than the Rough broken land.

CLARKSVILLE GRAVELLY LOAM.

The surface soil of the Clarksville gravelly loam consists of a gray silt loam, passing at 2 or 3 inches into a pale-yellow silt loam. This is underlain at a depth of about 15 to 20 inches by a yellow or slightly reddish yellow silty clay loam, which usually passes in the lower part of the 3-foot section into a reddish-yellow or dull-red, friable clay, often containing some yellowish mottlings. Angular chert fragments, ranging in size from small particles to fragments several inches in diameter, are abundant over the surface and throughout the 3-foot section. The surface soil of the smoother areas usually contains from 20 to 60 per cent of these fragments, while the subsoil frequently contains from 50 to 90 per cent of large fragments, which are often united somewhat in the form of the original rock, so that they can not be easily pried out. It is generally impossible to bore into this type with the soil auger to a depth of more than 18 or 20 inches, and plowing is difficult, except when the soil is quite moist.

The boundary between this soil and the Decatur gravelly loam is often difficult to establish, owing to the similarity of the surface soil of the two types. The Clarksville gravelly loam always carries a larger percentage of chert than the Decatur gravelly loam, however, and the fragments are smaller, sharper, and lighter in color than in the latter soil. In this county much of the Clarksville gravelly loam is also distinguished from the Decatur by the growth of pine timber which it supports.

The typical Clarksville gravelly loam occurs in the northwestern part of the county. A narrow strip extends from Bardley and Pine

northward along the county line. From Bardley the type follows the divide between Buffalo Creek and the West Fork of Fourche Creek as far as Camp Roy. Another large area occurs in the vicinity of Shurleys School, following the divide between Briar Creek and the East Fork of Fourche Creek. Areas of considerable size were encountered north of Doniphan in the Current River hills. Southeast of Doniphan along the line between R. 2 E. and R. 3 E. there is some rounded chert gravel on the surface. Here the type is forested with red, post, and blackjack oak. Small areas are scattered through the area of Decatur gravelly loam in the southwestern part of the county.

The topography of the Clarksville gravelly loam is rolling to hilly, with deep ravines in many places. The drainage is everywhere well established, and the soil is droughty. Probably less than 15 per cent of the type is in cultivation. The timber consists mainly of pine, red, black, and blackjack oak, and some hickory.

The principal crops are corn and wheat, with some forage for cattle, which are raised upon most farms. Corn yields ordinarily from 10 to 30 bushels per acre. The yields are often greatly reduced during dry spells. Wheat yields from 5 to 10 bushels per acre without fertilization. Where commercial fertilizer is used these yields are much increased. Winter oats do fairly well as a rule, yielding from 15 to 30 bushels per acre. Some timothy is grown, usually yielding about one-half ton of hay per acre. Timothy is often killed by the summer droughts. Orchard grass and redtop are both grown in a small way, and do better than any of the other grasses. Sudan grass has been tried by a number of farmers with success. Most farmers use millet as a summer catch crop for forage. Of the legumes, cowpeas, red clover, and Japan clover (*lespedeza*) are grown in a small way. Cowpeas are grown for hay, yielding about 1 ton per acre. Red clover is grown on the smoother and less gravelly areas. The yield is small and uncertain, especially in dry weather. The usual method of growing clover is to seed with timothy on wheat stubble in the fall. Japan clover grows in the open timber in many places and makes excellent pasturage for cattle. In some places the second-growth oak and small bushes have crowded out the clover.

In the past no attempt has been made to follow systematic rotations of crops or to increase the productiveness of the soil. The land has been farmed mostly to corn, the farmers devoting a large part of their time to the cutting and making of crossties. Owing to location most of this type can be bought at \$5 to \$10 an acre.

Most of this type is located some distance from markets and shipping points, so that under present conditions an extension of the live-stock industry seems to be the most promising way of utilizing

it. The animals kept on the farms at present are small. The stock should be improved by importing purebred bulls of beef breeds.

In wooded areas where the undergrowth is thick the range might be improved by clearing out the brush and smaller oaks and seeding to orchard grass and redtop. Crops such as cowpeas, winter oats, vetch, and rye should be more extensively grown as soil improvers and cover crops. Winter oats, rye, and vetch will provide good winter pasturage, in addition to adding some organic matter to the soil, a constituent much needed. By using silos and feeding more cattle during the winter, saving the manure, and applying it to the land the productiveness of the soil could be increased. At present the straw from the wheat is stacked in the fields and either burned or allowed to rot there. All the straw should be used as bedding for cattle during the winter and applied to the land in the form of barnyard manure.

CLARKSVILLE SILT LOAM.

The immediate surface soil of the Clarksville silt loam is a gray or, when dry, almost white silt loam. At 1 or 2 inches the color changes to pale yellow, but the texture remains the same to a depth of 8 or 10 inches. Below this there is a yellow to slightly reddish-yellow or buff-colored, friable silty clay loam, which passes abruptly into a yellowish, moderately friable silty clay. In the lower part of the 3-foot section the material, locally called hardpan, is compact in structure and is marked with grayish mottlings. In the more nearly level areas, owing to the poorer drainage, the subsoil is usually of a lighter yellow color and the compact mottled stratum is encountered nearer the surface. On the slopes in many places chert fragments are abundant in the lower subsoil, and frequently some of these are scattered over the surface and throughout the 3-foot section. There are included with this type patches of the Clarksville and Decatur gravelly loams, which were too small to be shown on the map.

This type is confined almost entirely to the "flatwoods" section in the eastern part of the county. The topography is level to undulating. The undulating areas have good drainage, but the level areas, owing to the compact subsoil stratum, locally known as hardpan, are imperfectly or poorly drained. That portion of the Clarksville silt loam bordering on the Memphis silt loam and that portion south of the railroad have a more rolling topography and a redder subsoil than the typical flatwoods land. Agriculturally the red-subsoil variation is much superior to the latter. It does not have the hardpan characteristics, and in general is similar to and closely related to the Memphis soil.

Probably 20 per cent of this type is under cultivation, the chief crops being wheat and corn. The forest growth consists mainly of

black and red oak and hickory, with considerable white oak on the level areas. Some winter oats are grown, and this year (1915) a larger acreage than usual is being sown to this crop. The grasses, timothy, redbud, and orchard grass, are grown for hay. Sorghum is generally grown for the home manufacture of sirup. It is difficult to get a stand of clover on this type, probably on account of the lack of lime and organic matter in the soil. Cowpeas do better than any of the clovers, although they are not extensively grown.

Corn yields from 10 to 25 bushels per acre. Wheat yields from 5 to 10 bushels per acre without fertilization, but where fertilizer is used and good cultural methods practiced, as much as 20 bushels per acre has been obtained. Agriculture is best developed on this type in the vicinity of Fairdealing and Gamburg. Here the land is nearly all cleared and most of it has been in cultivation a long time. One of the main causes of low yields on this type is shallow plowing. In many cases the land is only plowed 3 or 4 inches deep, and in most cases the vegetation turned down is not thoroughly covered. Where commercial fertilizer is used it is the common practice to apply a mixture analyzing about 8-2-2 at the rate of 100 pounds per acre at the time of sowing the wheat. Corn generally is not fertilized.

Farms on this type can be bought at \$5 to \$35 an acre, depending upon location and improvements. Within the last few years a good many German Poles have settled on this soil.

The Clarksville silt loam in its natural state is a comparatively unproductive soil, but it is capable of being brought to a high state of productiveness if properly handled. The land is comparatively easy to cultivate, and heavy farm machinery can be used. The soil is generally acid, and lime is needed to correct this condition. It also is decidedly deficient in organic matter. This can be supplied by applying barnyard manure and by turning under cowpeas or other vegetation. By liming the soil and adding organic matter clover could probably be grown successfully. The poorly drained areas could be improved by tile drainage. More attention should be given to the growing of legumes in rotation with other crops. A rotation that has elsewhere given satisfactory results on this type under somewhat similar climatic conditions is as follows:¹ Cowpeas sown in the spring, oats or wheat in the fall, cowpeas again the next summer, then grass and clover for two years. The land should have a good deep plowing in the fall and again the next summer after the wheat is harvested, planting to peas, either cutting the crop for hay or turning it under for green manure. In case the cowpea crop is light the whole, tops and all, should be turned under.

¹ See Soil Survey of Coffee County, Tenn. Field Operations, Bureau of Soils, 1908.

The land should be broken deep and harrowed to good tilth. When oats or wheat is sown an application of 200 to 300 pounds of high-grade potash and phosphatic fertilizer would probably prove helpful. Following the grain in the spring there should be another cowpea crop to be turned under, after which grass and clover should be sown. After the land has been in grass for two years it can be broken up and planted to corn.

In some parts of Tennessee a high-grade export tobacco is produced on this soil.

Clarksville silt loam, slope phase.—The Clarksville silt loam, slope phase, consists of a grayish silt loam, changing abruptly to a pale-yellow silt loam, passing at a depth of about 10 inches into a yellow, friable silty clay loam, which usually is underlain by a yellow silty clay. In places a few fragments of chert are scattered through the soil. On the lower slopes the subsoil often contains iron concretions, locally called "buckshot."

This phase occurs in narrow strips along the lower slopes, usually adjacent to stream bottoms. It includes in places some level, terrace-like areas, which are too narrow to separate on the soil map. The soil has better drainage than the typical Clarksville silt loam. Most of it is under cultivation, being used for corn, wheat, and grass. The yields average about the same as on the typical soil, and suggestions for improvement given for the typical soil apply as well to this slope phase.

DECATUR GRAVELLY LOAM.

The typical Decatur gravelly loam consists of a grayish silt loam, passing at 2 or 3 inches into a pale-yellowish silt loam, and this abruptly into a reddish silty clay loam, which is underlain at a depth of about 6 to 15 inches by a red to deep-red, moderately friable clay. Fragments of chert, most of them less than 2 inches in diameter, are abundant on the surface and throughout the soil and subsoil, though as a whole the subsoil of this type is less cherty than that of the Clarksville gravelly loam. In many places there is enough chert gravel in the soil to interfere somewhat with cultivation, and it is often difficult to penetrate to depths greater than 18 to 24 inches with a soil auger.

The Decatur gravelly loam occurs mainly in the southwestern part of the county. The largest areas are encountered around Tucker, and in the vicinity of Poynor. Doniphan is located upon this soil. The surface is rolling to hilly, probably of a somewhat lower relief than that of the Clarksville gravelly loam. Drainage is well established throughout the type.

The forest growth consists mainly of red oak, black oak, and hickory. Probably not more than 30 per cent of the type is under cultivation. It is used in the production of corn, wheat, winter

oats, forage crops, and as pasture land. Nearly every farm has an orchard of apple, peach, and pear trees. Several small commercial peach orchards are located on this type a few miles south of Doniphan. In general the orchards are not well cared for and are more or less infested with the San Jose scale and with fungus diseases.

The Decatur gravelly loam is considered a stronger soil than the Clarksville gravelly loam. Corn, the principal crop, yields from 10 to 40 bushels, wheat 10 to 20 bushels, and winter oats 20 to 35 bushels per acre. These yields are obtained without fertilization. When fertilizer is used for wheat the yield is usually a little over 20 bushels per acre. A low-grade fertilizer, analyzing about 8-2-1 or 8-2-2, is commonly applied at the rate of 100 to 150 pounds per acre. Good stands of clover and timothy are made where these are seeded in the fall after the wheat is harvested. Farmers claim that where clover is sown with the wheat a good stand is generally obtained, but that after the wheat is taken from the ground the sun usually kills the tender plants. On a few farms some redtop is grown.

The sale of beef cattle is one of the main sources of income on most farms of this type. The open timber supports a strong growth of Japan clover and nearly every farm has small stream bottoms, which also afford good pasturage. Some winter feeding is done, but the cattle are generally sold in the fall as feeders.

There are some fairly well improved farms on the Decatur gravelly loam. In the vicinity of Poyner the type is nearly all cleared. Moderately heavy work teams are used.

Land of this type sells for \$10 to \$35 an acre, the best prices being obtained for farms that include some bottom land.

This soil can be greatly improved by the addition of organic matter. The low organic-matter content seems to be the main cause of the low yields of corn and the difficulty in maintaining a stand of clover. More attention should be paid to feeding cattle during the winter and saving the manure to apply to the corn land. The use of the silo would effect a great saving in feeding cattle. In many cases the cattle are of inferior grades, and better stock should be introduced. The soil generally shows some acidity, indicating the need of lime. Heavy ledges of magnesium limestone outcrop over this type, so that ground limestone or burnt lime should be obtained cheaply.

HAGERSTOWN SILT LOAM.

The typical Hagerstown silt loam is a brown, mellow silt loam, grading at about 8 or 10 inches into lighter brown silt loam to silty clay loam, which, in turn, passes at about 12 to 16 inches into a reddish-yellow, moderately friable clay. In some places the lower subsoil is dull red or red, and in others it contains yellowish and

grayish mottlings. There are usually a few chert fragments on the surface and throughout the soil section.

This type is developed mainly in the southern part of the county. It occupies slopes adjacent to creek bottoms, and is well drained.

Most of this type has been in cultivation longer than any other upland soil in the county. Along Fourche Creek there are areas that have been farmed continuously for more than 50 years.

At present practically all of it is in cultivation, but owing to its small extent it is not a very important soil in the county. The principal crops are corn, wheat, winter oats, clover and timothy, and cowpeas. Corn usually yields from 30 to 60 bushels per acre; wheat, without the use of fertilizer, 10 to 15 bushels, and with fertilizer, 15 to 20 bushels. Winter oats do well, sometimes yielding as much as 35 bushels per acre, with ordinary yields of 20 to 25 bushels. Clover and timothy do better on this type than on the Decatur or Clarksville soils. Cowpeas usually make a strong growth of vine.

The Hagerstown silt loam is fairly well farmed. Frequently clover and cowpeas are turned under before the land is put in corn. Commercial fertilizer is commonly used for wheat.

The value of this land is affected by its distance from the railroad. It is considered one of the best upland soils in the county. The price ranges from \$30 to \$40 an acre.

This type in places has been farmed to corn without any rotation for so long a period that it has deteriorated considerably. It could be improved by a more liberal use of barnyard manure. The soil shows acidity in places, and lime should prove beneficial. Clover, alfalfa, and cowpeas can be successfully grown on this land when it is properly handled. After the land is built up so that clover will stand the dry weather, this soil should prove to be among the strongest upland soils in the county.

MEMPHIS SILT LOAM.

The Memphis silt loam consists of a brown, mellow silt loam, passing at about 10 to 15 inches into a buff or slightly reddish yellow silty clay loam, and this at about 24 inches into a light-brown to yellow, friable, silty clay, with some slight grayish mottlings in the lower part of the 3-foot section. There are patches which have a grayish surface soil, giving some plowed fields a spotted grayish and brownish appearance. The substratum frequently contains a rather heavy clay of mottled grayish and yellowish color. In places on the slopes and in stream cuts chert fragments are encountered in the substratum. This type differs from the Hagerstown silt loam in having a mellow surface soil and a yellower subsoil, and from the Clarksville silt loam in not containing as much cherty material in the soil and lacking the characteristic compact, mottled lower subsoil.

The origin of the Memphis silt loam is not clearly understood. The presence of occasional chert fragments in the lower subsoil would indicate that it is derived in part from a rather pure limestone. Nevertheless, the distinct buff color of the soil, the absence of stones, and the characteristic rolling to billowy surface indicate strongly that it is loessial in origin. Whatever may be the correct explanation, there seems no doubt that loess has entered into the composition, and that the soil is closely related to the bluff soils bordering the Mississippi bottoms elsewhere in the State.

The Memphis silt loam occurs along the outer edge of the uplands, bordering the bottom lands in the southeastern part of the county. It occupies long, gentle slopes adjacent to stream courses, and the topography is undulating to rolling. A terracelike strip of about one-half square mile on the east side of the Logan Creek bottoms, 2 miles south of Oxly, has been included with the type owing to its small extent. This resembles the Robertsville or Olivier silt loam. Both the surface drainage and underdrainage are good. The fields do not seem to wash as badly as is the case on the Memphis silt loam in other sections.

The Memphis silt loam is not extensive in Ripley County. The native forest growth consists of gum, hickory, red oak, walnut, and elm. Within recent years most of the gum and walnut have been removed. Most of the type has been occupied within the last 20 years. It is considered a strong agricultural soil. The principal crops are wheat, corn, winter oats, clover, and timothy. Wheat yields ordinarily from 15 to 25 bushels, and corn from 30 to 40 bushels per acre. Clover and timothy do well. Apples, peaches, small fruits, and vegetables are grown for home use and are well suited to this soil. Bluegrass grows wild by the roadsides and in fields.

The Memphis silt loam is the best upland soil in Ripley County. The soil is productive, is easily cultivated, and is favorably located with respect to railroads. The farmsteads on this type have a well-kept, thrifty appearance.

The price of land of the Memphis silt loam ranges from \$30 to \$40 an acre. At the present time not much of this type is for sale.

HUNTINGTON GRAVELLY LOAM.

The surface soil of the Huntington gravelly loam consists of about 10 inches of brown loam or silty loam containing a large quantity of angular and rounded chert gravel. This is underlain to a depth of about 3 feet by lighter-colored material of similar texture, which contains a larger proportion of gravel. In many places the subsoil is a mere mass of gravel, and there are included patches in which both surface soil and subsoil are composed entirely of this material.

This type has its largest development along the smaller streams of the county. The surface is almost level, though in places it is cut up by overflow stream channels.

A large percentage of this land is still forested with walnut, oak, and hickory, with an undergrowth of hazel brush. Owing to the frequency of overflows, much of the cleared area is kept in grass and used for pasturing cattle. Some corn and wheat is grown. Corn yields from 20 to 40 bushels per acre.

This type is more difficult to cultivate and less productive than the Huntington silt loam. Its best use is for pasturage.

HUNTINGTON FINE SANDY LOAM.

The Huntington fine sandy loam consists of a brown, heavy, fine sandy loam to loam, about 15 inches deep, grading into a light-brown fine sandy loam to fine sand. In places the lower part of the 3-foot section is a loose sand.

This type has its main development along the Current River south of Doniphan, in the vicinity of Gains Ferry. Several small areas lie along Little Black River in the northeastern part of the county. The total extent of the type in this county is 5.9 square miles. In some places the surface is almost level, while in others it is quite uneven, being characterized by low swells and depressions. The drainage is good.

Corn, wheat, and grass are the principal crops on this type. Wheat yields 25 bushels and timothy and clover about 1 ton of hay per acre. In dry seasons corn often "fires" in areas where the type is underlain by loose sand. Land of this type sells for \$35 to \$50 an acre.

It is probable that alfalfa would do well on this type. By plowing under green-manure crops and using more stable manure, so as to increase the organic-matter content and water-holding capacity of the soil, it could be much improved for corn.

HUNTINGTON SILT LOAM.

The Huntington silt loam consists of a brown, mellow silt loam, passing beneath into lighter brown silt loam to silty clay loam of a friable structure. In some places, mainly along the small streams, chert gravel is present, and in others some fine sandy material is encountered in the lower part of the 3-foot section.

This type occurs over the broader bottoms of the larger streams. It is extensively developed along Current River and Fourche, Buffalo, and Little Barren Creeks. The topography is level to slightly undulating. The Current River bottoms are in many places dissected by small stream channels in which the surface soil is a silty clay loam.

A greater proportion of the Huntington silt loam is under cultivation than of any other type in the county. It is used almost exclu-

sively for the production of corn and wheat. Corn yields ordinarily from 40 to 60 bushels and wheat from 20 to 25 bushels per acre in favorable years. On some of the swells where the sandy substratum lies close to the surface corn is liable to burn during dry weather. Timothy and clover yield from 1 to 1½ tons of hay per care. Good stands of those crops are obtained without difficulty.

It is the general practice to sow timothy and clover in the wheat stubble in the early fall. When clover is sown with the wheat there is danger of the tender plants being killed out by the sun immediately after the wheat is cut. Many farmers seed the wheat stubble to cowpeas, harvest a crop of cowpea hay, and then seed the land down to timothy and clover. Some alfalfa is grown, but this is not at present a commercial crop. Where alfalfa is sown on high ground not subject to deep floods, fair to good stands are obtained. The most serious problem in establishing alfalfa is the abundance of weeds resulting from the quantity of seeds deposited by flood waters.

The Huntington silt loam is one of the strongest and best developed soil types in the county. Heavy teams and implements are generally used for cultivating the land. Frequently the same land is used for corn year after year without any serious decrease in yields. The soil is enriched by the annual spring overflows. Fertilizers are not generally used, and the need for them has not been felt.

There is very little of this type changing hands. Farms that have recently been sold brought from \$35 to \$60 an acre.

Farms on the Huntington silt loam could in many instances be improved by draining the abandoned sloughs and low places. The killing out of alfalfa by weeds could be avoided to some extent by seeding in the fall on land previously occupied by some cultivated crop.

HOLLY SILTY CLAY LOAM.

Typically the Holly silty clay loam consists of a mottled grayish and rusty-brown silty clay loam, passing at about 5 or 6 inches into a mottled yellowish and gray or bluish-gray silty clay loam, underlain by a bluish-gray silty clay containing yellowish and brownish mottlings and some iron concretions. A common feature of the type is the presence of small, domeshaped mounds consisting of grayish to brownish silt loam overlying yellowish silty clay loam.

The Holly silty clay loam is most extensively developed in the southern and southwestern parts of the county, occupying first bottoms along Mulberry, Hurricane, and Fourche Creeks and their tributaries. The type generally grades into the Huntington silt loam along the lower courses of the streams. It is subject to overflows after heavy rains and is poorly drained.

This type is used principally as pasture land and for the production of hay. Redtop, timothy, and white clover do very well. Some corn is grown, but the yields are small and uncertain.

Land of this type is valued at \$5 to \$20 an acre, depending upon location.

Under present conditions the Holly silty clay loam is best suited for use as pasture and the production of hay. In other States a similar type, the Holly silt loam, has been greatly improved by tile drainage.¹ The soil is generally low in organic matter and very acid. Organic matter can be supplied by the use of green-manure crops and barnyard manure, and the acidity can be corrected by applying lime.

LINTONIA FINE SAND.

The Lintonia fine sand consists of a brown fine sand, grading at a depth of about 10 to 12 inches into a light-brown to yellowish-brown fine sand. In many places the material is so loose that it is drifted by the wind.

Areas of this type occur in the vicinity of Acorn and near the southeastern corner of the county, occupying hummocks and low hillocks in association with the Lintonia fine sandy loam. Drainage is perfectly developed, and crops usually suffer from lack of moisture in dry seasons.

This type is not an important agricultural soil in Ripley County, owing to its small extent. It is used principally for the production of cotton, corn, cowpeas, sweet potatoes, and melons, all of which do well. Cotton yields one half bale and corn about 25 bushels per acre.

The Lintonia fine sand could be greatly improved by plowing under more cowpeas and by more liberal applications of manure.

LINTONIA FINE SANDY LOAM.

The typical Lintonia fine sandy loam consists of a brown loamy fine sand to fine sandy loam, passing into a light-brown fine sandy loam or loamy fine sand, which is underlain at a depth of 20 to 30 inches by a light-brown to yellowish-brown, friable sandy clay. There are included with this type some patches of Lintonia silt loam and Waverly fine sandy loam which are too small to separate on a map of the scale used in this survey.

The main body of this type is located around Naylor and between Naylor and Glenn. It occupies low ridges or slight elevations between the low Waverly soils. These usually have a hummocky or billowy surface. The position is that of a terrace, the type standing above the associated Waverly soils, which are subject to overflow

¹ See soil survey report on Madison County, Ala. Field Operations, Bureau of Soils, 1911.

by backwater from the river. The drainage of the Lintonia fine sandy loam is well established.

Probably 75 per cent of this type is under cultivation, corn, cotton, and wheat being the principal crops. Clover, timothy, and cowpeas are grown for hay and as soil improvers.

The soil is suited to a variety of other crops, including peanuts, sweet potatoes, and vegetables, but at present these are not grown to any important extent. Corn yields from 30 to 60 bushels, cotton from two-thirds of a bale to 1 bale, wheat 12 to 15 bushels, cowpeas 6 to 12 bushels, and clover about 1 to 1½ tons of hay per acre.

The soil is easy to handle, and generally the teams and implements used give efficient tillage. The farm buildings and improvements are among the best in the county. The price of land of this type ranges from \$30 to \$100 an acre.

WAVERLY FINE SANDY LOAM.

The typical Waverly fine sandy loam consists of a gray or drab to mottled grayish and yellowish fine sandy loam, underlain at a depth of about 6 to 10 inches by a drab sandy clay or sandy clay loam, with some yellowish mottlings. Frequently the subsoil contains yellowish, brownish, and black concretionary material, which increases with depth, the lower subsoil being a hardpan. In places the material is drab throughout the 3-foot section, with very little mottling and very little of the concretionary material. In such places the lower subsoil is a compact, plastic clay. There are areas in which the soil is a mottled grayish and yellowish fine sandy loam to a depth of 15 to 20 inches or more, overlying mottled drab, yellowish, and brownish plastic clay. There are many included roundish and elongated mounds of Lintonia fine sandy loam, which were too small to separate satisfactorily. Some of these cover but a few square rods, while others are 2 or 3 acres in extent. They range in height from a few inches to 203 feet.

The Waverly fine sandy loam is confined to the southeastern corner of the county. All the type, except the highest parts of the included mounds, is overflowed every year, and drainage is slow after the subsidence of the floods. Frequently the subsoil, owing to its impervious nature, remains practically dry where water has been standing on the surface for weeks. Drainage ditches have been established over a part of the type.

The Waverly fine sandy loam covers an area of 15.1 square miles in this county. A large part of the type is still forested with sweet gum, willow oak, water oak, swamp white oak, maple, ash, and willow. This soil, along with the other Waverly types, is locally called "willow-oak brakes." Where cleared, it is used for the production of cotton, corn, and timothy. Cotton yields from one-half to three-fourths bale

per acre. It does best on the included mounds of Lintonia material. Corn does well in most seasons. Timothy and redtop are especially satisfactory, two tons of hay per acre being a common yield.

Before this soil can be highly developed or improved it must be protected by dikes and ditches. Wherever it has been ditched corn makes a good yield if the season is at all favorable. The type would produce larger yields if the plowing were deeper and crop rotations were followed.

WAVERLY VERY FINE SANDY LOAM.

The surface soil of the Waverly very fine sandy loam consists of a dark-gray very fine sandy loam containing some fine sand, grading below into lighter colored, more compact very fine sandy loam to silty clay loam. At a depth of about 18 inches a very hard, compact layer containing many iron concretions, the size of buckshot and larger, is encountered. This layer is practically impervious to water. Below 24 inches the subsoil becomes more friable, consisting of fine sandy clay to silty clay, usually mottled with rusty brown and yellowish brown. The type is characterized by many small, dome-shaped mounds of Lintonia fine sandy loam. These mounds are not so large as those included with the Waverly fine sandy loam, but are more numerous.

The Waverly very fine sandy loam occurs in the southeastern part of the county in the vicinity of Naylor. The type is poorly drained and can not be extensively developed until properly ditched and protected from overflows. Practically all of it is covered with a second growth of sweet gum, willow, oak, swamp white oak, hickory, ironwood, and ash.

Some corn is grown on the cleared areas, but the stalks are small and the yields low. Where drained, this soil can be improved by a systematic rotation of crops, including cowpeas to be turned under before planting to corn.

WAVERLY SILT LOAM.

The typical Waverly silt loam consists of a gray silt loam, changing at about 5 inches into a light-gray, floury silt loam, with some yellowish mottlings, which passes at about 15 to 20 inches into a light-gray to bluish-gray silty clay loam containing some yellow or yellowish-brown mottlings and black and brownish concretions. At a depth of about 24 inches a bluish-gray, compact silty clay, with some whitish, friable, more silty material and considerable black and brownish concretionary material, is encountered. In places the clay comes nearer the surface, and the content of concretionary material increases with depth until a compact hardpan layer is

reached. This hardpan is so impervious that the lower subsoil may be comparatively dry even when the surface soil is flooded.

The Waverly silt loam occurs along the Little Black River in a strip ranging from a half mile to a mile in width. It occupies a level first-bottom position, is subject to overflows, and is poorly drained.

A greater proportion of this type is cleared and in cultivation than of any of the other Waverly soils. It is used for the production of wheat, corn, and hay. Where overflows are not too severe wheat does well, yielding from 20 to 25 bushels per acre. When the seasonal conditions are favorable good yields of corn are made, but when the land can not be plowed under proper moisture conditions, as is the case in most years, the soil compacts and clods badly with cultivation and yields are low. The type is well suited to timothy and redtop, producing 1 to 2 tons of hay per acre. The forested areas support a heavy growth of sweet gum, swamp white oak, water oak, willow oak, maple, ironwood, ash, hickory, and cypress. The land is sometimes referred to as "willow-oak brakes." Land of the Waverly silt loam sells for \$10 to \$20 an acre.

The most immediate need of this type is tile drainage. It is so level and low that drainage can be established only by carefully laid drains. Applications of lime and stable manure probably would prove very beneficial. Deeper plowing and more thorough cultivation, so as to aerate the soil as much as possible, should be practiced.

SHARKEY CLAY LOAM.

The Sharkey clay loam consists of a dark grayish brown to almost black sandy loam to a depth of 3 or 4 inches, underlain by a dark-brown, heavy sandy clay mottled with yellowish-brown, this grading at about 10 inches into a dark bluish gray sandy clay, faintly mottled with yellowish brown. The subsoil is sticky and plastic. In some of the depressions the surface soil is very dark and somewhat mucky from accumulations of organic matter. Here the subsoil below 20 to 24 inches is a plastic silty clay. On drying the soil cracks somewhat.

This type occurs principally in two large areas in the southeastern part of the county. The topography is level and in some places depressed. All the type is subject to overflow and is poorly drained.

At present none of this type is cleared. The forest growth consists of sweet gum, tupelo gum, red oak, willow oak, ash, swamp white oak, and cypress.

The Sharkey clay loam has been found to be one of the most productive soils of the Mississippi bottoms and when properly ditched and drained it has elsewhere proved well suited to corn, cotton, and alfalfa. At the present time several drainage ditches are being

extended through the type, so that within the next few years it should all be brought under cultivation.

Most of the land is now held by a lumber company and very little of it is on the market. A few small uncleared areas have been sold for \$25 to \$30 an acre.

ROUGH STONY LAND.

There are large areas of Rough stony land in the northern part of the county, occurring mainly in connection with the Clarksville gravelly loam and the Clarksville stony loam. Rough stony land comprises areas, mostly steep and precipitous, which contain so many large chert fragments, bowlders, and exposures of bedrock that cultivation is impossible.

Rough stony land supports a forest growth consisting mainly of pine and red and black oak, with some white oak on the lower slopes. The undergrowth consists of bluestem and other wild grasses. The only agricultural use of this land is as range pasture.

SUMMARY.

Ripley County is located in the southeastern part of Missouri, about 200 miles south of St. Louis and about the same distance northwest of Memphis. The county embraces an area of 624 square miles, or 399,360 acres, and all of it, except approximately one township in the southeast corner, lies in the physiographic division known as the Ozark region. The topography of the uplands varies from level to very hilly. In general the western part of the county, west of the Current River, is the more broken, and large areas are too rough and rocky to cultivate. The southeastern corner of the county is in the Mississippi lowland region.

The western part of the county is thoroughly drained by the Current River and its tributaries and the eastern and northern parts by the Little Black River and its tributaries. The Little Black River forms the boundary in the southeastern part of the county between the upland drainage and that of the Mississippi bottom lands. The drainage of the Mississippi bottoms is poorly established, there being numerous sloughs and abandoned stream channels.

There were a few settlements in the territory which embraces Ripley County prior to 1821. The county was organized in 1847, but development has been slow, mainly on account of poor shipping facilities, the rough character of much of the land, and the bad condition of the roads. The southern and eastern parts of the county are most thickly settled. Fully 80 per cent of the county is still in forest, and the cutting of cross-ties is an important industry.

The 1910 census reports the population of the county as 13,099, or 20.9 persons per square mile. The entire population is classed as rural. The county is most thickly settled in the southern part, south of Doniphan, and in the southeastern part. There are still large areas of forested land in the northeastern part of the county which are sparsely settled. Here the settlements are located mainly along the creeks.

Doniphan is the county seat and largest town in the county, with a population in 1910 of 1,225. Naylor, with a population of 406, and Oxly, with 150, are the next largest towns. Doniphan is the main distributing point for the county and one of the largest railroad-tie centers in the United States.

The railroad transportation facilities are inadequate and the public roads in many places poor.

The climate of Ripley County is similar to that prevailing throughout southern Missouri. The winters are milder, the growing season longer, and the precipitation somewhat greater than in the northern part of the Ozark region. The mean annual temperature is 58.4° F. The mean annual precipitation is 47.45 inches, the greatest amount of rainfall occurring in the spring and summer months. The average growing season is 193 days.

At present the prevailing type of agriculture is general farming, in conjunction with stock raising. Corn, oats, wheat, and forage crops are the principal crops. Some cotton is grown on the terrace soils in the southeastern part of the county. Most of the corn and oats are consumed on the farms, while all the wheat is sold. All the fruits common to this section of the country thrive, but there are no large commercial orchards in the county.

Stock raising is an important industry throughout the county. In the northern and northwestern parts it is carried on more extensively than any other line of farming. Little attention has been given to dairying. Nearly every farmer raises some chickens, and large shipments of dressed poultry and of eggs are made from Doniphan.

In 1910 there were 1,862 farms in the county, of an average size of 102.8 acres. The land in farms amounted to 191,492 acres, of which 78,990 acres were improved. Of the total number of farms, 1,401 were operated by owners, 457 by tenants, and the remainder by managers. Land values range from \$3 to \$100 an acre, the higher prices prevailing for the bottom lands in the vicinity of Naylor and the lower prices for the rough land in the northern and northwestern parts of the county. Cut-over pasture land can be bought for \$5 an acre.

The soils of Ripley County fall mainly in two groups—residual and alluvial, with a small area of loessial origin. The residual soils

are derived from impure cherty limestone material and generally are more or less gravelly. The alluvial soils are derived from material brought down from the uplands, or, as in the Mississippi bottoms, transported from regions farther north. In all, 16 soil types, exclusive of Rough stony land, are mapped in Ripley County. These are grouped in 9 series. The residual soils are included in the Clarksville, Decatur, and Hagerstown series, the loessial in the Memphis, and the alluvial soils in the Huntington, Holly, Lintonia, Waverly, and Sharkey series.

The Clarksville series is represented in the county by three types, the stony loam, gravelly loam, and silt loam, together with a slope phase of the silt loam. Less than 20 per cent of the series is cultivated. Much of it is too steep and stony for farm land. Corn, wheat, oats, and grasses are the leading crops. A considerable area is used for grazing cattle.

The Decatur gravelly loam, the only type of the Decatur series encountered, is distinguished from the soils of the Clarksville series chiefly by its deep-red clay subsoil, which lies relatively near the surface. About 30 per cent of this type is under cultivation. The crops are the same as on the Clarksville areas, but the Decatur is considered somewhat more productive. The sale of cattle as feeders is one of the main sources of farm income.

The Hagerstown silt loam is of small extent, but almost all of it is in cultivation. It is a good general-farming soil.

The Memphis silt loam covers 16 square miles in the county. It has been developed within the last two decades. It is considered a strong soil.

In the Huntington series three types are mapped, the gravelly loam, fine sandy loam, and silt loam. The latter two are important stream-bottom soils, giving good yields of corn and wheat. Timothy and clover yield from 1 to 1½ tons of hay per acre.

The Holly silty clay loam covers an area of approximately 7 square miles. It is a poorly drained type, best suited under present conditions for pasture land.

Two types of the Lintonia series are mapped. These are well-drained second-bottom soils. The fine sand is inextensive and inclined to be droughty. Cotton yields one-half bale and corn about 25 bushels per acre. Between 5 and 6 square miles of the fine sandy loam occurs in the county and 75 per cent of it is in cultivation. Corn yields 30 to 60 bushels, cotton two-thirds to 1 bale, and wheat 12 to 15 bushels per acre.

The soils of the Waverly series are imperfectly drained and are subject to overflow. Three types, the fine sandy loam, very fine sandy loam, and silt loam, are mapped. Much of the Waverly area is un-

cleared. Areas under cultivation give good yields of cotton, corn, and hay. Levees and drainage are necessary for full use of these soils.

A little more than 5 square miles of the Sharkey clay loam is found in the county. The type is poorly drained, and none of it is under cultivation. It should prove productive when reclaimed. Ditches were being extended through the areas at the time of the survey.

Rough stony land comprises about 10 per cent of the area of the county. It is mainly in forest, and is nonagricultural land. The undergrowth furnishes some grazing.



[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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