Issued June 6, 1916.

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 PETTIS COUNTY, MISSOURI.

BY

H. H. KRUSEKOPF, OF THE UNIVERSITY OF MISSOURI, AND R. F. ROGERS, OF THE U. S. DEPARTMENT OF AGRICULTURE.

CURTIS F. MARBUT, INSPECTOR IN CHARGE.

[Advance Sheets—Field Operations of the Bureau of Soils, 1914.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1916.

BUREAU OF SOILS.

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SOIL SURVEY.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Soils,
Washington, D. C., October 16, 1915.

Sir: During the field season of 1914 a soil survey was made of Pettis County, Mo. This work was done in cooperation with the State of Missouri, 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 area and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1914, as provided by law.

Respectfully,

Milton Whitney,
Chief of Bureau.

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

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SOIL SURVEY OF PETTIS COUNTY, MISSOURI.

By H. H. KRUSEKOPF, of the University of Missouri, and R. F. ROGERS, of the U. S. Department of Agriculture.

DESCRIPTION OF THE AREA.

Pettis County, Mo., lies just west of the center of the State. Its eastern boundary is about 180 miles west of St. Louis, and its western boundary about 80 miles east of Kansas City. It is bounded on the north by Saline County, on the east by Cooper and Morgan Counties, on the south by Benton County, and on the west by Henry, Johnson, and Lafayette Counties. The county is nearly square, measuring 24 miles from east to west and 29 miles from north to south, and has an area of 675 square miles, or 432,000 acres.

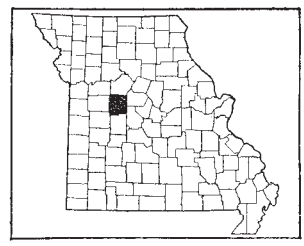

FIG. 1.—Sketch map showing location of the Pettis County area, Missouri.

Pettis County is on the eastern edge of the prairie region of western Missouri. The general topography is that of a broad plain, with a gradual slope to the northwest. The elevation ranges from about 750 feet above sea level in the northwestern part to a little more than 1,000 feet in the southeastern corner, and from a little more than 800 feet in the northeastern to about 900 feet in the southwestern corner. The elevation at Sedalia is 890 feet, at Smithton 887 feet, at Lamonte 863 feet, at Green Ridge 896 feet, and at Houstonia 750 feet.

The smooth to gently rolling area comprises the western two-thirds of the county, with broad, smooth prairies extending eastward between the larger streams. The smoother part extends from Sedalia to the southwest, and includes the area between Flat and Muddy Creeks. It is characterized by a flat to gently undulating surface, with watercourses flowing in wide, flat-bottomed valleys, bordered by low, gentle slopes. To the east of Sedalia this gently rolling area rapidly becomes narrower, passing out of the county to the east of Smithton.

The northern part of the plain includes the territory between Muddy Creek on the south and Heaths Creek on the north, and extends from the western county line through Lamonte and Hughesville to Postal. It is less extensive and slightly more undulating than the southern portion. To the north and west of Lamonte there are several isolated mounds and ridges, from 20 to 50 feet above the surrounding country, representing remnants of a somewhat higher plain which has been eroded away in this section, but which still exists to the southwest in the southern part of Johnson County. The topography of the southeastern part of the county is moderately rolling, with a few low but precipitous bluffs along Lake Creek. The roughest land is found along Muddy and Heaths Creeks in the northeastern part of the county. The valleys of these streams are from one-fourth to 1 mile in width. They are shallow and flat-bottomed, being trenched from 20 to 100 feet below the general surface of the surrounding prairies, and are bordered on both sides by belts of rolling to hilly country. Along Muddy Creek the bluffs are precipitous in places, and are generally high, but over the greater part of the county they are low and usually not too steep for cultivation. Where they are not cultivated this is due in many places to the stony surface rather than to the steepness of the slope.

The topography of the region expresses in a very marked degree the geological structure and relative resistance of the rocks to weathering. It has been produced by denudation, which carried away the soft overlying shale rock and exposed the harder and more resistant limestones. Where the shale thins out the surface changes gradually from the topography of the shale to the typically dissected plain of the limestone.

One of the pronounced topographic features of the region is the gradual southward slope and the abrupt northward slope from upland to valley. This feature is especially marked along Flat Creek, and to a less degree along Muddy and Heaths Creeks. The streams usually occupy the south side of the valley, and are bordered on this side by relatively high and steep bluffs. This relief becomes more pronounced toward the east. The north side of the valley and the upland usually merge almost imperceptibly.

Nearly all the drainage of Pettis County is through Lake, Flat, Muddy, and Heaths Creeks into the Lamine River, which skirts the eastern edge of the county and empties into the Missouri River. Blackwater River, a part of the same drainage system, crosses the extreme northwestern corner of the county, but drains only about 75 square miles of its area. The general direction of flow of the streams is northeasterly. They have soft bottoms and banks, and

usually the water is muddy. Flat Creek is more sluggish and not so clear as Muddy Creek. This is due to the fact that the former has less fall and is largely fed by surface waters, while the latter has a more rapid descent and is chiefly supplied by springs. The intermittent streams are short, of low gradient, and flow in shallow, indistinct valleys. Fresh-water springs are numerous throughout the limestone area. Several salt and sulphur springs are found in the northeastern part of the county.

Pettis County was settled in 1818 near Heaths Creek. Most of the early settlers came from Kentucky and other States to the east. In 1831 a colony of Germans settled along Lake Creek. Their descendants constitute the greater part of the present population in the southeastern section of the county. The county was organized in 1833. In 1865 the county seat was moved from Georgetown, then a town of about 1,500 population, to Sedalia. According to the census of 1900, the population of Pettis County was 32,438, and in 1910 it had increased to 33,913, the increase being confined to the city of Sedalia. The rural population is reported by the 1910 census as 16,091.

Sedalia, the county seat, has a population of about 18,000. Two trunk-line railroads and three branch lines intersect at this place and make it a general distributing and shipping point for a large part of central Missouri. Railroad car shops are located here in addition to a number of manufactories. Houstonia, Hughesville, Lamonte, Dresden, Green Ridge, and Smithton are other towns on railroads, supported mainly by agricultural interests.

The railroads radiating from Sedalia provide excellent shipping facilities to the Kansas City and St. Louis markets.

This is one of the leading counties of the State in the number and extent of improved wagon roads. Nearly every road within a radius of 8 miles from Sedalia is macadam or gravel. Of the 1,200 miles of public road, about 150 miles are of permanent character, either rock, gravel, or macadam. Rock and gravel for road material are abundant.

CLIMATE.

The climate of Pettis County is about the average for the State, and is favorable to the production of a wide variety of crops. It is continental in type, and shows a wide range in seasonal variations. The following table, giving the normal monthly, seasonal, and annual temperature and precipitation, is compiled from the records of the Weather Bureau station at Marshall, Saline County, and is representative of the climatic conditions in Pettis County.

Normal monthly, seasonal, and annual temperature and precipitation at Marshall, Saline County.

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	31.5	69	−22	1.70	2.58	2.17
January	28.4	72	−16	1.85	1.94	4.02
February	28.0	71	−26	1.96	1.19	1.85
Winter	29.3			5.51	5.71	8.04
March	41.9	90	2	2.74	4.35	6.45
April	54.1	97	17	3.42	3.43	3.10
May	64.3	102	25	5.01	1.11	9.17
Spring	53.4			11.17	8.89	18.72
June	72.7	101	41	4.67	2.52	5.34
July	76.4	108	50	4.28	1.54	2.63
August	75.9	102	40	3.97	1.73	1.49
Summer	75.0			12.92	5.79	9.46
September	68.5	102	28	3.95	1.59	6.36
October	56.8	95	20	2.39	1.16	5.43
November	42.4	79	4	2.11	0.71	2.18
Fall	55.9			8.45	3.46	13.97
Year	53.4	108	−26	38.05	23.85	50.19

The mean annual temperature is reported as 53.4°, which is a few degrees above the mean for the northern part of the State. By comparing the absolute maximum and the absolute minimum a wide range in temperature is indicated, but these extremes are seldom reached and periods of extremely high or low temperature usually are of short duration. The falls are characterized by long periods of pleasant weather, and pastures can be used until December. Cold weather is rare before January and zero weather is unusual.

The average date of the last killing frost in the spring is April 19 and of the earliest in the fall, October 11. This gives an average growing season of 175 days. The latest date of killing frost in the spring recorded is May 9 and the earliest in the fall, September 13.

From the table it is seen that the annual rainfall averages 38.05 inches and that 23.85 inches is reported for the driest year, which is considerably more than half of the normal precipitation. Of equal importance in agriculture to the total rainfall is its seasonal distribution, and in this respect Pettis County is favored, since about one-half of the total rainfall occurs in May, June, July, and August

and nearly 66 per cent from April to September, inclusive. May has the heaviest rainfall, averaging 5.01 inches, while the months of June and July average 4.5 inches. The average monthly rainfall in the winter is a little less than 2 inches. Most of the rain occurs just before and during the period of maximum plant growth, when it is most needed by the crop. Occasionally periods of drought of several weeks duration occur in late summer and early fall, but in this respect conditions are as favorable for agriculture in Pettis County as they are in most humid regions.

AGRICULTURE.

Owing to its favorable soil, climate, and topography, the interests of Pettis County are predominantly agricultural. General farming, consisting of combined grain and stock farming, is the prevailing type of agriculture.

This form of agriculture has been practiced since the original settlement of the county. The prairie lands furnished abundant pasture, and stock raising soon became an important industry. Corn and wheat were the principal cultivated crops, and were grown in sufficient quantity to supply the home demand. From the time of the construction of the Missouri Pacific Railway in 1861 and of the Missouri, Kansas & Texas Railway in 1866 agricultural development made rapid progress. Owing to the absence of large forested or rocky areas, the land was completely and quickly occupied. At present practically all the tillable land is under cultivation. A few small areas of rough and stony land in the northeastern and southwestern parts of the county remain forested. The cultivation of these areas is impracticable, and their best use is to supply timber for wood and fuel. There are several thousand acres of virgin prairie in the southern part of the county. This land is used for the production of prairie hay.

Of the cultivated crops, corn is by far the most important, both in acreage and in value. About 120,000 acres, or over one-fourth of the total area of the county, is devoted to this crop, with an annual production of more than 4,000,000 bushels. The corn is grown mainly on the Summit and Oswego soils, which are recognized as the corn lands of the county. The red limestone soils, where well supplied with organic matter, are equal to the best Summit soil for the production of corn. Practically all the bottom lands are devoted to this crop and large yields are obtained. Practically all the corn crop is used locally for the feeding of cattle, much of it in the form of ensilage.

In the rotation most commonly practiced corn follows clover or some other hay or pasture crop. On bottom soils and on the better upland soils the crop is grown in succession for 2 or 3 years. In growing corn usually a check-row planter is used, and the first and

second cultivations generally consist of harrowing the ground. Commercial fertilizers are rarely used, but all the manure available generally is applied to the corn land. Most of the corn crop is either husked or snapped in the field and the stalks used for early winter grazing. In seasons in which hay is scarce a larger acreage is cut and shocked. The practice of planting cowpeas or soy beans in the corn is becoming popular. The legumes are sometimes used as a green manure, but more frequently they are pastured or put into the silo with the corn.

Wheat is an important crop in every part of the county, although the black prairie and red limestone soils are recognized as the best wheat land. Approximately 27,000 acres were grown in 1914, with an average yield of about 20 bushels per acre. In general, yields range from 12 to 22 bushels, although yields of 35 bushels per acre are common. The crop occasionally is injured by the Hessian fly and the chinch bug.

Where wheat follows corn the seed bed is prepared by disking and harrowing. The crop usually is seeded between the middle of September and the middle of October. Clover is often sowed on wheat land in the spring and is sometimes plowed under with the stubble the following fall. It is more commonly allowed to stand a year or two for hay, in such cases timothy usually being seeded with it. The use of commercial fertilizers with wheat is growing in favor, especially in the southern part of the county. Bone meal and a complete fertilizer containing 2 to 4 per cent nitrogen, 8 to 12 per cent available phosphoric acid, and 2 to 4 per cent potash, applied at the rate of 100 to 150 pounds per acre, give good results. The effect of fertilizers is seen also on the clover or grass following the wheat.

The oat crop is relatively unimportant, although many farmers grow a few acres of oats to supply feed for the work horses. In 1914 a total of 10,282 acres was devoted to oats. The 1910 census reports a production of 507,427 bushels from a total of 19,165 acres. In favorable seasons yields of 35 to 50 bushels per acre are obtained, but occasionally the crop is a total failure. The rust-resistant varieties give best results.

The acreage in rye has gradually increased during the last few years. The crop is used primarily for green manuring and winter pasturage. In the spring it is plowed under and the land used for corn.

Kafir, milo, and millet are grown, although not extensively. Their acreage is largest in dry years. On account of their drought-resisting properties, these crops can be sowed late in the summer, and generally produce large quantities of coarse forage. Sorghum is grown and used for making sirup to supply the local demand. A few of the farmers have small fields of rape for hog pasture. On account of the good pastures and the large acreage of corn, there is

little need of growing forage crops extensively, but it is considered profitable to have a few acres of some green crop on each farm to supplement the pastures during late summer and in seasons of drought.

A large part of the agricultural land of Pettis County is in sod, and in general the soils, on account of the clay subsoils, are well suited to grass. All the common tame grasses are grown successfully. Approximately 18,000 acres are devoted to timothy. The yield averages 1½ tons per acre. The larger yields are obtained on the Summit soils, where the crop is most extensively grown. Timothy is sown on the wheat land in the late fall. Some difficulty in securing a stand is had owing to late summer droughts. A very small part of the crop is cut with a binder and thrashed for seed. Timothy and clover mixed are grown extensively.

The pastures consist of bluegrass almost exclusively, and the luxuriance and permanence of this valuable grass on the soils of the county is the main factor in the important live-stock industry found here. In general, the soils of the northern part of the county are better suited to bluegrass than those of the southern part. Little difficulty is had in getting a stand, and when once the grass is started it is practically permanent. On the prairie soils, however, there are few permanent pastures. Land that is run down is usually seeded with grass and clover, used for pasture for a few years, and then cultivated again to corn and wheat.

Orchard grass does well on the gravelly and open subsoil lands of the Eldon and Baxter soils. It is hardy and withstands the summer heat better than bluegrass. In the southeastern part of the county there remain about 4,000 acres in wild prairie grass. The yield of hay ranges from 1 ton to 2 tons per acre.

In the aggregate about 3,000 acres are devoted to clover in Pettis County. This legume will grow on most of the types, but does best on the black prairie and limestone soils. The latter are natural clover soils, and little difficulty is had in obtaining a stand. The level prairies are not so well suited to the crop. In general, clover is sown in the spring on the wheat. Sweet clover grows along roadsides and in unoccupied fields in most parts of the county. It makes a vigorous growth on soils rich in lime. No effort is made to utilize this plant.

Alfalfa is not an important crop in Pettis County. However, experiments during the last two years in various parts of the county have given promising results, particularly on the better soils. The Summit, Crawford, and Pettis silt loams seem best suited to the crop. The well-drained bottom land, especially of the Huntington type, makes good alfalfa land. On account of the heavy clay subsoil and the low lime content, the Oswego and Eldon silt loams are

less desirable for this crop. In order to get a stand on average or thin lands, much care is necessary.

The best results with alfalfa are usually obtained by sowing the seed about the first of September at the rate of about 20 pounds per acre. The crop is usually cut just as the new shoots are making their appearance at the crown of the plant. Three or four cuttings of about 1 ton each per acre are made each year. Like clover, alfalfa is a nitrogen gatherer, and its growth is highly beneficial to the soil.

The difficulty of getting a stand of clover on some of the thinner soils has made the growing of cowpeas and soy beans important. The soy bean has proved especially valuable, and in some parts of the county it is grown on almost every farm. In many places this crop is displacing cowpeas, because it is hardier and more easily handled.

Cowpeas and soy beans are usually grown, and are planted with the corn in the hill or drill, or drilled in between the rows at the last cultivation. Many farmers plant cowpeas on wheat land after the grain is harvested. Preparation of the seed bed consists of disking and harrowing the ground two or three times. A large quantity of nutritious hay is obtained, or the green crop can be used with corn for filling silos.

Except in the immediate vicinity of Sedalia the trucking industry has not yet been developed in Pettis County on a commercial scale, although every farm has a home garden in which vegetables and small fruits are grown for the use of the family. The red limestone soils are best adapted to truck crops. They are warm, well drained, and easily handled.

The growing of fruit does not receive much attention in Pettis County. The orchards are small. Apples and peaches are practically the only fruit grown. Little or no attention is paid to pruning, spraying, and cultivating. The soils of the Crawford and Baxter series are admirably adapted to fruit growing, many desirable slopes affording good orchard sites.

Pettis County ranks as one of the most important live-stock regions in the State. As a source of income the live-stock industry holds first place. The numbers of live stock shipped out of the county in 1912, according to the Missouri Red Book, are: Cattle, 15,044; hogs, 25,872; horses and mules, 1,708; sheep, 4,704; jacks and stallions, 48.

In addition to the large number of cattle raised in the county, many carloads of "feeders" are brought in from Kansas City and the Ozark region and fattened for market. Feeding is carried on most extensively in the northwestern part of the county, where many farmers make a specialty of it. The breeds of beef cattle most favored are the Hereford, Shorthorn, and Angus.

The cattle-feeding industry has declined somewhat in recent years on account of the high prices of grain and of feeder cattle, and

because cattle feeding is not now so profitable as other branches of agriculture.

Hog raising is carried on in conjunction with cattle raising, although this industry also has declined in recent years, largely because of the high prices of corn. On some farms the raising and feeding of hogs is made more or less a specialty. Large numbers of purebred hogs of various breeds are kept in the county, although crossbred animals also are numerous.

Horses and mules are raised, although few farms are devoted solely to this interest. The Percheron is the most popular, and there are many animals of excellent breeding in the county. On the larger farms mules are used as work stock in preference to horses, and the raising of mules is an important industry.

Sheep raising receives little attention. Western range sheep are frequently brought into the county to be fattened for market.

Dairying is carried on in an incidental way on many of the farms near shipping points. Conditions are favorable to the development of this industry, and near Sedalia several farmers make a specialty of dairying to supply the local demand. According to the 1910 census there are more than 9,000 dairy cattle in the county.

One of the striking features of the agricultural practice is the large waste of corn stover and other coarse forage. Over thousands of acres cornstalks are left in the fields without any attempt being made to utilize the fodder, except that in some cases stock is turned in to forage in the fields. There is a general need for the more extensive use of the silo to increase the feed supply.

The question of crop rotation is given some consideration, and it is quite generally recognized that the various soils of the county are better adapted to certain crops than are other soils. However, since the soils are predominantly silt loams, the methods of farming differ but slightly on the various types.

The use of commercial fertilizer is receiving increasing attention in Pettis County. The 1910 census reports an expenditure of $5,479 for fertilizers. In general, commercial fertilizers give best results on the poorer soils. It is doubtful if they would prove profitable on the better land in the county under the present extensive system of farming.

A number of tests made during the progress of the soil survey indicate that in many areas in Pettis County the soil is deficient in lime. This condition is most pronounced in the Oswego and Eldon soils and on the gray bottom soils. Even the red soils derived from limestone are deficient in lime in places, owing to the leaching out of this constituent. Soil acidity is usually indicated by the growth of certain weeds, such as sheep sorrel, redtop, and sour dock, and by the fact that clover can not be grown. This deficiency can be cor-

rected by the use of burned lime or ground limestone. The latter in most cases is preferable, because it is less expensive. Applications of about 1½ to 2 tons per acre every four to six years give good results. The thick beds of Burlington limestone found in the county are well adapted to the manufacture of high-grade ground limestone.

Except in rolling areas of the Crawford soils, erosion is not a very serious factor in Pettis County. However, on all the slopes there is some loss through surface wash, as indicated by the clay points in several parts of the county. To check erosion it is necessary to get the soil in such a condition that it will absorb and retain large quantities of rain water, so that rapid run-off will not take place. This can be accomplished by incorporating organic matter and by deep plowing. The soil on the steeper slopes can be protected during the winter with a crop of rye or wheat, or such areas may be used for permanent pasture.

In general, the soils of Pettis County are well drained. However, some of the smooth prairie lands with tight subsoils may be improved by artificial drainage. Tiling is needed on the heaviest soils, and outlets usually are available. On the level prairies the tile must be laid close together, usually not over 100 feet apart, and for thorough drainage considerably closer. Many areas near the heads of shallow draws, the gray second bottoms, and the seepy areas of Eldon soils, which are saturated by surface drainage from higher land, would, if thoroughly drained, undoubtedly give much larger and more certain yields.

According to the 1910 census, a total of 407,360 acres, or about 93 per cent of the land area, is in farms. Of the land in farms, 356,639 acres, or 87.5 per cent, is classed as improved. The total number of farms in the county is reported as 2,869, with an average of 142 acres per farm.

Of all the farms 1,963, or 68.4 per cent, are operated by the owners, and 864, or 30.1 per cent, by tenants. The average value of all property per farm in 1910 was $10,979, 71.1 per cent of which is represented by land, 13.2 per cent by buildings, 2.1 per cent by implements, and 13.7 per cent by domestic animals. The total value of farm property in 1910 was $31,498,615 and in 1900 $14,872,232, showing an increase of 111.8 per cent within a decade. In total value of farm property Pettis County ranks fifteenth among the counties of the State.

Land values range from $40 to $200 an acre, the higher prices prevailing on the better land in the northern and western sections of the county. In all parts of the county land values are increasing.

In general, the type of farming now established and the methods in common use seem well suited to the soils and general conditions in the county. Occasionally slight changes in the agricultural practices are made to conform to changing economic conditions. Where

grain growing is more profitable than stock raising the grass lands are largely converted to cultivated areas, and vice versa. The combination of stock raising and grain farming permits the most economical utilization of farm labor and farm products, and tends to maintain the soil in a fairly productive state. The farmers throughout the county are generally prosperous. The improvements are of a permanent character, and few farms change hands. Probably no other region in the State has a better balanced agriculture than Pettis County.

SOILS.

The soils of Pettis County belong to the group of residual prairie soils that cover the greater part of western Missouri. They were formed by the weathering of the country rock, and their distribution and character are influenced by the distribution and character of the rock. The rock consists of bedded strata of limestone, sandstone, and shale belonging to the lower Carboniferous, Devonian, and Silurian systems. The various formations dip slightly to the northwest, so that the upper or younger beds are found in the northwestern part of the county, while the lower or older beds approach the surface in the southeastern part. The upper beds have been most important in the formation of the soils.

A geological section from the southeastern corner to the northwestern corner of the county would show a series of rocks. The lowest or basal rocks, known as the Jefferson City limestone, consist of a series of alternating crystalline and fine-grained noncrystalline magnesian limestone (cotton rock), thin beds of sandstone, and thick layers of chert. The next layer is a massive, fine-grained, compact, bluish limestone, known as the Devonian. It is only a few feet in thickness, and outcrops at several places along Flat Creek. Above the Devonian lies the Chouteau limestone, which, like the former, is comparatively thin. It is thinly bedded, earthy, and almost chert free. The Burlington limestone is next in the ascending series and has a wide distribution in the northeastern part of the county. It is made up of beds of massive, fossiliferous, crystalline limestone, with a moderate content of chert. The last or upper layer, known as the Cherokee, covers the western part of the county. It consists of soft gray or yellowish shale and thin beds of sandstone. The material has decomposed readily, and except in a few places in the southwestern corner of the county it rarely outcrops, the Carboniferous rocks being now a mere remnant in Pettis County.

The Devonian, Chouteau, and Burlington limestones occur as soil formers only in the eastern part of the county. In the southern part they disappear entirely or are too thin to affect the soil, and consequently the decomposition products of the shale rest directly upon the soils of the Jefferson City limestone.

The relation existing between the soils and this grouping of rocks is plain. The cherty limestones in the southeastern corner of the county give rise to the Eldon soils and a part of the area mapped as the Baxter gravelly loam. In the decomposition of the rock, the more resistant chert has withstood weathering, and now appears as loose stone and gravel in the soil. This material is most abundant on the steeper slopes where the finer soil has been washed out, concentrating the rock fragments sufficiently to form gravelly and stony types.

The relatively thin and chert-free Devonian and Chouteau limestones are not important as soil formers. The impurity in the rocks consists largely of clay, which remains as a gray to yellowish soil. These formations give rise to the Baxter soils.

Weathering of the Burlington limestone has resulted in the formation of the Crawford soils. Since the rock contains a relatively small quantity of chert, only a small part of the soil is gravelly. The purity of the limestone has permitted rapid weathering, so that the soil layer, or the layer of decomposed material overlying the solid rock, is thick, thoroughly oxidized, and has a fair content of lime. The ledge rock is rarely exposed, except on steep slopes and in ravines.

The Carboniferous shales give rise to the extensive areas of Oswego, Cherokee, Bates, and Boone soils. The higher shale beds are interstratified with thin beds of limestone, and the resultant soil is darker. It is included with the Summit, Pettis, and Gerald series. In the Oswego, Cherokee, and Boone series the grayish, or at least light, color of the soil, the heavy character of the subsoils, and in a few places the poor drainage, are clearly due to local conditions. These soil characteristics are such as are developed in old plateau areas where soil material has been stagnant for a long period, and where poor drainage resulting from the flat topography has caused an accumulation of clay in the subsoil, and has not permitted its thorough oxidation.

A few granite fragments of glacial origin are encountered in the northern part of the county, the extreme southern line of the drift formation. There is considerable evidence that the soils of the northern part of the county are modified by loess, or eolian deposits, from which most of the soils in Saline County to the north are derived. This is indicated by the great depth of the soil mantle. It is also significant that the farmers consider the black prairie soil occurring in the northern part of the county more productive than that found to the south.

In general the soils of Pettis County are silt loams, containing relatively little sand or clay. They are usually mellow, or are easily made so with proper treatment. They are well drained, and are moderately early and warm. The subsoils are universally heavier than the surface material, which makes the various types generally

retentive of moisture. As in most prairie regions, the soils originally had a high content of organic matter, but continuous cropping has reduced this to a large extent.

From their origin and color the upland soils of Pettis County are grouped into four general divisions. The dark-colored rolling prairie includes the Summit, Pettis, and Bates series. The Oswego, Cherokee, and Boone series make up the flat prairie soils. The red limestone soils are represented by the Crawford and Baxter series, while the Eldon series and a part of the Baxter gravelly loam represent material coming from the cherty limestone.

The alluvial soils are composed of material carried down from the uplands and deposited over the stream flood plains from overflows. Since most of the streams rise within or near the border of the county, the material deposited by them is of local origin, and the bottom soils are closely related to the upland soils. The alluvium, where derived from the lighter colored prairie soils, is gray in color; it is darker gray or brown where derived from the black prairie soils. Thus, the Muddy Creek bottoms are somewhat darker than the Flat Creek bottoms, because the former drains the black prairie and the latter the light prairie soils. The difference, however, is not sufficiently great to warrant a separation, and all the lighter colored alluvial soils are included with the Osage and Robertsville series. In the northeastern part of the county the alluvial soils are largely derived from the Crawford material. They are darker in color and have a higher content of organic matter than the Osage soils, and are classed with the Huntington series. The Chariton soil is similar to the Robertsville in topography, origin, and texture but differs from it in color and organic-matter content.

The following table gives the name and actual and relative extent of each soil type mapped in Pettis County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Oswego silt loam	86,656	24.9	Crawford gravelly loam	7,360	1.7
Shallow phase	21,312		Gerald silt loam	7,296	1.7
Summit silt loam	89,792	20.8	Pettis silt loam	5,888	1.4
Eldon silt loam	45,440	10.5	Huntington silt loam	4,800	1.1
Crawford silt loam	45,248	10.5	Cherokee silt loam	1,664	.4
Osage silt loam	35,520	8.2	Bates loam	1,664	.4
Bates silt loam	19,648	4.5	Rough stony land	1,408	.3
Baxter gravelly loam	10,496	4.3	Chariton silt loam	1,280	.3
Dark-colored phase	8,192		Baxter gravelly sandy loam	1,216	.3
Baxter silt loam	11,968	2.8	Osage clay	256	.1
Robertsville silt loam	8,896	2.1	Eldon loam	256	.1
Crawford stony loam	8,256	1.9			
Boone silt loam	7,488	1.7	Total	432,000	

Summit Series.

The Summit soils are dark gray to black in color to a depth of 8 to 12 inches. The subsurface material is brown to light brown, slightly heavier than the surface soil, and friable in structure. The upper subsoil, into which the subsurface layer passes gradually, is a plastic silty clay to clay, dark drab in color, with abundant spots of yellowish brown. The lower subsoil is predominantly grayish yellow or yellow with abundant gray mottling. These soils are residual in origin and derived from shales and limestones. The drainage is good and the topography is smooth to undulating. The series is represented in Pettis County by a single type, the Summit silt loam.

Summit silt loam.

The Summit silt loam is locally known as "black land" or "black prairie." It consists of a black, dark-brown, or very dark gray, rather heavy silt loam, 10 or 12 inches deep, underlain by a brownish-black or very dark gray, crumbly silty clay loam, which at about 18 inches grades into a dark-drab to black silty clay or clay loam of a plastic, waxy character. The subsoil below 30 inches is a yellowish to drab, crumbly silty clay, mottled with brown and yellow. On many of the slopes where erosion has been active the surface soil is frequently only 6 to 8 inches in depth and rests directly on the heavy, compact clay subsoil. Such areas are locally known as "glade lands," and are easily affected by drought. In the northern part of the county much of this type has a brownish color in both surface soil and subsoil, the latter containing less clay and being more friable than in the dark-colored areas. The brown variation has a more rolling topography, and is associated with the Bates silt loam. North of Dresden and Lamonte the type has a lighter color than typical.

The Summit silt loam is similar in appearance to the Oswego silt loam. When wet these types have almost the same color, but when dry the Summit silt loam retains the dark color as distinguished from the lighter color of the Oswego silt loam. In general, the former type has a slightly more rolling surface than the Oswego, which in part causes the difference in the subsoil of the two types. The boundary between the two soils is more or less an arbitrary one, and small areas of Oswego silt loam are included with the Summit, and vice versa. As a rule, however, the character of the subsurface material is the determining factor in classifying the soils. Where the surface material is black and the gray subsurface color is absent, the soil is mapped as the Summit silt loam.

One of the characteristic features of this type is the presence of lime concretions in the subsoil. Another characteristic of the type

is its tendency to crumble and break into small aggregates, with the result that it does not pack, bake, or run together. Cultivation can be carried on when the soil is thoroughly dry. Except in those areas in which the surface soil is shallow, crops on the type endure droughts fairly well. The content of organic matter is relatively high.

In the vicinity of Lamonte and westward the soil mapped as Summit is really a transitional soil between the Summit and the Oswego. It is like the Summit in color and in the gradual change from subsurface material to subsoil, but approaches the Oswego in the presence of a faintly developed subsurface gray layer. Since its characteristics are a little nearer those of the Summit soils than those of the Oswego it is included with the former.

The Summit silt loam is one of the most extensive types mapped, and includes all the smoother land in the northwestern part of the county. In general, it may be said that the Summit silt loam in Pettis County represents the eastern edge of the most extensive soil type in west-central Missouri. The surface drainage is good. The soil mantle is very thick, frequently extending to depths of 50 to 60 feet, and it is only on a few of the steeper slopes along the larger streams that shale and limestone outcrop.

The type is of residual origin, being derived from the weathering of shale with some limestone. The latter consists of the thin beds found in the Coal Measures, and in part of the Burlington limestone. The proportion of limestone material present is small as compared with that derived from shale. Its presence is important, however, in that it tends to give the soil a more open structure and to make it more productive. It is probable that that part of the type along the northern county line is affected by the drift soil, or loess, which at one time undoubtedly covered a part of this county.

The Summit silt loam represents typical prairie land and originally supported a heavy growth of wild grasses. Where properly plowed the soil is loose and friable and easily tilled. The mellow surface soil, good drainage, and heavy subsoil make it well suited to all the staple crops, and it is regarded as one of the best upland soils in the county. It is the best corn soil of the uplands, although wheat is grown extensively. Corn yields 40 to 75 bushels per acre, and wheat 20 to 30 bushels. These yields are frequently exceeded when the season is particularly favorable. A large acreage of the type is used for pasture and produces an excellent growth of bluegrass. Clover thrives on it, and alfalfa is grown successfully, except in the more eroded areas. The feeding of beef cattle is an important industry. Manure is relied upon to maintain the productiveness of the soil, but the supply generally is inadequate, and in many instances crop yields show a decline from those of former years. The growing of cowpeas and soy beans in corn or alone as a green manure is growing in favor.

With an extension in the acreage of clover the present system of farming will tend to keep the soil in a fairly productive condition. This soil has a good content of lime.

The Summit silt loam is occupied by large, well-improved farms. Very few of the better farms can be bought for less than $100 an acre, while in many cases the land is valued at $150 an acre.

Oswego Series.

The soils of the Oswego series are dark brown to a depth ranging up to about 12 inches. The soil grades into a gray subsurface layer, slightly heavier than the soil, and this in turn at a depth ranging from 15 to 20 inches passes rather abruptly into a tough, plastic silty clay to clay layer, dark drab in color, mottled with dark reddish brown. At about 30 inches this passes into a lighter textured, friable silty layer, which is lighter in color, usually being yellow with gray mottlings. The soils are residual in origin, and are derived from shales. The topography is smooth. Only one member of this series is recognized in Pettis County, the Oswego silt loam.

Oswego silt loam.

The Oswego silt loam is the typical prairie soil of the county, and is characterized by its dark color, nearly level topography, and stiff subsurface stratum. The surface soil to a depth of 9 to 12 inches consists of a dark-gray, dark-brown or black, mellow silt loam, grading into a lighter gray and more friable silt loam at about 12 inches. The subsoil, beginning abruptly at a depth of 16 to 18 inches, is a brown or grayish-brown to dark-drab, heavy, plastic clay, faintly mottled with red. This grades at about 30 inches into a yellowish-gray or drab or mottled yellow, gray, and brown silty clay. The lower subsoil is friable and contains small nodules of iron oxide. The gray subsurface layer is not always well developed, having its most complete development only in the smoother areas of the type. In general, however, the subsurface material is somewhat lighter in color than the surface soil.

When wet the soil has a uniform black color, but when dry it is much lighter colored, usually being dark gray. The color and the structure of the soil vary somewhat with topography. The almost flat areas, as those west of Green Ridge, have a light-gray surface soil, a well-developed gray subsurface layer, and a darker and stiffer subsoil than the more rolling areas. These areas closely resemble the Cherokee silt loam, but since they include considerable dark soil they are not separated from the main type.

That part of the Oswego silt loam to the east and south of Sedalia averages darker in color and probably possesses a slightly higher

agricultural value than the main body of the type in the southwestern part of the county.

This is one of the most extensive types mapped. It occupies entire sections in the southwestern part of the county. It occurs on high, flat divides and gentle slopes, and in general represents the smoothest land in the county. Although perfectly flat areas are not frequent and there is apparently enough fall to afford good surface drainage, the heavy subsoil does not permit of a free downward movement of water, and crops sometimes suffer from excessive moisture in wet seasons. The topography of the soil is such that artificial drainage is easy to install.

The Oswego silt loam is derived from soft argillaceous shale of the lower Coal Measures. The limestone beds that outcrop in ditches act merely as a support for the overlying soil and give character to the topography, but have no influence in the formation of the soil.

The original vegetation was a rank growth of prairie grass. All the type is now under cultivation and is used for the production of the staple crops. The soil is easy to cultivate, and since most of it is divided in large fields, rarely smaller than 40 acres, it is well adapted to the use of heavy farm machinery. The typical soil is not as strong as the Summit or Crawford silt loams.

Probably 50 per cent of the Oswego silt loam is used for corn, and in normal seasons an average yield of 40 bushels per acre is obtained. Larger yields are common. Wheat also is extensively grown and yields from 12 to 30 bushels per acre. Hay yields range from 1 to 2 tons per acre. Clover and alfalfa will grow on this land, but frequently it is difficult to get a stand. For these crops it is necessary that the soil be well supplied with organic matter. Alfalfa does not make a very vigorous growth and is usually soon crowded out by grass and weeds.

When first broken the Oswego silt loam is highly productive, and it remains so with good management; but where poor systems of farming are followed the supply of organic matter in the soil is reduced, and yields decline. For the improvement of the soil the addition of fresh organic matter through the plowing under of green crops, particularly legumes, or the application of large quantities of stable manure is needed. Better drainage, careful cultivation to conserve moisture, and the use of lime and fertilizers would also prove profitable in many places. Wherever applied, fertilizers have given good returns.

Land of this type ranges in value from $75 to $125 an acre.

Oswego silt loam, shallow phase.—The soil of the smooth prairie land in the southern part of the county is of the same origin as the Oswego silt loam, but on account of its lower agricultural value and

poor physical condition it has been separately shown on the map as a shallow phase. The soil is a dark-gray to dark-brown silt loam, grading into a brownish-gray silty clay. This is underlain at about 10 to 15 inches by a dull-brown, heavy, plastic clay, which at about 30 inches passes into a drab or yellowish-gray silty clay, mottled brown and gray.

The surface soil is lighter in color, shallower, and not so mellow as that of the typical Oswego silt loam. The gray subsurface layer is rarely present and the gradation from the surface silt layer to the clay subsoil is gradual. The latter is more plastic and lies nearer the surface than in the main type. Erosion has removed much of the surface soil and brought nearer to the surface the compact and intractable subsoil. These characteristics are most pronounced on the narrower ridges.

The shallow phase of the Oswego silt loam occupies the flat divides and plateaus south and east of Flat Creek. It has an average altitude of about 1,000 feet and represents the highest land in the county. It was originally more extensive, but is steadily being encroached upon by draws heading back into the upland.

A large part of the shallow phase of the Oswego silt loam is in virgin prairie and yields from 1 ton to 2 tons of wild hay per acre. Corn, wheat, and timothy also are grown, but in either wet or dry seasons these crops often fail. Drainage is deficient on account of the impervious subsoil.

Artificial drainage and applications of ground limestone tend to sweeten the soil and make it more friable. The growing of cowpeas or soy beans as a green manuring crop and the use of fertilizers are essential to the production of good crops.

Cherokee Series.

The soils of the Cherokee series are gray and have a floury structure. The subsurface material is nearly white and slightly heavier in texture than the surface soil. The upper subsoil, beginning abruptly at 12 to 18 inches, is a tough, waxy clay to silty clay, dark drab in color, with mottlings of reddish brown or yellowish brown. The deeper subsoil is lighter in color and friable. These soils are residual from shales and have a level or very gently rolling topography. The silt loam is the only member of the Cherokee series mapped in Pettis County.

CHEROKEE SILT LOAM.

The surface soil of the Cherokee silt loam is a gray, floury silt loam ranging from 10 to 12 inches in depth. When dry the soil is almost white, but when moist it is much darker in color. The sur-

face soil grades into an almost white silt loam, which contains slightly more clay and usually is somewhat more compact than the surface material. The ashy-gray layer has a depth of 4 to 6 inches. It is often mottled with rusty-brown ferruginous material. The subsoil, beginning abruptly at 16 or 18 inches, is a tough, plastic, waxy, heavy clay of dark-drab to brown color, faintly mottled with reddish brown. Below 30 inches the material becomes more friable, and the dominant color is drab with yellowish-brown and gray mottlings.

The type is locally called "white ashy land" owing to its light color and ashy texture, or "hardpan land" because of its tough, impervious subsoil. It closely resembles the light-colored areas of Oswego silt loam, and is similar to these in origin and topography. It represents the smoothest land in the county, and occurs on low, gentle slopes, grading almost imperceptibly into the Oswego silt loam on the one side and the Osage silt loam on the other.

The Cherokee silt loam is derived from a fine argillaceous shale. It is distinctly a prairie soil, and prairie grass constitutes the original vegetation. Its level topography, the lack of organic matter, and the tough, dense, almost impervious subsoil combine to produce unfavorable drainage conditions, which apparently can be best corrected by ditching. Crops are frequently injured by drought.

Wheat is the most important crop, yielding between 12 and 18 bushels per acre. In favorable seasons corn does fairly well, but the land is better suited for the production of grass and wheat.

In addition to drainage the Cherokee silt loam apparently is in need of both organic matter and lime. Organic matter can be supplied by applying stable manure, or by plowing under cowpeas or some other green manuring crop.

Applications of 2,000 to 4,000 pounds of ground limestone per acre tend to improve the condition of the soil. The use of commercial fertilizers, particularly those high in phosphorus, has invariably given good results.

Crawford Series.

The soils of the Crawford series have dark-brown to reddish-brown surface soils and reddish-brown to red, friable subsoils. The series includes residual limestone soils of the prairie regions. The soils contain a fair percentage of lime. The surface is undulating to rolling, with some local areas of rough, broken topography. The Crawford soils are generally well drained. Three types of the series—the stony loam, gravelly loam, and silt loam—are found in Pettis County.

CRAWFORD STONY LOAM.

The soil material of the Crawford stony loam consists of a black to dark-brown friable silty clay loam. The subsoil is a reddish-brown clay loam, which crumbles on exposure.

This type includes steep, precipitous areas and slopes where the percentage of rock at or near the surface is so large as practically to preclude cultivation. It represents the roughest land in the county and is mapped along Muddy and Heaths Creeks. Practically all the type supports a characteristic growth of walnut and elm, and grape vines.

Some of the less stony areas might be cleared of stones and used for pasture and for growing fruit, but the greater part of the type can be used only for woodlots.

CRAWFORD GRAVELLY LOAM.

The fine material of the Crawford gravelly loam is like that of the silt loam, varying from a reddish-brown or dark-brown silt loam in the surface soil to a reddish-brown silt loam or silty clay in the subsoil. Both soil and subsoil contain from 20 to 60 per cent of brownish-gray, porous chert. The lower subsoil usually consists of a mass of cherty material, and frequently bedrock is encountered within the 3-foot section. The chert and limestone fragments in the soil make cultivation difficult and in many places impossible.

The Crawford gravelly loam is derived from the Burlington limestone. It occupies the slopes and ridges of the more rolling areas within the region of the Crawford soils.

The greater part of the type remains forested with walnut, elm, hickory, and red oak, and clumps of these trees in the region of the Crawford silt loam usually mark the gravelly areas. The cleared areas are used largely for pasture and produce an excellent quality of grass. Where the rock substrata are not too near the surface the type is well adapted to corn and clover. Peaches and small fruits thrive on this soil.

CRAWFORD SILT LOAM.

The soil of the Crawford silt loam is a dark-brown, yellowish-brown or reddish-brown, mellow silt loam, grading at about 15 to 18 inches into a reddish-brown, friable silty clay loam. Frequently there is little change within the 3-foot section, although the subsoil is always redder than the surface material. Eroded areas and material recently weathered from limestone have a brighter color than the soils high in organic matter. In general, that part of the Crawford silt loam south of Muddy Creek is mellower and has a brighter color than the main body of the type in the northeastern part of the county. In the latter place it is usually a yellowish-brown, heavy silt

loam with a yellowish-red or dull-red, plastic silty clay subsoil. The red phase has a smoother topography, contains slightly more organic matter, and shows more weathering than the lighter colored soil. It is probable that the former is influenced to some extent by material washed down from the adjoining black prairie soils. On some of the steeper slopes a few stone fragments are scattered through the soil, and occasionally bedrock is encountered within the 3-foot section.

Locally the Crawford silt loam is known as "red land" or "mulatto land." It occurs on the slopes of the streams in the northeastern part of the county. The topography varies from smooth to gently rolling, averaging considerably more rolling than that of the Summit silt loam. The greater part of the smooth land occurs south of Muddy Creek.

The type is well drained by small streams which have cut down to the limestone beds or through them, and are now bordered in places by steep, stony slopes, varying in height from 5 to 30 feet. Although practically all of the type is easily cultivated, stony areas frequently limit the size of the fields.

The soil is residual from the fossiliferous Burlington limestone. The purity of the limestone permits of rapid weathering, so that all the lime, at least in the subsoil, is not leached away. In general, the Crawford soils contain more lime than the Baxter.

Most of the type originally was forested with walnut, red oak, elm, and locust, but practically all of it is now cleared. It is a good agricultural soil, well suited to the general farm crops of the region. It is considered the best wheat and fruit soil in the county, and when well supplied with organic matter it is equal to the best land of the Summit silt loam. Ordinarily the yield of corn ranges from 35 to 50 bushels and of wheat from 15 to 22 bushels per acre, but higher yields are common. The Crawford silt loam is more easily cultivated, is more responsive to the use of manure, and is from 2 to 10 days earlier than the adjoining prairie soils. It is a natural clover soil, and is the best type in the county for the production of alfalfa.

On account of its rolling topography, much of the type is subject to serious erosion. The warm, open character of the soil causes a rapid decay of the organic matter. The type requires careful farming, together with the frequent growing of legumes as green manuring crops.

Baxter Series.

The soils of the Baxter series range in color from reddish brown to gray and pale yellow, and the subsoils are brown. The stone content of both soil and subsoil varies from a negligible quantity to quantities sufficient to make a gravelly or stony type. The layer of soil material

above the solid rock is comparatively thin. It is derived from a series of pure and argillaceous, moderately cherty limestones, with thin interbedded layers of shale. The soils differ from the Crawford series in being shallower and usually lighter in color. The chert seems to be less calcareous than the Crawford chert. This series includes three types in Pettis County—the Baxter gravelly sandy loam, gravelly loam, and silt loam.

BAXTER GRAVELLY SANDY LOAM.

The Baxter gravelly sandy loam has the same origin and distribution as the gravelly loam, but differs from the latter in the larger percentage of sand in the soil. Typically it consists of a gray to dark-brown fine sandy loam, grading at about 6 inches into a light-brown, friable loam. Chert fragments and bits of sandstone are scattered through the soil. The lower subsoil is a mass of sharp, angular chert. There are a large number of areas of the gravelly sandy loam too small to be shown on the map, and these are included with the gravelly loam.

The sandy material of the soil is derived from the thin sandstone lenses in the cherty limestone and from the Carboniferous sandstones originally overlying the limestone formation. The type is associated with the Baxter gravelly loam, and is of about the same agricultural importance.

BAXTER GRAVELLY LOAM.

The fine material of the Baxter gravelly loam is a yellowish-brown to grayish-brown silt loam, grading at 6 to 8 inches into a yellowish-brown or dull-red silty clay loam. The lower subsoil is usually a red, plastic clay loam. Large chert fragments and bits of limestone are scattered through the soil and subsoil and make up from 20 to 60 per cent of the soil mass. The loose material is rarely over 2 feet deep, and is underlain by partially decomposed bedrock.

The soil is residual from cherty magnesian limestone. It occupies steep slopes, and usually is bordered by the Baxter silt loam on the one side and by bottom land on the other. The steep slopes and the stone fragments practically preclude cultivation. A small part of the type is cleared and used for pasture. The tree growth consists of white and black oak. Grasses and clover thrive on this soil, but crops frequently suffer from drought on account of the open, stony subsoil. The best use of this gravelly land is for pasture and woodlots.

Baxter gravelly loam, dark-colored phase.[1]—The Baxter gravelly loam, dark-colored phase, is locally known as "veneer land," be-

[1] This is thought to be identical with the Eldorado soils as mapped in Cedar County, Mo., and future reports will probably include it under that series.

cause of the thin covering of soil material over the gravelly substratum. The surface soil is a black to dark-brown or dark-gray, mellow loam or silt loam, grading at about 8 to 10 inches into a brown, friable silt loam. The lower subsoil consists of a mass of chert, and rarely is it possible to penetrate to a depth of more than 18 inches with the soil auger. The surface soil contains from 10 to 40 per cent of chert, but this is usually covered by 2 to 3 inches of soil. The impervious cherty subsoil gives rise to many seepy areas, and makes cultivation practically impossible.

The phase is derived from the cherty Jefferson City limestone, although the surface material is partly derived from higher lying shale and sandstone. It occurs at the heads and along the slopes of draws, with occasional areas occupying the ridges between streams. The topography is gently rolling.

Originally all the phase was prairie, but now some of the more broken areas are covered with black oak, blackjack, sumac, and hazel brush. It is used for hay and pasture land, but the grass does not make a vigorous growth. A few areas are cultivated to corn, and fair yields are obtained in seasons of abundant rainfall. Clover makes a fair growth. The most profitable use of this land is to seed it with some of the hardy bunch grasses, such as orchard grass, and use it for the production of hay and for pasture.

BAXTER SILT LOAM.

The Baxter silt loam typically consists of a light yellowish brown or light grayish brown silt loam, grading at about 8 to 12 inches into a friable silty clay, with little change in color. The content of organic matter is low. The subsoil becomes heavier and redder with depth, and at about 30 inches the color changes to mottled brown and yellow. There are a number of included areas, several acres in extent, which have a reddish-brown surface soil and a red clay subsoil. These represent inclusions of Crawford silt loam, which are not quite typical, the color being a dull red and the soil less mellow than the true Crawford. These reddish areas occur southeast of Sedalia and north of Flat Creek.

The Baxter silt loam has its greatest development in the eastern part of the county along Flat Creek and its tributaries. Several smaller areas occur west of Sedalia along Muddy Creek. Like the Crawford silt loam, it occupies slopes, although it is more rolling than the latter. It also is of limestone origin, but is inferior to the Crawford agriculturally. Along the streams the type usually is bordered by stony and gravelly slopes and cliffs, while on the side away from the streams it grades into the prairie soils. Being lower than the latter, it receives considerable wash, and in many places

resembles the upland soils. The type is residual from the rather impure magnesian limestones of the Chouteau and Jefferson City formations. The soil contains less lime and is more argillaceous than the material derived from the purer Burlington limestone.

Originally the Baxter silt loam was forested, but practically all of it has been cleared. The tree growth consisted mainly of white, black, and post oak, with some walnut and elm. Wheat and grass are the principal crops. Some corn is grown, but only fair yields are obtained. As a grass, clover, and fruit soil this type is equal to the Crawford silt loam, and, like the latter, it responds to manuring and good cultivation. Erosion is active in places, on account of the rolling surface and the low percentage of organic matter in the soil. While the surface soil is sometimes in need of lime, the subsoil usually contains a considerable quantity of this constituent. Land of this type is valued at $60 to $90 an acre.

The results of mechanical analyses of samples of the soil and subsoil are given in the following table:

Mechanical analyses of Baxter silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
343611	Soil	4.6	4.8	2.2	10.4	15.6	46.7	15.6
343612	Subsoil	3.8	4.2	2.0	9.0	14.6	43.7	22.7

ELDON SERIES.

The surface soils of the Eldon series are dark brown to nearly black. The upper subsoil is gray or grayish yellow to yellowish brown, and has a friable or crumbly structure. It is underlain by mottled gray and red, moderately plastic to crumbly silty clay material, and the lower subsoil is mottled gray and yellow in color and rather plastic. Usually a compact layer, consisting largely of angular chert mixed with reddish clay, is encountered at a depth of 18 to 30 inches. The soils of the Eldon series are derived from shale and limestone. The topography is gently rolling, with rounded ridges and gentle slopes. Two types of the Eldon series are recognized in this county—the loam and silt loam.

ELDON LOAM.

Several small areas of the Eldon loam are mapped in the southeastern part of the county. The soil consists of a dark-brown to light-brown loam or fine sandy loam, grading at a depth of 12 to 15

inches into a yellowish-brown, friable silty clay loam, mottled with gray and yellow in the lower part. The sandy material is derived from the thin sandstone layers within the Jefferson City limestone.

This type is closely associated with the Eldon silt loam, and has the same agricultural value.

ELDON SILT LOAM.

The surface soil of the Eldon silt loam consists of a dark-brown to dark-gray or brownish-gray, mellow silt loam, grading at 8 to 10 inches into a brown or yellowish-brown, friable silt loam, which gradually becomes lighter in color and heavier in texture with increasing depth. The subsoil, beginning at 15 to 18 inches, is a yellowish-brown, crumbly silty clay. It has a highly mottled red and yellow color and contains small iron concretions. A few chert fragments are scattered through the soil mass and occasionally the chert layer is encountered within 3 feet of the surface. In the southern part of the county the soil contains a small percentage of sand, the sandy areas being associated with the shallower soil.

At the outer edges the Eldon silt loam is a dark-gray to brownish-gray silt loam, changing quickly at about 12 to 16 inches into a drab, friable silty clay, highly mottled with yellow and brown. In the lower lying areas the subsoil is a brown silt loam, which approaches the subsoil of the Baxter silt loam in its characteristics. That part of the type occurring on the lower slopes along Lake Creek and its tributaries has a darker and deeper surface soil and a lighter subsoil than the main body. These areas resemble the Crawford silt loam and compare favorably with it agriculturally.

The Eldon silt loam has its greatest development in the southeastern part of the county in the area drained by Flat Creek. It occupies long, gentle slopes on the gently rolling uplands. For the most part it is prairie, although some of the lower slopes are forested with oak, elm, and hickory.

The type is derived mainly from decomposed limestone of the Jefferson City formation. However, the surface soil is undoubtedly largely from modified Oswego soil, the latter having been let down upon the limestone material. The presence of chert, its nearness to bedrock, and the brown color of the subsoil would indicate that the latter is of limestone origin.

The surface drainage is good, but on some slopes where the cherty subsoil lies near the surface the ground is seepy and hard to cultivate. In wet seasons such areas are cold and fail to produce crops.

In the southeastern part of the county, particularly in that part bordering Benton County, a large proportion of this type is in virgin

prairie grass. The cultivated areas are used for corn, wheat, and grass and the yields obtained are about the same as on the Oswego silt loam. The soil occurs in a region of large stock farms and much of it is used for pasture. As a clover soil it is superior to the flat prairie types. Erosion is not serious, but in many places the fields are made irregular by the meandering draws invariably associated with the type. It is not a very drought resistant soil, probably because the lower subsoil has a tendency to become compact owing to the deposition of iron salts.

It is of primary importance in the management of the Eldon silt loam to add large quantities of organic matter, and thus improve the physical condition and the water-holding capacity of the soil. Like the Crawford silt loam, it responds readily to manurial treatment. Numerous tests indicate that the soil is in need of lime. Land values on this type range from $60 to $100 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Eldon silt loam:

Mechanical analyses of Eldon silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
343605	Soil	0.0	0.2	0.4	12.4	27.3	48.1	11.3
343606	Subsoil	.0	.2	.3	20.4	30.3	39.0	9.8

Bates Series.

The soils of the Bates series are dark brown. The subsoils are yellowish to mottled red, yellow, and brown. The types are derived from sandstone and shale. They are distinguished from the soils of the associated Oswego series by the darker color of the surface soils. They are usually well drained and treeless and have a level to undulating topography. In Pettis County two members of this series are mapped, the Bates loam and silt loam.

Bates loam.

The Bates loam is closely associated with the silt loam of the same series. Typically the soil is a brown or grayish-brown loam, becoming lighter in color with depth. The subsoil, beginning at about 15 inches, is a light-brown, friable sandy clay loam, highly mottled with red and yellow. In general, the sand content decreases with depth, but where bedrock lies near the surface the subsoil usually is a fine sandy loam and lighter in texture than the surface soil. Sand rock is usually encountered at a depth of 20 to 30 inches. In places the soil is a fine sandy loam.

The type is residual from sandstone and arenaceous shale. It usually occurs near the heads of draws, where the thin sandstone strata lie near the surface. Small shale and sandstone fragments are scattered through the soil.

The Bates loam has a rolling topography, with prevailingly moderate to gentle slopes. The loose, open structure of the soil and the rolling topography render the drainage good, and the soil is early and easily worked. Good crops are produced where the soil has sufficient depth and is properly managed, particularly with reference to conservation of moisture. Corn yields are about the same as on the Bates silt loam. Cane and cowpeas make a good growth on this soil in seasons of scant rainfall.

BATES SILT LOAM.

In the western part of the county the soil of the Bates silt loam is a dark-brown to grayish-brown, mellow silt loam. This is underlain at about 8 to 10 inches by brown silt loam, which changes at about 18 inches to light yellowish brown, friable silty clay, mottled with red, brown, and gray, and becoming lighter in color and texture with depth. Iron concretions occur in the lower strata. Eroded areas have a lighter soil and a more friable and mottled subsoil than the smoother areas. In the northern part of the county the type has a dark-gray to yellowish-brown surface soil and a yellowish-brown subsoil, and the red mottlings are absent.

The Bates silt loam is widely distributed over the county. Like the Boone silt loam, it occurs near draws and on slopes where the Oswego and Summit soils have been removed and the underlying shale and sandstone material exposed. The type is not so typically developed as in other parts of southwestern Missouri.

Sandstone fragments and thin sandstone outcrops are encountered in this type. It is residual in origin and is derived from the lower Carboniferous sandstone and shales. It is probable that in the northern part of the county limestone has entered into its composition, as is indicated by the light-brown, friable subsoil, similar to that of the lighter Crawford soils.

The topography is gently rolling and for the most part consists of gentle slopes along draws and streams and the rather indistinct escarpment slopes found in the northern part of the county.

All the type is in cultivation. Corn is the most important crop, and yields 30 to 50 bushels per acre. The type produces fair yields of wheat, but is not considered a good grass soil. Applications of manure are necessary to produce good yields. The soil has an advantage, as compared with the heavier silty soils, in the ease with which it can be worked and in the early date at which it can be plowed in the spring.

Boone Series.

The Boone series includes light-gray soils, containing a small percentage of organic matter, underlain by pale-yellowish to slightly reddish yellow and often mottled, porous subsoils. A bedrock substratum is frequently encountered at shallow depths. The soils of this series are residual in origin, and are derived from sandstones and shales, mainly of Carboniferous age. The topography is rolling to steeply sloping, and the soils are usually forested. Only one member of the Boone series, the silt loam, is encountered in Pettis County.

BOONE SILT LOAM.

The Boone silt loam is closely associated with the Bates silt loam, and has similar topographic and geologic relations. The surface soil is a gray to grayish-brown or yellowish-brown silt loam, grading into light-gray floury silt loam. This changes at 16 to 18 inches to a light yellowish gray, moderately compact silty clay loam or clay, becoming more friable and mottled with increasing depth. The gray subsurface material is absent in places, the surface soil in such cases passing at 8 to 12 inches into the yellowish silty clay subsoil. Black iron concretions occur in the subsoil.

Areas of this type occur throughout the western half of the county. They occupy gentle slopes and low-lying flats, usually forming narrow strips along the streams between the bottom land and the Oswego or Summit silt loam. Wherever the upland soil grades into the bottom-land type, the transition soil is the Boone silt loam, but these strips are frequently too narrow to indicate on the soil map. Shale and sandstone outcrops are present in some of the stream cuts.

The soil is evidently composed of the same material as the adjoining upland types, though it has acquired distinct characteristics through the modification of this material by different drainage conditions and timber growth. Most of the type originally was forested, principally with oak and hickory, but the greater part of the land has been cleared. It is locally known as "post-oak land."

The Boone silt loam is not considered a very productive soil. It is low in organic matter and lime and does not retain moisture well. Some of the land has suffered from excessive erosion, and has therefore a low agricultural value. However, the type responds readily to good treatment, and with proper cultivation and liberal applications of stable or green manure, good yields are obtained. Small grains and grasses do best on this soil. Yields are somewhat lower than on the Bates soils.

In the following table the results of mechanical analyses of samples of the soil and subsoil of this type are given:

Mechanical analyses of Boone silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
343617	Soil	0.4	1.5	0.4	0.9	7.7	74.4	14.4
343618	Subsoil	.4	1.6	.9	1.6	3.0	64.0	28.3

PETTIS SERIES.

The soils of the Pettis series are brown to dark brown in color. At a depth of 6 to 12 inches the soil grades into a brown to yellowish-brown, friable subsoil, slightly heavier than the soil. The color, texture, and structure continue practically uniform throughout the 3-foot section, though faint grayish mottlings may appear below a depth of 30 inches. These soils are residual from shales, and the topography is smooth to undulating. The series is represented in this county by a single type, the Pettis silt loam.

PETTIS SILT LOAM.

The soil of the Pettis silt loam is a dark-brown, mellow silt loam, grading at 15 to 18 inches into a brown silt loam, which at 24 to 30 inches grades into yellowish-brown, friable silty clay loam, mottled with red, brown, and yellow. The lower subsoil is frequently a brown silt loam.

This type grades into the Summit silt loam, and where it borders the Crawford silt loam it blends imperceptibly with that type. It differs from the Summit silt loam in having a more rolling topography, a mellower soil, and a lighter subsoil. It is darker than the Crawford silt loam and has a deeper soil.

The Pettis silt loam occurs near the heads of draws, where, owing to the rolling topography, the underlying material is less compact than the typical Summit subsoil, and where erosion has not completely exposed the underlying residual soil. It borders areas of the Summit silt loam, but usually it occurs in strips too narrow to be shown satisfactorily on the soil map. In origin it is like the black prairie soil, although in many places the subsoil is almost entirely composed of limestone material. In general, the smoother areas have a darker color and a higher content of organic matter than the rolling areas.

All of the type is in a high state of cultivation, and it is recognized as one of the best soils in the county. It is more easily kept in good tilth and is more productive and earlier than the adjoining prairie soils. These advantages, however, are frequently offset by the greater washing to which the soil is subject.

The type is used for the production of the staple crops of the region, and good yields are obtained. Corn averages 40 to 80 bushels per acre. Clover and alfalfa do particularly well. For fruit and vegetables the Pettis silt loam is equal to the best Crawford soil.

The results of mechanical analyses of samples of the soil and subsoil of the Pettis silt loam are given in the following table:

Mechanical analyses of Pettis silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
343613	Soil	1.7	2.6	1.2	6.6	15.8	51.9	20.2
343614	Subsoil	.0	.2	.2	.6	5.2	68.2	25.5

GERALD SERIES.

The Gerald soils are gray to light brown in color. The subsurface material is light gray, friable, and slightly heavier than the surface soil. This layer grades at 12 to 18 inches into a pale-yellow to drab, silty, rather plastic clay mottled with brown or yellowish brown. These soils are residual from shales and limestones. The topography is smooth. In Pettis County the Gerald series is represented by one type, the silt loam.

GERALD SILT LOAM.

The surface soil of the Gerald silt loam to a depth of 8 to 10 inches consists of a dark-gray to grayish-brown silt loam, the color being much darker when the soil is wet. The content of organic matter is low, and the soil is not as mellow and porous as that of the bordering types. The subsurface soil is a light-gray silt loam or friable silty clay loam which extends to a depth of about 15 inches, where it changes to a yellowish-gray to drab clay, mottled with yellow and gray, the mottling increasing with depth. The subsoil is rather tough when dry. That part of the type bordering the residual limestone soils has a more granular structure and is browner than the typical soil.

The Gerald silt loam is closely associated with the Summit silt loam and the Pettis silt loam, and, like the latter, is a transitional type between the black prairie soils and the lower lying residual types. The soil is variable in color, and in general is inferior agriculturally to the surrounding types.

This type is relatively unimportant. It occurs in the northeastern part of the county on narrow ridges that extend from the prairie out between the upper courses of small streams. Other areas border the prairie soils where these grade into the limestone soils. Like the Pettis silt loam, its boundaries are rather indefinite, and only the larger areas of the type can be indicated on the soil map.

In origin the type is similar to the Summit silt loam, and it is really a modified form of the latter, resulting from the removal of material from the surface and the modification of the subsoil by filtration.

A large part of the type originally was forested with white oak, post oak, and black oak.

Grass and wheat are the principal crops, although all the common field crops of the region are grown to some extent. Yields are low, and in dry seasons crops frequently are a failure. The organic-matter supply has not been maintained, and for improving this land it is necessary to incorporate organic matter through the use of green manuring crops, particularly the legumes, or large quantities of manure and lime. The soil is early, easily handled, and responsive to fertilization.

Osage Series.

The Osage series includes dark-gray to black alluvial soils, composed principally of wash from sandstone and shale soils of the prairie regions. Two types are encountered in Pettis County—the Osage silt loam and clay.

OSAGE SILT LOAM.

The Osage silt loam to a depth of 8 to 12 inches consists of a dark-gray to almost black silt loam. This is underlain by somewhat lighter colored and more compact material of the same texture. When dry the soil has an ashy-brown color. The lower subsoil is usually a drab or dark-gray silty clay, retaining this characteristic to a depth of several feet. There are some included areas in which this soil is gray. These occur in the wide bottoms and in poorly drained situations. The areas of dark soil do not have the gray subsurface layer, and the rather heavy silt loam extends from the surface to a depth of 3 feet or more. The larger streams are usually bordered on one side by a narrow band of low bottom land, rarely more than 100 yards in width, the soil of which is a dark-brown loam or fine sandy loam of great productiveness. These areas are subject to frequent overflows, but are highly prized for the growing of corn. On account of their small extent they are not separated on the soil map. Near the streams the soil generally contains a noticeable quantity of fine sand.

The Osage silt loam as mapped in the small draws in the southwestern part of the county, especially along Elk Fork, is a little more sandy than elsewhere. In general, the lighter colored soil is inferior agriculturally to the darker soil, although the latter usually is more subject to overflow and on account of its heavier texture is more difficult to cultivate.

The Osage silt loam is the most extensive of the alluvial types and is found in all parts of the county. The soil material shows a close relation in its color and textural characteristics to the upland soils from which it is derived.

This type occupies first bottoms along streams. It is subject to overflow, but owing to the porous nature of the soil and subsoil the type dries out rapidly. In general, the drainage is good, although a few areas, especially along Flat Creek, could be improved by tiling. The soil is easily tilled and ordinarily maintains its loose, crumbly structure.

The material forming this type has been washed down from the higher adjoining land, carried varying distances by the streams and flood waters, and deposited. The soil in the Muddy Creek bottoms, derived from the black prairies, is darker in color than the soil in the Flat Creek bottoms, which is derived from the light-colored prairie soils. Originally the Osage silt loam was forested, but, excepting narrow belts along the streams, all of it is now in cultivation.

It is one of the most valuable types in the county and is highly prized for the production of corn. Some fields have been used continuously for corn for 30 years or more and, although the yields are decreasing, they are still profitable. Such fields, after being kept in clover or cowpeas for about two years and again planted to corn, produce yields that compare favorably with those obtained from the virgin soil. Alfalfa succeeds on the well-drained areas not subject to overflow. Three or four cuttings are obtained each year. Corn yields average about 45 bushels per acre. The wheat and grass acreage is small. The usual rent for bottom land of this type is $5 to $8 an acre, or one-half the crop.

OSAGE CLAY.

Several small areas of Osage clay, locally known as "gumbo," are mapped in the wide bottoms of Flat and Muddy Creeks. The soil to a depth of about 10 inches is a black, heavy silty clay, rich in organic matter, grading into a bluish-black, heavy, waxy clay, which generally becomes slightly lighter in color in the lower subsoil. Usually there is very little change from the surface soil to the subsoil, the most marked difference being the larger percentage of clay in the latter. On drying, the surface becomes hard and cracks.

The type occupies shallow depressions. It is subject to overflow, and frequently is covered with standing water. It is alluvial in origin. The black color is due to the accumulation of relatively large quantities of decaying vegetable remains, mainly the stems and roots of coarse grasses.

Where well drained the Osage clay is an excellent corn soil and gives good yields of grass. Corn averages 40 to 60 bushels and grass 1 to 3 tons of hay per acre.

On account of its poor drainage only a small part of the type is in cultivation. Drainage is necessary on all the type to insure good yields. Tile drains are most effective, as they not only carry off the surplus water but are advantageous in improving the structure of the soil and subsoil. By plowing in the fall the soil may be made more friable by exposure to the action of frost during the winter.

Robertsville Series.

The Robertsville soils are gray to light gray in the surface portion. The subsoils are gray to almost white and compact, passing into a lower stratum of compact, impervious, plastic clay of grayish to brownish color, with some faint mottling of reddish brown. The flat surface and impervious subsoil cause many areas to be poorly drained. These soils consist of old stream alluvium occupying terraces and abandoned stream valleys no longer subject to overflow. The soil includes material washed principally from limestone, sandstone, and shale soils. Only one member of the series, the Robertsville silt loam, is recognized in Pettis County.

Robertsville silt loam.

The Robertsville silt loam is locally known as "gray second bottom." The soil to a depth of 8 to 12 inches is a gray silt loam, which is very light gray or almost white when dry. This grades into an almost white silt loam, usually faintly mottled with yellow and brown, and containing small iron concretions. The subsoil proper begins at an average depth of 20 inches, and consists of a drab or dull-gray, rather plastic silty clay. In the lower part of the soil section the material is mottled yellowish, grayish, and brownish. The gray clay subsoil is always present, and is a distinguishing characteristic of the type.

This type occupies the low second bottoms, or terraces, along the larger streams and the wide, flat depressions along the draws in the flat prairies of the southwestern part of the county. The second bottoms usually stand from 1 foot to 5 feet above the adjoining first bottoms and frequently are set off from the latter by faint bluffs

or abrupt drops. That part of the type found along the small streams is slightly darker than the terrace soil, and the clay subsoil is encountered at a greater depth, rarely at less than 30 inches.

The Robertsville silt loam has its greatest development along Flat Creek and its tributaries, although smaller areas occur along the streams in other parts of the county. The soil is alluvial in origin, but has received a large quantity of wash material from the adjoining Oswego silt loam. The topography is flat, with a very gentle slope to the stream. Drainage is deficient, owing to the impervious subsoil and smooth surface. The greater part of the type lies above overflow.

On account of the poor drainage and the accumulation of seepage water from the uplands, the type is cold and wet until late in the spring. Tile drainage would greatly improve this condition. If plowed when too wet the soil puddles and crops are injured. Owing to the deficiency of organic matter and the impervious subsoil, the water-holding capacity is low and in times of drought crops frequently fail. The soil has a lifeless appearance, characteristic of imperfectly drained silt loams. Many farmers consider it impossible to grow profitable crops of wheat without applying phosphatic fertilizers to the land.

In normal seasons this soil yields from 25 to 45 bushels of corn, with an average of about 35 bushels, and from 10 to 20 bushels of wheat per acre. Grass and cowpeas do well, and next to corn are the crops most extensively grown on this land.

Chariton Series.

The surface soils of the Chariton series are dark in color, ranging from dark gray to black. The subsurface layer, encountered at depths of 10 to 15 inches, is usually lighter in color than the surface material. The change from the subsurface layer to the subsoil is abrupt, and the latter consists of a dark-drab, heavy, plastic silty clay, mottled with yellowish-brown spots. The lower subsoil is usually lighter in color and in texture than the upper subsoil. These soils are derived from old alluvial deposits occurring as terraces, and the surface is flat. The Chariton silt loam is the only member of the series mapped in Pettis County.

Chariton silt loam.

The Chariton silt loam is similar to the Robertsville silt loam in topography, origin, and texture, but differs from the latter in color and organic-matter content. Typically it consists of a dark-brown or black mellow silt loam, grading at about 18 inches into a black, plastic silty clay. Usually there is little change in color in the soil

section, but in some of the flat areas the subsurface material at about 12 to 18 inches becomes somewhat lighter in color than the surface soil. The Chariton silt loam is darker than the first-bottom land and is considered one of the strongest soils in the county.

The type occurs as low, poorly defined second bottoms along the streams in widely scattered locations. Frequently it is associated with the related Robertsville silt loam, but is easily distinguished from the latter by its darker color. It rarely is overflowed, and has good surface drainage. It is a rich, productive soil, well suited to the production of the staple crops of the region, which give as good yields as on the better first-bottom land.

Huntington Series.

The Huntington soils are light brown to brown, and the subsoils yellow to light brown. Frequently there is little change in the color or character of the material from the surface downward. The soils are developed in the limestone, sandstone, and shale sections of the humid region in the first bottoms of streams, and are subject to overflow. They consist of material derived from limestone, sandstone, and shale soils. These are the best drained first-bottom soils of the region. The silt loam is the only representative of the Huntington series in Pettis County.

HUNTINGTON SILT LOAM.

The soil of the Huntington silt loam is a very dark brown to almost black, mellow silt loam, with little change in color or texture in the soil section. The lower subsoil is usually a brown silt loam. Small quantities of fine sand are present in both soil and subsoil. Gravel beds are frequently encountered in the lower subsoil, and gravel fragments are scattered over the surface in places. The content of organic matter is high, and this is responsible for the dark color and in part for the mellow structure of the soil. The type also is well supplied with lime, which leaches down from the adjoining limestone outcrops and soils.

This type comprises the rich, productive bottom lands along the streams in the region of Crawford soils in the northeastern part of the county. It occupies first bottoms, and is subject to occasional overflows. The overflows, however, are of short duration and less frequent than on the other bottom-land soils of the county.

All the Huntington silt loam is in cultivation. It is considered the most productive type in the county. It is used almost exclusively for the production of corn, and very little attention is given to crop rotation. Many fields have been in corn continuously for 30 to 40

years and yield ordinarily 45 to 60 bushels per acre, although yields of 80 to 90 bushels are common. Wheat, clover, and timothy grow luxuriantly.

Where well drained and not subject to overflow this is a particularly good alfalfa soil, although very little of this crop is grown.

The type withstands drought better than any of the other bottomland soils, and good crops of corn can be produced with very little rainfall, as the water table usually is only a few feet below the surface. Farms that contain some of this type are considered the most valuable in the region.

Miscellaneous Material.

ROUGH STONY LAND.

Rough stony land consists of rock exposures, cliffs, and steep, precipitous land too rough to permit cultivation. The soil material is usually silty, and is similar to that of the gravelly areas. The stony loam occurs along ravines and valleys of Flat Creek and its tributaries, within the main development of the Baxter soils. All the land is forested with oak, hickory, and elm. It has practically no agricultural value.

SUMMARY.

Pettis County is situated in the prairie region of west-central Missouri. The county comprises 675 square miles, or 432,000 acres, nearly 90 per cent of which is improved farm land.

The surface features have been developed by erosion, and are influenced by the relative hardness of the sandstone, shale, and limestone which form the country rock. In general, the topography is smooth to gently rolling, with rough areas in the limestone region in the northeastern part of the county.

The improvements throughout the county are good and indicative of the prosperity of the farmers. A rural population of 16,091, or 23.5 persons to the square mile, is reported in the 1910 census. The entire population of the county is 33,913. Sedalia has a population of about 18,000 and is an important local market.

The average annual temperature is 53.4° F. and the average annual precipitation 38.05 inches.

The agriculture of the county is based on general farming combined with stock raising and stock feeding. Corn and wheat are the most important crops, most of the former being used to fatten large numbers of cattle. Clover is grown in all parts of the county. Oats, alfalfa, cowpeas, and soy beans are secondary crops. Bluegrass and timothy grow luxuriantly. Truck farming and dairying are important industries near Sedalia.

The farm practices are good, but there is a general need of better crop rotations, the more extensive use of legumes, especially clover, and the incorporation of more organic matter in the soil, with the proper use of fertilizers and lime on the poorer lands.

Land values range from $50 to $150 an acre, the higher prices prevailing near the towns and in the northwestern part of the county.

The upland soils of Pettis County are residual in origin. They are classed in four distinct groups.

The black prairie soils include the Summit, Pettis, and Bates series, characterized by their dark color and heavy subsoil. They include the best land in the county, are very productive, and are well suited to all the staple crops, of which corn, wheat, and grass are the most important. The Gerald is a transitional type between the black prairie soils and the lower lying residual soils. It is closely associated with the Summit and the Pettis.

The flat prairie soils are classed with the Oswego, Cherokee, and Boone series. They have lighter colored surface soils and more compact subsoils, and are somewhat inferior agriculturally to the black prairie soils.

The red limestone soils, derived from limestone, are the Crawford and Baxter. These soils are characterized by their red color and mellow structure. They are naturally productive, and are well adapted to the staple crops common to the region and to truck and fruit.

The gravelly limestone soils are represented by the Eldon series, and in part by the Baxter gravelly loam type. They have gravelly subsoils and are of medium productiveness. These soils are best suited to grass and small grain.

The alluvial soils include the Osage, Robertsville, Chariton, and Huntington series. They are generally subject to overflow, but where well drained comprise some of the most productive land in the county. They are used largely for corn and grass.

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[PUBLIC RESOLUTION—No. 9.]

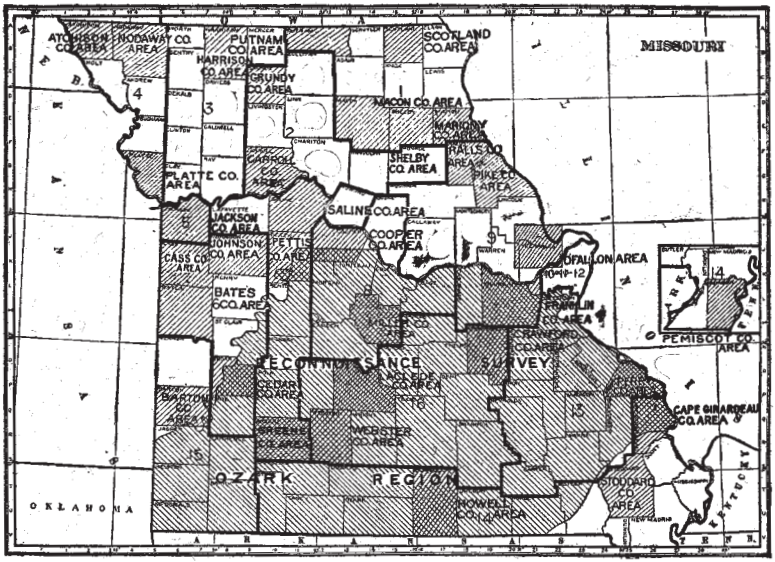
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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.]



Areas surveyed in Missouri.

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