

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 BARRY COUNTY,
MISSOURI.

BY

A. T. SWEET, OF THE U. S. DEPARTMENT OF AGRICULTURE,
IN CHARGE, AND E. W. KNOBEL, OF THE
UNIVERSITY OF MISSOURI.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1916.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS;

Washington, D. C., December 24, 1917.

SIR: Field operations of the Bureau of Soils for 1916 included a soil survey of Barry County, Mo., undertaken in cooperation with the University of Missouri Agricultural Experiment Station. The selection of Barry County for survey was made after conference with State officials.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1916, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

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MAP.

Soil map, Barry County sheet, Missouri.

SOIL SURVEY OF BARRY COUNTY, MISSOURI.

By A. T. SWEET, of the U. S. Department of Agriculture, In Charge, and E. W. KNOBEL, of the University of Missouri—Area Inspected by HUGH. H. BENNETT.

DESCRIPTION OF THE AREA.

Barry County lies near the southwest corner of Missouri, about 200 miles south of Kansas City. Lawrence County bounds it on the north, Stone County on the east, and Newton and McDonald Counties on the west. Benton and Carroll Counties, Ark., form the southern boundary. Barry County has a length north and south of approximately 29 miles, and a width east and west of 27 miles. Its area is 791 square miles, or 506,240 acres.

The topography of the county is that of a dissected plain sloping northwestward. The thoroughness as well as the depth of the dissection varies widely in different parts of the county, the resulting topography differing to the same degree. A little more than half the county has a relatively smooth topography; the rest is rough. All the northwestern part of the county, a narrow strip along the north line, and a narrow belt along the railway reaching the south county boundary south of Seligman are smooth. The line between the rough and smooth areas follows approximately the southern boundary of the Lebanon soils from $4\frac{1}{2}$ miles south of the northeastern corner westward to the head of Stanberry Branch. Thence in a line approximately straight to McDowell, then along the valley of Flat Creek to Star City, up Cross Hollow to the Lebanon soils south of its head. Thence following approximately the Lebanon and Boone soil boundaries to the State line south of Seligman. All the county south and east of this line is rough except the stream valleys and the areas of the Jenkins and Shell Knob basins, to be described below. All of the county west of it is smooth, except the southwest corner, comprised in the area between the Lebanon silt loam boundary and the county line, and narrow belts along the various streams. None of the latter belts, however, are broad.

In general, the area drained by Shoal Creek and its tributaries is smooth, that drained by White River and the streams belonging to its drainage basin, except the upper parts of the Flat Creek basin



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

and the basins referred to above, is rough. The smoothness of the former, as well as the roughness of the latter area, is the result of the varying depth and thoroughness of the dissection of the respective areas. White River, a large stream, flows to the Mississippi by a direct and short course. It is able, therefore, to cut its valley to within a few hundred feet of the level of the Mississippi Valley where the White River enters it. Shoal Creek, on the other hand, reaches the Mississippi by a very long and circuitous course through the Spring, Grand, and Arkansas Rivers. It has not been able to cut its valley to so low a level as that of the White. The White River basin has dissected the higher part of the upland of the county also, so that a dissection down to the same level would form deeper valleys in the White River basin than in that of Shoal Creek.

The elevation of the upland in the northwest corner of the county is approximately 1,300 feet above sea level. Carters Store, likewise on the upland, 7 miles east, lies at an elevation of 1,400 feet, and the upland in the vicinity of Madry lies at 1,530 feet. The elevations of the stations on the St. Louis & San Francisco Railway show the rise of the upland southward. Purdy lies at 1,482 feet, Butterfield at 1,538 feet, Exeter at 1,575 feet, Wayne at 1,582 feet, and Seligman at 1,536 feet. The last place lies at a point where the upland has been lowered by recent erosion. The elevations of points on the valley floors bring out the differences referred to above. The Clear Creek bottoms, near the northwest corner of the county, lie 1,150 feet above sea level, which is 140 feet below the highest part of the ridge 1 mile south. The valley of Little Crane Creek, in the northeast part of the county, has an elevation of 1,200 feet, and the uplands $2\frac{1}{2}$ miles west have an elevation of 1,400 feet. The elevation of the valley of the White River where this stream leaves the county is 900 feet, and that of the nearby uplands 1,500 feet. The depth of the larger valleys thus ranges from about 150 feet in the northwestern part of the county to nearly 600 feet in the southeastern part. This depth of valley dissection represents the total fall of the branch streams and is also a measure of the work that has been done in reducing the upland to its present topography, since the surface relief is due almost entirely to erosion.

The Shell Knob basin occupies all the area south and east of White River Valley and a strip varying in width along the north and west sides, while the Jenkins basin occupies the lower part of the basin of Jenkins Creek and a roughly circular area on both sides of Flat Creek, opposite the mouth of Jenkins Creek. These basins consist of undulating to rolling upland surfaces lying about 300 feet below the level of the nearest remnant of the original upland plain and 100 feet or less to 300 feet above the floors of the valleys by which they are dissected. The valleys are narrow, so that the greater part of

the basin area consists of rolling upland. It extends in long narrow tongues up the valleys of streams entering the basins from the higher surrounding areas. The basins are surrounded by the worn, ragged edge of the higher upland, which terminates in a well-marked escarpment, completely surrounding them, except where broken by gaps made by outward-flowing streams. The areas of these basins are shown approximately by the distribution of the Hagerstown soils, though it is evident from an inspection of the map that the Hagerstown soils do not occupy all their area.

Alluvial first-bottom lands, varying in width from a few rods to one-fourth mile, extend along all the stream courses in the more nearly level parts of the county and along the larger streams in the more hilly regions. These stream valleys are not so nearly level as in a region of more advanced stream development. There is usually a slope from the outer valley margin toward the stream, and frequently a considerable slope downstream. Low terraces are common within the flood plain, due to the rapid cutting of the streams.

Along the outer margins of the valleys of the larger streams there are in places alluvial benches or terraces lying 30 to 60 feet above the present flood plains. These are remnants of flood plains formed at a previous stage of the stream development. Closely associated with these benches are alluvial fans, which consist of material carried down by small tributary streams and deposited at their entrance into the larger valleys. The terrace soils are also modified by colluvial material which has been gradually moved down the steep slopes from the upland by gravity and other agencies. Along White River and Kings River, in addition to the low terraces which lie but a short distance above the stream flood plains, there are terraces which have an elevation of 200 feet or more above the first bottoms. The soils here are closely associated with those of the high benches previously described, but are in part of different origin, since these latter carry water-worn gravel and have, therefore, at least been modified by stream action. These high terraces have in many places been so modified by subsequent erosion that they have almost or entirely lost their original terrace topography.

The western third of Barry County is drained into the Grand River. The remainder of its area is tributary to the White River, which follows a very meandering course across the southeast corner of the county. The most important stream in the county belonging to the White River basin is Flat Creek, which with its tributaries drains all the central part of the county and almost one-half the total area. There are several perennial streams in the county fed by numerous limestone springs. All the streams, especially those in the more hilly areas, are swift flowing. They carry large quantities of chert and gravel and are eroding rapidly. Water power sufficient

to run flour mills of considerable capacity has been developed in many places along the larger streams. There were at one time many water-power mills of small capacity, but the greater number of these have been abandoned in recent years on account of the expense of installing modern machinery.

The native vegetation of the smooth area of the county was grass, with open oak woodlands in its rougher parts and along the banks of the streams; that of the rough area was woodland in open growth, with grass and other annual plants growing among the trees. The timber vegetation has extended its area rapidly, except where prevented by cultivation during the last 60 years. At the present time there are three types of arboreal vegetation in the county, each type prevailing on and rather generally confined to soils of certain type characteristics. The trees growing on the Lebanon and Gerald soils are predominantly post oak and blackjack oak. These trees are rarely found on other soils than these excepting areas of very shallow phases of the Hagerstown soils where the soil moisture supply is low. The trees predominating on the Baxter soils are red, black, and white oak and hickory, and on the moist alluvial lands elm, walnut, hackberry, and the water-loving oaks.

Barry County was organized in 1835. The early settlers came principally from Tennessee, Kentucky, Arkansas, and other parts of Missouri. The descendants of these pioneers constitute the larger part of the present population of the large stream valleys and of the more hilly areas. Soon after the close of the Civil War several small colonies of Germans, Savoyards, and Poles were established in the northern and northwestern parts of the county. At the present time this part of the county has a rather high percentage of people of foreign birth or parentage. Barry County has practically no negro population. The total population in 1910 was 23,869, of which 19,692 was rural. The northern, north-central, and extreme southeastern are the most densely populated parts of the county.

Monett, near the northwest corner of the county, had in 1910 a population of 4,177, which has increased materially since that time. It is the largest town in the county, and an important railroad center, being a division point on the St. Louis & San Francisco Railroad system. Cassville, the county seat, is situated near the center of the county. The population of this town in 1910 was 781. It has extensive rock quarries, a creamery, a large flour mill, and other industries, and is the distributing point for a large section of country to the south and east. Towns of importance on the St. Louis & San Francisco Railroad are Purdy, with a population in 1910 of 459; Exeter, with 375 inhabitants; Seligman, with 475; and Wash-

burn, with 219. Wheaton, on the Missouri & North Arkansas Railroad in the extreme western part of the county, is an important and growing town. Jenkins, Golden, Shell Knob, McDowell, Mineral Spring, and Viola are small inland towns in the central and eastern parts of the county. There are numerous trading points throughout the rural districts.

The St. Louis & San Francisco Railroad furnishes the principal transportation facilities. One line of this system crosses the county north and south several miles west of its median line, passing through Monett, from which a line extends northeasterly to Springfield. This system furnishes direct communication with St. Louis, 283 miles from Monett; Kansas City, 213 miles from Monett; and with Fort Smith, Fort Worth, and the South. The Missouri & North Arkansas Railroad enters the county near Wheaton, uses the track of the St. Louis & San Francisco from Wayne to Seligman, and thence continues southward. The Cassville & Western, an independently owned line 4 miles long, extends from Cassville to Exeter, on the St. Louis & San Francisco Railroad. A line of the St. Louis, Iron Mountain & Southern Railway passing through northwestern Stone County furnishes transportation for a small area in northeastern Barry County. In general, Barry County is not well supplied with railroad facilities. Over one-half the area of the county is more than 5 miles from any line of railroad, and a considerable area in the southeastern part is 15 to more than 20 miles distant. Supplies for Eagle Rock, Shell Knob, Viola, and Golden are freighted 15 to 25 miles over very rough roads from Cassville.

The wagon roads are, as a whole, in poor condition. Those first laid out by the early settlers followed the routes most easily passable, which in many cases were marked by Indian trails. The "wire road," which in the early days formed the principal thoroughfare from Springfield to Fort Smith, Ark., followed such a trail. These early roads followed the larger valleys for considerable distances, usually skirting the foot of the gentle hill slopes. The roads on the upland clung closely to the crest of the divide. In the more broken parts of the county some of these divides are merely sharp ridges or "hog-backs," but they are often followed for many miles by these ridge roads. With more extensive use of the bottom lands and the fencing of the uplands important changes in the roads were made. The valley roads were in many places crowded from their original place along the valley foot slopes and made to follow the stream channel for long distances. On the uplands where possible the roads were placed on land lines and made to cross sharp ridges and deep gullies regardless of topography. The only roads which retain their original position are the ridge roads of the more hilly regions. There is an abundance of good road-building material in all parts of the county, but none

of the highways except for a few short stretches has been surfaced with crushed stone or gravel, and very little has been done to improve the grade.

Cassville and Monett are the principal market points within the county. Garden, orchard, and general farm products are hauled in large quantities to Aurora and Joplin, which, on account of their extensive mining industries, afford good markets. Kansas City and St. Louis are the principal stock markets. Strawberries are shipped through the berry growers' association to many of the larger cities.

CLIMATE.

The climate of Barry County is temperate and healthful and well suited to general farming, stock raising, dairying, and fruit growing. The mean annual temperature as recorded at Mineral Spring is 56.7° F. The mean for the spring season is 56.4° and for the fall 58.5°. The mean temperature for the winter is 35.6° and for the summer 75.6°. The rainfall is favorably distributed throughout the year. The mean annual precipitation as recorded at Mineral Spring is 43.69 inches. The heaviest rainfall is in the spring, the mean for this season being 15.32 inches. The season of least rainfall is winter, with a mean of 6.96 inches. The mean precipitation for May is 6.86 inches, almost as much as for the three winter months combined.

The average date of the last killing frost in the spring is April 14, and that of the first in the fall, October 16. The average length of the growing season is thus 185 days. Killing frost has been recorded at the Mineral Spring station as late in the spring as May 20, and as early in the fall as September 29.

A comparison of the weather records for Mineral Spring with those of stations in the central and northern parts of the State show that while the mean summer temperature is approximately the same the mean winter temperature is several degrees higher in Barry County. The mean annual precipitation is 3 to 8 inches greater and the growing season is somewhat longer.

The summer season is long and warm, but owing to the good breezes which usually prevail at this time of the year and to the dry atmosphere extremes of temperature are less oppressive than in regions of lower altitude and greater humidity. The apple crop is rarely destroyed by excessive cold in winter or by late frosts in spring. Strawberries are ready for the market between May 15 and 25. Marketing of the earliest varieties of grapes begins about August 1, and of sweet potatoes between August 1 and 10. Cowpeas, soy beans, kafir, or feterita may follow wheat or oats the same season, and after the harvesting of this forage crop the land may again be put in wheat. Wheat is sown principally between the 1st and

20th of October. Alfalfa, if moisture conditions are favorable, may be cut four times within a season, and a succession of garden vegetables may be grown on the same ground.

As in all other parts of the Middle West, crops are occasionally damaged by severe droughts, hot winds, excessive precipitation, or untimely frosts, but such injury is rare and with the great diversity of crops that may be grown there is little danger of the loss of all or even a large part of the money crops.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded at the Weather Bureau station at Mineral Spring, in the central part of the county:

Normal monthly, seasonal, and annual temperature and precipitation at Mineral Spring.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1901).	Total amount for the wettest year (1898).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	37.2	72	- 6	2.68	1.60	2.37
January.....	35.4	75	-24	2.48	.80	3.16
February.....	34.1	77	-28	1.80	1.77	.71
Winter.....	35.6	77	-28	6.96	4.17	6.24
March.....	46.8	83	3	4.32	4.11	10.72
April.....	57.2	95	16	4.14	2.88	3.72
May.....	65.3	90	28	6.86	.76	12.43
Spring.....	56.4	95	3	15.32	7.75	26.87
June.....	72.6	101	41	3.37	.86	5.40
July.....	76.7	107	44	4.78	.42	12.07
August.....	75.5	102	40	3.76	3.03	6.74
Summer.....	75.6	107	40	11.91	4.31	24.21
September.....	69.6	99	30	3.83	1.08	6.91
October.....	59.1	91	24	2.91	1.72	5.82
November.....	46.8	85	6	2.76	4.34	2.54
Fall.....	58.5	99	6	9.50	7.14	15.27
Year.....	56.7	107	-28	43.69	23.37	72.59

AGRICULTURE.

The early settlers in Barry County made their homes at or near some spring, usually at the margin of the larger stream bottoms. Small areas of first-bottom or terrace land were cleared and devoted to the growing of corn, wheat, tobacco, and cotton for home use. Much of the upland which has since become forested was at that time

clear and afforded excellent open range for cattle, horses, and sheep. Hogs ran at large in the forests and the creek-bottom lands. Corn and wheat were ground at water-power mills, of which there were several in the county. Clothing was to a large extent made from homespun wool or cotton. Hogs and cattle were the principal source of income. These animals were driven long distances to market or to river shipping points. With increase in population, the best parts of the valley lands were taken up and settlement spread to the uplands. The soils here, although not so good as those of the bottom areas, were entirely or almost entirely unforested and were easily put under cultivation. They were used rather extensively for grain.

The fencing of the uplands limited the available stock range, and the valley farmers were forced to turn to grain growing as a source of part of the farm income. The settling of German immigrants and people of other nationalities in the northern part of the county did much to increase grain growing and to check stock raising. Grain farming reached its maximum about 15 to 20 years ago, and the acreage of corn in 1899 was larger than in 1909 or in 1915. The acreage of wheat in 1899 was almost twice as large as that in 1889 or 1909 and was much larger than that in 1915, when the acreage was extended on account of increased prices.

The upland soils of Barry County are not naturally durable enough to hold up long under continuous grain production, and it was soon found necessary to grow clover more extensively, to use part of the land as pasture, rotate crops, and to raise live stock without outside range. Within the last few years there have been other important changes in the agriculture. The most important of these is the growing of small fruits, especially strawberries, which is developing principally within short distances of shipping points. Dairying is receiving increased attention throughout a much larger part of the county, cream in some places being hauled to market as far as 10 or 15 miles. The growing and canning of vegetables, particularly tomatoes, is receiving considerable attention, especially in the rougher and more inaccessible parts of the county, where long distances and rough roads make the growing of small fruits impracticable. Several home and small community canneries are in operation 12 to 25 miles from shipping points. In the more broken parts of the county stock raising on large inclosed ranches cleared of timber and sown to pasture grasses is gradually developing. Poultry raising in combination with almost all other forms of agriculture is receiving increased attention throughout the county.

In a broad sense the agriculture of Barry County may be said to be of three types. First and most important is general farming and stock raising. This type of agriculture is carried on throughout the county, but largely in the central and northern parts. The farms

are of medium size, ranging from 80 to 320 acres. Corn, wheat, oats, and clover are grown. Hogs, cattle, horses, and mules, and in many cases sheep and goats, are raised, and the income is derived from the sale of grain, hay, and livestock. Poultry on many of these farms is a source of considerable income. On a large number, especially in the vicinity of Cassville and Monett, dairying is increasing in importance. Many farmers milk 5 to 25 cows, and derive much of the farm income from the sale of cream. Jerseys are the principal dairy stock. There are a few herds of pure-bred cattle, but the greater number are low-grade animals.

The second type of farming consists almost purely of stock raising, principally cattle. The farms or ranches are large, ranging from 500 to several thousand acres. They consist mainly of rough grazing land, but include sufficient bottom land for the growing of winter feed. Hereford and Shorthorn are the principal breeds of cattle raised. The animals are marketed from the range.

In the third type of farming small fruits, especially strawberries, are the principal money crops. Increasing attention is being given to grapes and peaches. Dairying and poultry raising receive some attention. The farms are small, usually ranging from 20 to 80 acres, and are situated principally within 5 miles of a railroad.

Corn has occupied a larger acreage than any other crop since the beginning of agricultural development. The area devoted to this crop in 1879¹ was 30,803 acres, which produced 819,580 bushels, an average of 27 bushels per acre. In 1915 there were planted 54,254 acres, which produced 1,139,334 bushels, an average of 21 bushels per acre. The area in wheat has averaged about two-thirds that in corn, but both acreage and yield have been more variable. In 1879 there were sown 19,432 acres, which produced 172,693 bushels, an average of a little less than 9 bushels per acre. In 1915 the area in wheat was 36,072 acres and the production 249,979 bushels, an average of 7 bushels per acre. Oats in 1879 occupied 5,773 acres, which produced 80,807 bushels, and in 1915, 11,242 acres, which produced 269,808 bushels. A small total acreage has been devoted to rye for many years. This crop in 1909 occupied 236 acres, which gave a production of 1,869 bushels. Yields have ranged from 7 to 10 bushels per acre. The acreage has probably increased during the last few years, owing in part to the use of rye for winter pasturage.

Buckwheat was at one time grown to a limited extent. Tobacco was formerly grown to some extent, occupying 169 acres in 1889, with a production of 101,094 pounds, and 24 acres, with a production of

¹Statistics for 1915 are taken from the Missouri Crop Review, 1915; the other statistics are taken from the Federal census reports.

7,827 pounds, in 1909. At present tobacco is grown in several small patches for home use.

All hay and forage crops combined occupied 26,079 acres in 1909, and produced 27,883 tons. Of the total acreage, 24,409 acres were in tame grasses, 102 acres in wild grasses, 100 acres in grains cut green, and 1,468 acres in coarse forage. Of the tame grasses, timothy occupies 9,785 acres, timothy and clover mixed 10,129 acres, clover alone 3,678 acres, alfalfa 136 acres, millet 429 acres, and all other tame grasses 252 acres.

Miscellaneous crops include Irish potatoes, sweet potatoes, and fruits. Irish potatoes in 1909 occupied 1,104 acres, which produced 71,442 bushels, and sweet potatoes 103 acres, with a production of 5,569 bushels. All other vegetables together, of which tomatoes are the most important, occupied 2,159 acres. In 1910 there were 410,896 apple trees, 191,345 peach trees, and 13,506 grapevines reported in Barry County. There were 970 acres of strawberries, with a production in 1909 of 1,176,990 quarts, and 140 acres in blackberries and dewberries, which produced 130,482 quarts.

The value of domestic animals sold or slaughtered in 1909 amounted to \$1,295,997. There were 3,219 calves sold or slaughtered, 20,399 other cattle, 41,619 hogs, and 6,547 sheep and goats. Milch cows on farms and ranges amounted in number to 8,868, other cattle to 15,289, horses and mules to 13,378, hogs 19,139, sheep 11,954, and goats 1,801.

Much of the rough or broken land in the county is quite productive. The high basins are in general areas of productive soils. The north and east sloping hills support a somewhat different timber growth from that on those sloping south and west, and are often less rocky and more productive. In almost level or slightly depressed areas the subsoil is more compacted than on slopes, and the soil is not so well suited to fruit trees or to deep-rooted crops, such as clover or alfalfa. Level topography and poor drainage are usually accompanied by sour soils. The peculiar adaptation of certain crops to particular soils is quite generally recognized in Barry County, and crops are grown to the largest extent on the soils to which they are naturally best suited. To some extent, however, nearly every crop is grown on the entire range of soils. Farmers realize that the nearly level areas with heavy or compact subsoil are best suited to wheat and timothy, with the use of commercial fertilizers, and to some extent for strawberries, and that these soils are not suited to tree fruits, alfalfa, and clover, and only moderately well to corn. The deep, well-drained soils are considered most desirable for corn, clover, and alfalfa. The gravelly soils without a compact layer are recognized as the best for orchards and as being well suited to clover,

strawberries, and grapes. "Red gravelly land" is known to be more productive than "white gravelly land."

The farm equipment is in general fairly good, especially in the more nearly level parts of the county and along the valleys of the larger streams. Here the houses and barns are large and well cared for, and there are many silos. Water is supplied from deep wells by engine or windmill or piped from a near-by spring. On the better farms breaking is done largely with three or four horse riding plows, and a few tractors are in use. The soil is prepared largely with disk harrows. Two-horse riding and walking cultivators are in common use in cultivating corn. Self binders are used for harvesting grain, some of which is stacked, but much of which is thrashed from the shock. Much of the corn is cut by hand, but some corn binders are in use. Alfalfa, clover, and cowpea hay is often left in small cocks until cured, when it is either baled or hauled into the barn loose. On the gravelly soils two-horse implements are used in breaking the land, and most of the subsequent preparation is done with two-horse spring-tooth and spike-tooth harrows. The greater part of the cultivation is done with 1-horse implements and heavy, narrow-bladed hoes.

Land to be put into wheat is generally well prepared. The thoroughness in tillage is due, in part at least, to the campaign which is being carried on to exterminate the Hessian fly. Land to be planted to strawberries is also well prepared, and the soil kept thoroughly cultivated throughout the season. Sweet potatoes and tomatoes also receive good cultivation, but not such thorough treatment as strawberries. Corn on many farms receives less attention than is given it in those parts of the State where it is a more important crop. Many corn growers plant in a poorly prepared seed bed, plow deep at the last cultivation, and leave the corn on high ridges. Failures with alfalfa seem to have resulted in several cases from lack of thoroughness in preparing the soil and failure to cultivate the land to keep out grass and weeds.

Strawberries are set out in the spring and kept well cultivated throughout the season. Much hand labor is required to keep down grass and weeds. The plants come into bearing the following spring, the berries ripening between May 15 and June 1. In this region strawberries are grown almost without exception in matted rows, and the plants under ordinary conditions are allowed to bear three, and occasionally four, crops. The beds are then plowed up, and the best practice is to keep the land in cowpeas, clover, or other crops for a few years before again setting it to strawberries. The crop is often planted in peach and apple orchards before the latter come into bearing, and in young vineyards. The Aroma berry

has been found superior in flavor, yield, and shipping qualities to any other variety yet tried, and is grown almost exclusively. Strawberries are grown mainly in connection with other crops. There are few berry fields as large as 20 acres, and the greater number of them range from 2 to 8 acres. In these smaller fields the labor, except at picking time, is performed principally by the grower and his family. The average yield of strawberries for a series of years is probably between 75 and 100 24-quart crates per acre, and the selling price between \$1 and \$2 a crate. The cost of growing strawberries until the first crop is ready to pick is said to be about \$50 an acre. Fruit growers' associations at Butterfield, Monett, Purdy, and Cassville attend to the packing and marketing of the fruit. There have been many failures in strawberry growing, attributable largely to lack of preparation or to inexperience on the part of the grower. Those who have followed proper methods have usually been successful, and a few growers have made large profits.

Much less attention is given to grape growing in Barry County than in some of the near-by sections, although the soil and climatic conditions seem equally favorable. A considerable acreage of Moore Early grapes has recently been planted. The census reports the production of 88,774 pounds of grapes in 1909.

Good crop rotations are not followed to as great an extent as in many other parts of the State, owing to the difficulty of arranging satisfactory rotations rather than to a lack of understanding of their value. On the bottom lands and on the upland areas where clover can be successfully grown the rotation most commonly followed consists of corn for one or two years, followed either by wheat and clover or by oats to be succeeded by these crops. Newly cleared land is preferred for strawberries, and some fields are abandoned after one or two plantings of this crop. The more successful farmers, however, build up the soil by growing legumes or by pasturing the land, and put it again into strawberries.

Commercial fertilizers are employed to some extent in Barry County, and their use is steadily increasing. Upland to be used for wheat is generally fertilized. When wheat is to be followed by timothy or clover, raw bone meal is often applied at the rate of about 100 pounds per acre. If timothy or clover is not to follow the wheat, finely ground steamed bone is preferred to the raw bone meal, to be applied at about the same rate. Some farmers, before the shortage of potash caused by the war, used a 2-8-2¹ or a 1-8-2 mixture in applications of 75 to 125 pounds per acre. Fertilizers analyzing 2-8-2 or 2-10-2 are used to some extent on corn, being applied at the rate of 75 to 100 pounds per acre with a fertilizer attachment on

¹ Percentages, respectively, of nitrogen, phosphoric acid, and potash.

the corn planter. Some berry growers use 200 to 300 pounds of a 3-8-5 mixture per acre, but many do not use any commercial fertilizer. On tomato land some farmers use 200 to 400 pounds of a 3-8-5 mixture per acre, but most growers prefer a good grade of stable manure for this crop. The growing of cowpeas and soy beans for building up the soil is apparently becoming more general.

Most farmers keep one or more hired hands during part or all of the year. Much day labor is employed on farms where strawberries, sweet potatoes, tomatoes, and other crops requiring special cultivation are grown. The customary wage is \$1.25 to \$1.50 a day. Laborers employed by the month receive \$20 to \$25 and board. Farm hands with a family hired for the season are often furnished a house and garden and paid from \$25 to \$30 a month. Berry pickers are paid 1½ to 2 cents a quart. Much of the berry harvesting is done by women and children, whole families often working in the strawberry fields. The daily earnings range from a fraction of a dollar for children to \$2 or more for efficient adult pickers. Grapes are picked by the basket and tomatoes by the hundredweight.

According to the census of 1910, 69.6 per cent of the area of Barry County is in farms. There are 3,403 farms, averaging in size 102.6 acres, of which on an average 63.8 acres are improved. The average value of all farm property per farm in 1910 was \$3,458, of which the land constituted 63.2 per cent, buildings 15 per cent, implements 3.4 per cent, and domestic animals 18.3 per cent. Seventy-four per cent of the farms were operated by owners in 1910, as compared with 71.7 per cent in 1900. Eighty-five per cent of the tenanted farms are operated on a share basis.

Land prices in Barry County range from \$5 to \$50 an acre. Of nearly 5,000 acres of farm land sold in 70 transactions during the years 1914 to 1916, principally in 40 and 80 acre tracts, approximately 20 per cent was sold for \$10 or less an acre, 50 per cent for \$20 or less, 25 per cent for \$50 or less, and only 5 per cent for more than \$50 an acre. Land valuations, as indicated by these sales, are considerably lower than prices asked for the same grade of land in adjacent counties which have advertised their resources more extensively.

SOILS.

The upland soils of Barry County are residual in origin, consisting of material formed through the weathering of the underlying rocks. The soils which occupy the first bottoms and terraces of the larger streams are alluvial. They consist of material washed from the uplands and deposited over the flood plains of the streams by overflow waters. The soils that occupy the small, narrow valleys and

strips along the outer edge of the main valleys are largely colluvial, having reached their present position through the gradual movement, chiefly by running water and gravity, of soil and rock particles down the slopes.

The soils have some characteristics not attributable to the rocks from which they are derived. Dark-colored organic matter has accumulated in places, giving the soils a darker color. In other places deficient underdrainage, through lack of aeration and resulting oxidation, has imparted a light color to the soils. The forested types in most places have light-colored surface soils, while soils derived apparently from the same source, but occurring in prairie areas, are generally dark in color. Mottlings in the subsoil, especially where drab and gray colors are pronounced and are confined to a belt or layer, usually indicate restricted or deficient underdrainage. On the other hand, the soils having uniformly brown or reddish-brown subsoils have good underdrainage. Differences in the weathering of the same rock material result in important differences in the resulting soils. On south slopes, where alternating limestone and chert beds are exposed, the soils are generally quite stony or gravelly, with a low percentage of fine earth, while on the north slopes soils of the same derivation carry a much higher percentage of clay.

The soils of the county are predominantly silty with clay or silty clay subsoils and very little sand in either soil or subsoil, with the exception of the Boone series, and with a high percentage of chert gravel and stones in the soil, subsoil, or upper substratum, or in all three. The stony soils occur in the areas of rolling topography; the stone-free soils or those with small percentages of stone in areas of smooth topography.

In other characteristics there is a close relation of the soils to the topography, closer indeed than to the slight variations of the rock. The most striking characteristic of the soils of the smooth parts of the county, aside from those already mentioned, is the practically universal compaction of the subsoil. In some cases this is accompanied by a certain amount of cementation, but the formation of distinct hardpans by cementation has not taken place except locally. The compaction retards the subsoil drainage but does not prevent it, and its effect on the drought-resisting power of the soils seems to be slight. Along with the compaction the lime content of the soil and subsoil seems to be quite low. This has its effect on the growth of deep-rooted and lime-loving plants like the clovers and alfalfa. It is a matter of common knowledge in the county that red clover and alfalfa do not do well on the gray silty soils of the smooth lands.

In the hilly areas, on the other hand, the subsoils are not compacted, the lime content, while low, is not so low as in the soils of the

smooth lands, and the subsoil color is deeper with a higher percentage of red.

These differences in soil correspond rather closely to the differences in upland vegetation. The soils with the compacted subsoils support a growth of post and blackjack oak, while those without the compacted layer support a growth of red, white, and black oak.

Barry County lies well toward the western margin of the Ozark region. The oldest rocks which outcrop belong to the Jefferson City limestone. In this region the thickest and most important bed of this formation consists of a pale-yellow to light-gray, fine-grained soft limestone called "cotton rock." Some of the beds of the formation are rather thick, but there are also thin, shaly beds of the same material, and thin layers of greenish and gray shale. Distributed through the Jefferson City formation are lenses and nodules of chert, but in much smaller quantities than in the overlying formations. Outcrops of this formation occur along White River and its tributaries, along Piney Creek, and along Flat Creek almost to McDowell. They also occur along Rock House Creek almost to Mineral Spring and along Jenkins Creek to Leann. This formation underlies the greater part of the region classed as Rough stony land. From it is also derived the greater part of the Hagerstown silt loam, especially the larger areas along White River and along Flat Creek.

Immediately above the Jefferson City formation is a thin layer consisting of gnarled, unevenly bedded, cherty limestone, with some masses of sandstone. This formation has, however, with a few exceptions, been either included with the Rough stony land or the high basins.

Overlying these beds are the rocks of the Mississippian group. These consist of gray to bluish-gray, rather coarse grained, fossiliferous limestone, with alternating thinner beds of chert. There are also within the limestone beds chert lenses and nodules. The Mississippian limestone is the most extensive and important soil-forming rock of the county.

Exposure of the rock beds to weathering and erosion results in the removal of a large part of the calcium carbonate, leaving the slopes covered with fragments of the more resistant chert and other impure or less soluble constituents of the limestone. These chert fragments are embedded in a gray to yellowish-gray silt loam near the surface and in red, plastic clay beneath. At a depth of usually not more than 3 or 4 feet below the surface a mass of chert fragments is in most places encountered. Below this a red, plastic clay containing chert fragments extends to the next layer of chert. In many places these alternating clay and chert layers extend to depths of 10 to 30 feet or even more before massive limestone beds are reached.

Deep drillings at Granby, in Newton County, indicate that the Mississippi limestone is there 260 to 380 feet in thickness.¹ That part of it which outcrops over this region is variously known as the Burlington, Keokuk, Chouteau, or Boone formations, these names being given to the different layers or beds which make up the formation. The upper part of this formation carries a somewhat higher percentage of chert than the lower part. Outcrops of the alternating limestone and chert beds are rarely seen on gentle or even on steep slopes, on account of the surface covering of loose chert and soil, but in many places where the larger streams have recently cut into the adjacent slopes outcrops and ledges may be noted.

From the more cherty layers of this formation have been derived the soils of the Baxter series and in part the soils of the Lebanon series. From the less cherty beds have been derived the soils of the Hagerstown series.

The Lebanon soils have gray to grayish-brown or light-brown surface soils and a mottled gray, drab, and brown compact layer in the upper subsoil. The lower subsoil is light brown or reddish brown to red and contains large quantities of chert. This series is closely related to the Baxter series in origin, but owing to its more nearly level topography the compact mottled layer has been formed, apparently, by fine material being carried from the upper part of the soil section by percolating water. The surface soil, especially of the silt loam type, probably contains in places residue from shale and sandstone beds which formerly covered the area, but which has been almost removed by erosion. Two members of the Lebanon series are mapped in Barry County, the silt loam, with a depression phase, and the gravelly loam.

The soils of the Baxter series have characteristically light-brown to grayish-brown or reddish-brown surface soils, with a dull-red to red subsoil. Chert fragments, except in the silt loam type, are abundant throughout the soil section. These soils are distinguished from those of the Clarksville series by the red instead of yellow subsoil and by a soil color containing more gray or brown than that of the Clarksville, in which series the surface soil is pale yellow or yellowish brown. In this county small areas of soil, especially on the south slopes and closely associated with the Jefferson City limestone, although approaching the Clarksville soils in characteristics, have been included with the Baxter series. Three types of the Baxter series are recognized in this county—the silt loam, stony loam, and gravelly loam. The gravelly loam has been further separated into the typical soil and a smooth phase.

The soils of the Hagerstown series characteristically have brown to reddish-brown surface soils and a reddish-brown to dull-red sub-

¹ Geology of the Granby area, Vol. IV, 2nd Series., Mo. Bu. Mines.

soil. They are derived from the more massive limestone beds of the region. Two types, the Hagerstown silt loam and gravelly loam, have been recognized in this area. A slope phase of the latter type is separated. The predominant soil on the uplands of the high basins is the Hagerstown. In these areas it is derived from the Jefferson City limestone formation and has in places a yellowish-brown rather than a reddish-brown color.

The youngest rock formations found in the county consist of thin-bedded, shaly layers of fine-grained gray to reddish-brown sandstone. This probably belongs to the Lower Coal Measures, and it gives rise to the soils classed with the Boone series.

The Boone soils have light-gray to yellowish-brown surface soils, and yellowish to reddish-brown sandy clay or mottled subsoils, overlying sandstone. Two types are recognized in this county, the very fine sandy loam, with a rolling phase, and the stony loam. Around the edges of the basins a few small sandstone areas occur. The soils of these areas, although of different origin, have been included with the Boone soils. The sandstone giving rise to these small areas of soil either represents portions of a thin bed laid down between the "cotton rock" and the more cherty overlying beds, or may be fragments of a much more recently formed and extensive bed which has been removed by erosion, except where deposited in old valleys and basins and so protected by the surrounding more resistant beds.

The Gerald series has dark-brown surface soils grading into lighter colored brown or gray material. This in turn is underlain rather abruptly by a heavy compact, mottled layer which becomes slightly less compact with increasing depth. This soil is probably derived largely from shale beds which formerly covered the limestone and chert beds. Only one type, the silt loam, is recognized in this area.

The Huntington soils are alluvial stream-bottom soils having brown to dark-brown surface soils and a somewhat lighter colored subsoil. The material has been washed from the uplands and similar soils occurring along the streams outside the county. Three types—the gravelly loam, very fine sandy loam, and silt loam—are encountered in this county.

The Dunning soils differ from the Huntington in having a dark-gray to black color in the surface soil, with mottled grayish and brownish heavy subsoils. One type, the silt loam, is recognized in this area.

The Riverton soils are characterized by the brownish color of the surface soils and the reddish-brown color and friable stratum of the subsoils. They occupy second bottoms of good drainage, and consist of material washed largely from limestone soils. In Barry County two types are mapped—the silt loam, with a high phase, and the gravelly loam.

Rough stony land is practically nonagricultural, except for a small acreage of pasture.

The following table gives the actual and relative extent of the several types of soil identified and mapped in Barry County. The distribution of the soils is shown on the accompanying map by means of colors.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Baxter gravelly loam.....	103,232	28.9	Riverton gravelly loam.....	9,152	1.8
Smooth phase.....	43,072		Boone very fine sandy loam.....	3,520	1.6
Baxter stony loam.....	78,656	15.5	Rolling phase.....	4,800	
Rough stony land.....	71,168	14.1	Riverton silt loam.....	4,096	.9
Lebanon gravelly loam.....	66,304	13.1	High phase.....	512	
Lebanon silt loam.....	31,552	6.3	Hagerstown silt loam.....	4,480	.9
Depression phase.....	128		Boone stony loam.....	2,432	.5
Huntington silt loam.....	22,848	4.5	Huntington very fine sandy loam.....	2,112	.4
Huntington gravelly loam.....	22,848	4.5	Gerald silt loam.....	1,280	.2
Hagerstown gravelly loam.....	16,000	4.4	Dunning silt loam.....	832	.2
Slope phase.....	6,272		Total.....	506,240
Baxter silt loam.....	10,944	2.2			

LEBANON GRAVELLY LOAM.

The Lebanon gravelly loam is a light-gray to light-brown gravelly silt loam which at about 6 inches passes into pale-yellow or yellowish-brown gravelly silt loam, and this at 10 to 16 inches into a mass of angular chert fragments with interstitial material consisting of mottled gray or drab and yellowish-brown, compact silty clay. When very dry this mottled, compact layer is quite hard, approaching a hardpan, and it undoubtedly has an important influence upon the movement of moisture and air through the subsoil. When moist, however, it crumbles readily. In this type the heavy silty clay or clay layer found in the Lebanon silt loam between the surface soil and the compact layer, is almost or entirely absent. The compact layer, which usually has a thickness of 6 to 10 inches, can often be seen near or along the bottom of gullies and in road cuts. Below it the chert is abundant and often embedded in red clay. Red clay, however, does not occur above the compact layer in the typical soil, although the chert may be red. On slopes, especially where steep, near the small stream valleys this type grades into the Baxter gravelly loam, and as mapped in many places it includes areas of that soil too small to be outlined on the soil map. The Lebanon gravelly loam includes from 20 to as high as 50 per cent or more of chert fragments scattered over the surface and through the soil and subsoil. These are in most places small, ranging in size from

one-half inch to 2 inches in diameter, are often reddish brown, and are somewhat rounded and easily crushed. Over the greater part of the type they are not sufficiently abundant to interfere seriously with cultivation. In places, however, the gravel is larger, some of it having a diameter of as much as 6 or 8 inches, the larger gravel in most places being sharp and angular and hard. Plate I, figure 1, shows a field in which soil of this type carrying a high percentage of large angular chert fragments has recently been planted to strawberries.

In extent and crop value this is one of the most important soils of the area. Large areas extend across the northern and western parts of the county, covering a large part of the more highly developed section. It surrounds the Lebanon silt loam areas, extending from that type on the crests of the divides to the Baxter gravelly loam along the larger stream valleys or to the alluvial or colluvial land along the smaller streams. On many of the divides the silt loam is not encountered, and the gravelly loam extends entirely across the upland.

The surface is gently undulating to rolling, and the surface drainage, except in the case of a few small, almost flat areas, is good, being as a whole somewhat better on the gravelly loam than on the silt loam. Underdrainage, however, on account of the compact layer in the subsoil, is not good. The soil of this type and of the silt loam is sour, the degree of acidity being greatest in the flat areas having the poorest underdrainage and least where the slope is greater. The compact layer of the Lebanon soils also makes them much less resistant to drought than are the adjacent Baxter soils, in which the "hardpan," or compact layer, is lacking. Corn, and to some extent other crops, on this type show injury from drought much more quickly and give much lower yields in dry seasons than on the adjacent Baxter gravelly loam.

Although not a very productive type, the Lebanon gravelly loam is of considerable importance agriculturally. After the bottom lands were occupied, this type and the associated Lebanon silt loam were the next soils to be brought under cultivation when the county was first settled. The greater part of these types has been under cultivation for 30 or 40 years, and in many cases longer. Being largely prairie lands or forested only with scattered clumps of trees and free from rocks and gravel in sufficient quantities to interfere seriously with cultivation, they were quickly fenced and farmed. Nearly all the Lebanon soils are under cultivation at the present time. Where forested the growth consists principally of post oak, the trees in many places being much taller than the typical post oak of other areas. On the more rolling and better drained parts of the gravelly loam type, especially where it approaches the Baxter soils, there is

considerable blackjack oak and some hickory and black oak. Sumac, hazel bushes, wild grape, buckberry, and other shrubs and vines are common.

The Lebanon gravelly loam, like the silt loam, is devoted principally to the general farm crops of this region, corn, wheat, oats, timothy, and pasture grasses. For pasturage, bluegrass, white clover, orchard grass, redbtop, and lespedeza are grown. Red and alsike clover are grown to some extent in the better drained areas. Sorghum, feterita, kafir, and Sudan grass are grown quite extensively for roughage. Cowpeas have a recognized place in the crop rotation on many of the farms. Soy beans are grown to some extent.

General farming, with special attention given by many farmers to dairying, is the form of agriculture most extensively developed on the Lebanon gravelly loam. Where the agriculture has taken this form of development farm improvements are good (Pl. I, fig. 2). Over part of the area covered by this type the farms are small, ranging from 20 to 80 acres, and more attention is given to orchard fruits, small fruits, vegetables, and poultry.

This type is also used extensively for strawberries. Grapes are grown to some extent on this soil in Barry County, and in Newton County it is used quite extensively for the planting of commercial vineyards. Sweet potatoes and Irish potatoes are both rather important crops in the vicinity of Monett. Tomatoes for market and to supply local canneries are grown on a considerable acreage. Blackberries and raspberries also receive some attention.

In general, crop yields on the Lebanon gravelly loam, on account of its somewhat better surface drainage and underdrainage, are slightly higher than on the Lebanon silt loam. Corn yields, where the soil is well handled, probably average between 20 and 25 bushels per acre. Wheat yields 12 to 15 bushels and oats 25 to 35 bushels per acre. Strawberries yield about the same as on the silt loam. The methods of preparation and cultivation followed on the silt loam are practiced on this type, and about the same application of fertilizer is made.

Land values on this type vary greatly, depending upon improvements and distance from public roads and railroads and from the more important towns. With the exception of land in the immediate vicinity of Monett, the best improved farms on soils of this type can be bought for \$40 to somewhat over \$50 an acre. Where improvements are not so good prices range from \$30 to \$40, and unimproved as low as \$20 an acre.

The productiveness of the Lebanon gravelly loam as a whole has been seriously impaired by continuous cropping. The first needs for its improvement are organic matter and nitrogen. These can be added by putting the land in grass and pasturing it, by applying

manure, by plowing under all available straw, trash, and stalks, and by growing cowpeas and soy beans. Good surface drainage should be maintained, and where the soil is to be used for clover the use of ground limestone is advantageous.

LEBANON SILT LOAM.

The Lebanon silt loam is a light-brown or grayish-brown to nearly white, floury silt loam, which at about 8 inches passes into pale-yellowish or light-brown silt loam or silty clay loam, usually becoming somewhat heavier with increasing depth. At 14 to 16 inches this grades into a light-brown or yellowish-brown clay loam or clay, the transition to the heavier soil often being rather sharp. At depths ranging from 16 to 24 inches slight mottlings of gray and drab are encountered, and these rapidly increase until the material is distinctly mottled with gray and brown. This mottled layer is compact and usually contains angular chert gravel. When very dry it is quite hard and has the appearance of a hardpan layer, and undoubtedly it has an important influence upon the movement of moisture and air. When moist, however, it is easily crumbled. Below the compact layer, which usually has a thickness of 6 to 10 inches, gravel beds, without the mottled compact interstitial clay, usually are present. Red clay frequently is found in the cherty substratum, but never above the compact layer. In places this type carries a small quantity, usually not over 20 per cent, of small fragments of chert on the surface and in the subsurface. Some areas in which the chert is much more abundant are, on account of their small size, included with this type, although they consist of the Lebanon gravelly loam.

In the vicinity of Exeter, in places along the public road between Butterfield and Purdy, north of Madry, and near Wheaton, there are areas of this type in which the surface soil is slightly darker in color, the subsoil more silty and friable, and the compact layer less pronounced. These areas are somewhat more productive than the typical Lebanon silt loam, and approach rather closely in appearance and crop value the Clarksville silt loam, but on account of their small extent and close association with the Lebanon they are included with it.

The largest area of the Lebanon silt loam extends as an almost continuous body from Kings Prairie south to Wayne, following the crest of the divide which forms the watershed between the eastward and westward flowing streams. Other smaller areas extend from this main divide along the divide between Shoal Creek and the streams which flow southwest through McDonald County, and between Shoal Creek and its larger tributaries which enter it from the east. From Kings Prairie a small body extends eastward following the

divide between Little Flat and Jenkins Creeks on the south, and the tributaries of Spring River on the north. The type occurs principally as long, narrow strips following the crests of the ridges, but in some places small areas occur as benches well down the slopes. These in most cases are too small to be shown on the soil map, and are included with the associated gravelly loam type.

The topography is almost level to undulating or gently rolling. In the vicinity of Purdy and Butterfield there are some nearly flat areas in which the surface drainage is not good and underdrainage also is somewhat deficient.

This type is of considerable importance agriculturally, practically all of it being under cultivation. After the clearing and improvement of the larger stream valleys, this was the next soil to be brought under cultivation when the county was first settled. The greater part of the type has been under cultivation for 30 or 40 years and in some parts of the county it has been farmed for a longer time. It is devoted principally to the general farm crops of the region. Corn, wheat, oats, timothy, and pasture grasses are the most important crops grown. Bluegrass, white clover, orchard grass, and redtop are grown for pasturage. Red and alsike clover are grown to some extent on the better drained areas. Sorghum *feterita*, kafir, and Sudan grass are grown quite extensively for roughage. Cowpeas and soy beans are grown, the former having a place in the rotations practiced on many farms.

Of the specialized crops by far the most important is strawberries. During the season of 1916 over 60 carloads were shipped by the Berry Growers' Association from Butterfield, and smaller shipments were made by the associations at Monett, Cassville, and other points. A large part of these berries were grown on the Lebanon silt loam near Butterfield and Purdy.

The average yield of corn on this type is probably about 20 bushels per acre, although much larger yields are frequently obtained. Wheat, if well fertilized, yields 10 to 15 bushels and oats 20 to 35 bushels per acre. Strawberry yields have a wide range, varying from very low to as high as 200 crates per acre. Experienced growers estimate the average yield for a series of several years at about 75 crates. Sweet potatoes yield 75 to over 150 bushels per acre, and Irish potatoes 50 to over 100 bushels.

Prices for land of this type where well improved and located on public roads or near a shipping point range from \$40 to \$50 an acre. Where poorly drained and unimproved the land is valued at \$20 to \$30.

This type, where farmed for any considerable length of time, has been in many cases seriously injured by continuous cropping to corn or to small grains. For its improvement it requires about the same treatment as the gravelly loam. Good surface drainage should be

supplied, and ground limestone applied to fields which are to be used for clover.

Lebanon silt loam, depression phase.—The Lebanon silt loam, depression phase, consists of a light-gray to drab or slightly darker colored silt loam to a depth of 4 or 5 inches, below which it grades into an almost white, loose, flourlike silt loam. At a depth of 26 to 30 inches or more this is underlain by compact clay of mottled-gray or bluish-gray, brownish, and drab color. This soil is mapped as the Lebanon silt loam, depression phase, for convenience in handling such small areas on the soil map. It is typical Guthrie, a silty, poorly drained limestone soil.

The phase occurs in small, shallow, isolated depressions which have no outlet. The surrounding soils are in most cases the Lebanon or Baxter. The drainage is imperfect.

Small areas of this phase are used for corn, but the greater part of it is too wet for cultivation. It is not extensive, and is of little importance.

BAXTER STONY LOAM.

The Baxter stony loam differs from the Baxter gravelly loam chiefly in the larger size of the chert fragments and the greater abundance of rock outcrop. The typical soil is a light-brown to grayish-brown stony silt loam. At 6 to 10 inches the color is lighter brown, yellowish, or reddish gray, the interstitial material gradually becoming heavier and redder with increasing depth. On the crests of the ridges the red-colored silt or clay is often reached at a depth of 15 or 20 inches, but on the slopes it usually lies much deeper. It is encountered in most places at a depth of not over 30 inches. Over the surface and through soil and subsoil there are many chert fragments, the quantity ranging up to about 60 per cent. While the chert fragments average larger in size than on the Baxter gravelly loam, small fragments are generally present.

The light-colored surface soil of many areas is similar to the Clarksville, but examinations of the subsoil show that at least the greater part of it is red, and therefore Baxter rather than Clarksville material. There are, however, small included areas of the Clarksville stony loam. The number and size of such areas is not definitely determined, as, owing to the very slight difference between the stony and hilly areas of the two soils, their separation on the soil map is impracticable. In general, the Baxter silt loam and gravelly loam are stronger soils than are the corresponding Clarksville types. The Baxter stony loam is inherently a more productive soil than the Clarksville stony loam, but in the eastern part of Barry County where both types occur they are not used extensively enough for the difference in productiveness to be shown by crop yields.

The largest areas of this type lie in the east-central part of the county along the lower course of Flat Creek and its tributaries, and in the southwestern part of the county. Small areas of this soil are included with the Baxter gravelly loam, from which it differs only in carrying a higher percentage of stone and in having a rougher topography. Likewise small areas of the gravelly loam are included with the stony loam type. The topography of the Baxter stony loam is hilly, consisting of high, sharp ridges, deep, narrow gullies, and steep slopes (Pl. II, fig. 1). The surface drainage is excessive, and underdrainage good.

This is an extensive type, but agriculturally it is relatively unimportant. Probably not over 5 per cent is under cultivation or over 20 per cent cleared for pasture. The remainder is forested, mainly with a growth of large red, black, and white oak. In places on the tops of ridges occasional post and blackjack oak trees may be present. The greater part of the largest timber, except that in the most inaccessible areas, has been cut for lumber or ties.

When the land is cleared for pasture the native wild grasses, lespedeza, bluegrass, and white clover grow voluntarily. Some stockmen have obtained excellent results by seeding to orchard grass. Where the type is used for corn, yields about as good as those on the Baxter gravelly loam are obtained, though the difficulty of cultivation, on account of the rough topography and the stony nature of the soil, is much greater. Several small fields of tomatoes are grown for local canneries. Fair yields of tomatoes of good quality are obtained. Strawberries do well.

Land of this type sells at \$8 to \$15 an acre, according to location, topography, and improvements.

If held in large tracts, cleared, and a good sod established this type would seem to offer opportunities for the development of an important cattle or sheep raising industry. Plate II, figure 2, shows land of this type partly cleared for grazing.

BAXTER GRAVELLY LOAM.

The Baxter gravelly loam is a light-brown or grayish-brown to almost gray gravelly silt loam, which passes at 6 to 8 inches into a lighter brown, yellowish, or reddish gravelly silt loam, which is somewhat heavier in texture. This, in turn, overlies at 15 to 18 inches a mass of angular chert fragments mixed with dull-red or brick-red, friable clay. The red color increases in intensity with increasing depth, and in nearly all cases becomes distinctly red within 30 inches. Angular chert fragments ranging in size from one-half inch or less to 4 or 5 inches in diameter and in amount probably from 25 to over 60 per cent, are scattered over the surface and dis-

tributed through both soil and subsoil, the amount of coarse material usually increasing with depth. The rock fragments often include white, sharp angular chert, spoken of locally as "white flint," but the greater part consists of irregular, somewhat rounded masses of reddish-brown, soft, porous, cherty material, locally called "red flint." Typically there is no noticeable compact layer corresponding to that of the Lebanon soils, and very little mottling in the subsoil.

The most important variation in this type is in the amount and kind of chert present. This ranges from quantities so small as scarcely to interfere with cultivation to amounts sufficient to cover the entire surface to a depth of several inches. The size and kind of chert fragments also vary considerably within short distances in many places, and the cherty layer often lies very near the surface. In general, the more cherty areas are those of more broken topography. Southern slopes are also usually more cherty than northern slopes, and here the rocks often appear to be more whitish. Included areas have a deep-brown to reddish-brown color like the Hagerstown soils. Good examples of this are to be found at Monett and along the tributaries of Shoal Creek, in the northwestern part of the county. Such areas are more productive than the average of the type. Some areas, especially near the more broken country have a light-gray to almost ashy gray color, and the subsoil is of a lighter red color. This lighter colored soil occurs largely on southern slopes. Where the type adjoins areas of the Lebanon soils there is frequently a slight mottling in the subsoil, such areas really representing a transitional soil between the two types. Some small bodies of the Lebanon gravelly loam are included with this type.

The principal areas of this soil extend as narrow strips between the bottom lands along the narrow streams and the more nearly level uplands throughout the northwestern part of the county, the largest areas being found adjacent to Clear Creek and to Shoal Creek and its tributaries. Similar strips extend along Little Crane Creek in the northeastern part of the county. Throughout the central part along a large part of the upper course of Flat Creek, and along Gunter and Little Flat Creeks, it is the predominating type. In the southwestern part of the county it is found along Sugar Creek and northwest of Washburn on the crests of the ridges.

The topography varies from undulating and rolling to hilly and rough. The larger bodies of the more nearly level areas are mapped as a smooth phase. In general this smoother land occupies the divides, but breaks sharply around stream heads and slopes. Much of the type is almost too steep for cultivation. Some of that cultivated would be considered too steep for cultivation in regions where the soils are more inclined to wash.

The surface drainage is good to excessive, but serious gullying or erosion, even on steep slopes where cultivation is directly up and down the slope seldom takes place. This absence of serious erosion is due to the porous nature of soil and subsoil, and to the protection given by the surface covering of gravel. This type resists drought much better than do soils having the compact layer in the subsoil, such as the Lebanon soils.

This is an important type agriculturally, although probably less than one-half of it is under cultivation. Being heavily timbered and having a hilly topography and a stone-covered surface it is difficult to put under cultivation, and is used only after the stream bottoms and more nearly level uplands are taken up. Where uncleared it supports a heavy growth of large black and red oak, some post oak, and in many places, especially on north slopes, white oak. Hazel, sumac, blackberry, and wild grape are abundant. Near the stream bottoms there is in places a growth of elm, walnut, maple, and papaw. On the upper edges of this type adjacent to the Lebanon soils, post oak, blackjack, and some hickory are found.

On this type corn, red clover, wheat, and pasture grasses are the most important crops. The soil is used extensively for the production of orchard fruit, small fruit, tomatoes, melons, and tobacco.

As the adaptation of this soil to clovers and to pasture grasses, especially orchard grass, becomes recognized the dairy industry receives increasing attention. Some of the largest and most productive apple orchards in the county are on this type. In the adjacent counties this soil is used quite extensively for growing peaches, strawberries, and grapes, and from the success attained there it is believed that large areas of the type in Barry County could be successfully used for the same purposes, the greatest difficulty being the distance of the greater part of it from shipping stations.

During the progress of the field work several small patches of tobacco for home use were noted. At one time tobacco was grown commercially in a small way in this county. Burley tobacco was grown principally, and yields of 700 to over 1,200 pounds of good quality are said to have been obtained. It is believed by men acquainted with the tobacco industry that if the proper attention were given to it a profitable tobacco business could be developed on this soil in Barry County. Cotton has also been grown in a small way, nearly 100 acres being planted to that crop in 1889. None is grown at the present time. The soil best suited to this crop, apparently, is the warm hill slopes of the Baxter gravelly loam. During the progress of the work numerous small patches of peanuts were seen, planted for family use. The Baxter gravelly loam seems well suited to this crop, and it is believed that if given proper attention it might be made a crop of importance either as a sale crop or as field forage for

hogs. Alfalfa has been successfully grown in a few fields on the best part of this type.

Corn yields 15 to 40 bushels per acre, with an average in favorable seasons of about 30 to 35 bushels. Only the smoother parts of the type are used for wheat, the yield ranging from about 10 to 15 bushels per acre. Clover yields two cuttings of three-fourths ton to 1½ tons each. Where a seed crop is harvested three-fourths bushel to 3 bushels of seed per acre are obtained.

Two-horse walking plows are used principally in breaking soil of this type. Disk and spring-tooth harrows are used in preparing the soil for planting. Owing to the hilly topography and gravelly nature of the land one-horse cultivation is extensively practiced. In clearing land goats are used extensively on the larger farms, but on the smaller farms sprouts are cut by hand, about 3 years being required in either case to kill the roots. The cost of removing the surface stones ranges from \$5 to over \$10 an acre, but the greater part of the type is farmed without the stones being removed.

Land in which this is the predominating soil sells at prices ranging from \$20 to \$35 an acre. Much of it, quite as well suited for orchards and small fruits as are the more extensively advertised lands of adjacent counties, sells for lower prices.

This soil, like those of the Lebanon series, is in need of organic matter. The growing and plowing under of legume crops is beneficial. Sheet erosion should be checked by contour plowing; that is, plowing along rather than up and down the slope. Much of the unused land of this type could profitably be cleared and put into cultivation or used for pasture.

Baxter gravelly loam, smooth phase.—The Baxter gravelly loam, smooth phase, is smooth only in contrast with the hilly topography of the typical soil. It is rolling to hilly, but the hills are neither so steep nor so high as are those of the main type. There is a general gradation in the topography of the Baxter soils from the low hills and gentle slopes in the northwestern part of the county to the higher hills, steeper slopes, and more broken country toward the south and east. There is also a gradation in the quantity of gravel present and in the number of areas in which the surface and upper subsoil is gray and the contained chert white and sharp, the more hilly regions carrying the greater quantity of gravel and having more numerous areas of gray soils. Crop yields and land values are somewhat higher in the more nearly level areas.

In general, the occurrence of the smooth phase of the Baxter gravelly loam is indicated by the public roads, which on this phase follow the land lines, but in the more hilly areas follow either stream divides or stream valleys. A rather arbitrary separation of this phase is shown on the soil map by cross lines. This phase is more

easily cultivated than the main type, owing to its gentler slopes, and relatively more of it is farmed.

BAXTER SILT LOAM.

The Baxter silt loam consists of a light-brown to brown silt loam, which grades into a pale yellowish brown silt loam to silty clay loam, the texture becoming gradually heavier with increasing depth. At depths of about 16 to 20 inches slight mottlings of gray and drab appear, and these become more numerous with increasing depth, the soil between the mottlings assuming a deep reddish brown to deep-red appearance. As seen in ditch banks or other exposures, it has a distinctly speckled appearance. The mottled layer is quite friable, and when thoroughly pulverized closely resembles in both color and texture the Hagerstown silt loam, with which this type frequently is associated. Below a depth of 26 to 30 inches the mottling becomes less pronounced. The soil is in places light brown to grayish brown or yellowish brown in color and lighter in texture. Very little gravel is found in the soil or subsoil. In a few places gravel is encountered below about 30 inches. On Kings Prairie and north of Wheaton areas closely related to the Hagerstown silt loam and southwest of Monett an area closely related to the Lebanon silt loam is included with this type.

The largest and best developed area of this type extends as a continuous body from Washburn Prairie School northeast to Horner School, forming the divide between streams which flow north into Flat Creek and those which flow southeast into White River. Another body lies about 2 miles northeast of Seligman. Smaller areas lie both north and south of Wheaton, between Kings Prairie School and Monett, and between Monett and Purdy. The largest area of this type in the northern part of the county extends westward from a point about $2\frac{1}{2}$ miles southwest of Monett.

The areas in the southern part of the county are almost level to very gently undulating, and form stream divides. The other areas of the type occupy broad, shallow, basinlike depressions or parts of such depressions, around the heads or along the upper courses of small streams.

Surface drainage of the greater part of the type is very good, although small areas of poorly drained soils are included with the type, and the underdrainage seems to be better than that of the Lebanon soils.

Practically all this type is under cultivation. It is of considerable importance locally, but on account of its small extent is not important in the general agriculture of the county as a whole. The most important crops are corn, wheat, oats, and clover. Yields are better



S7252

FIG. 1.—CHARACTERISTIC TOPOGRAPHY OF LEBANON GRAVELLY LOAM.

Field in foreground recently planted to strawberries. The soil in this field is very gravelly even for this type.



S8593

FIG. 2.—BUILDINGS ON A WELL-IMPROVED FARM ON LEBANON SOILS.

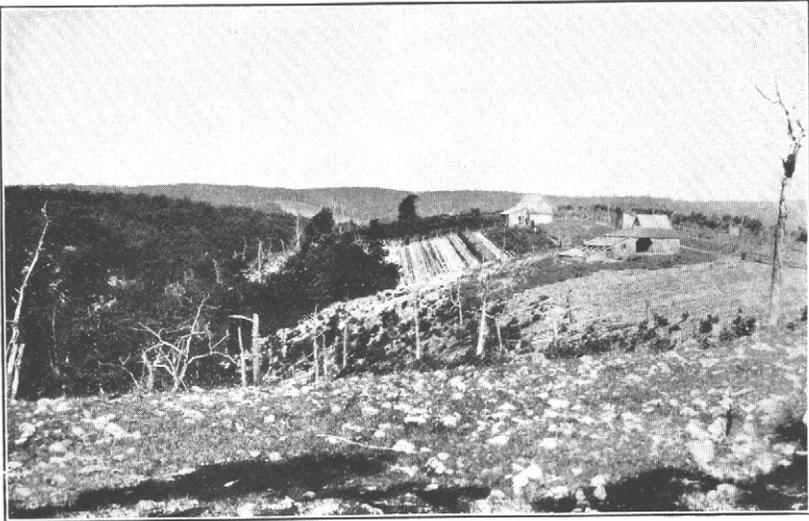


FIG. 1.—BAXTER STONY LOAM, SHOWING ROUGH TOPOGRAPHY.

S8690

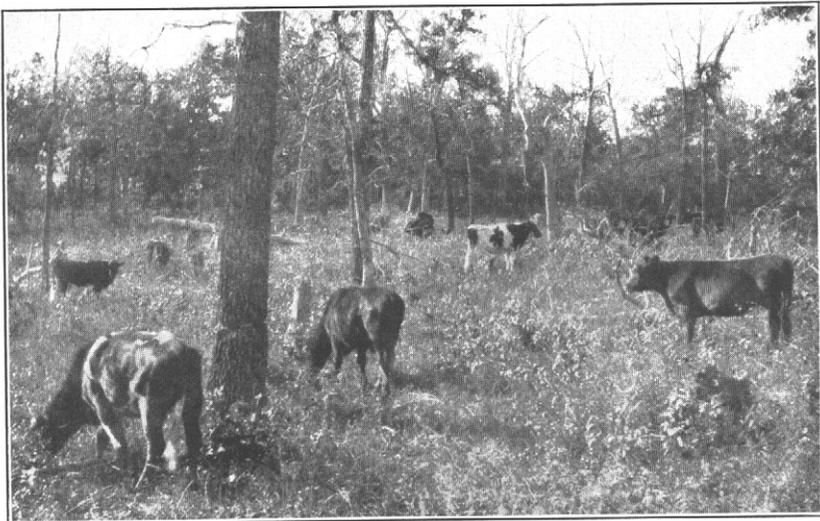
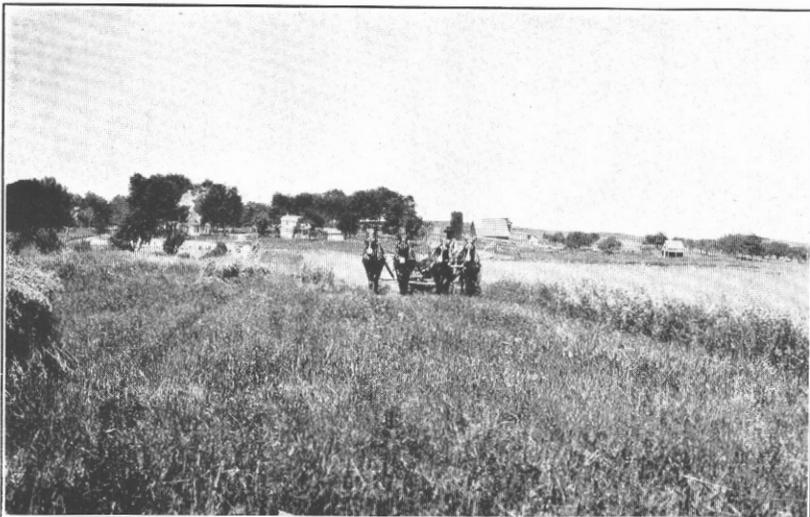


FIG. 2.—BAXTER STONY LOAM; LAND PARTLY CLEARED FOR GRAZING.



S8307

FIG. 1.—HARVESTING FIRST CUTTING OF RED CLOVER ON HUNTINGTON SILT LOAM, NEAR MCDOWELL.



S8592

FIG. 2.—HARVESTING OATS ON TERRACE ALONG FLAT CREEK, NEAR CASSVILLE.

than on the Lebanon soils. Clover does well in the better drained areas. The type is used to some extent for orchards.

Prices are about the same as for the best grade of Lebanon soils.

This type requires about the same treatment as the Lebanon soils. It is in need of organic matter and nitrogen. Pasturing the land, applying manure and growing legume crops, providing good drainage, and adding ground limestone where clover is to be grown are beneficial practices.

HAGERSTOWN GRAVELLY LOAM.

The Hagerstown gravelly loam consists of a light-brown to brown gravelly loam to silt loam grading at 8 to 12 inches into yellowish-brown or reddish-brown heavy silt loam to clay loam. This passes into red clay, which may extend to a depth of 3 feet or more, but in many places beds of chert or layers of limestone are encountered at depths of 24 to 30 inches or less. Scattered over the surface and disseminated through the soil and subsoil are small fragments of angular chert, and in places considerable quantities of reddish-brown sandstone. In many places in this type, especially around the heads of small streams and for short distances below areas of glade land, the soil of included areas is dark gray to almost black, resembling the Gasconade gravelly loam, and in places greenish yellow. In other places the surface soil is quite sandy, such areas approaching the character of soils of the Boone series. In many places, especially around the outer and upper edges of areas occupied by this soil, fragments of sandstone and large irregular chert fragments are abundant. Some of the latter are a sort of cherty conglomerate in which the embedded material consists largely of waterworn gravel. Within the areas of Hagerstown gravelly loam are numerous small areas closely related to the Baxter gravelly loam.

The principal areas of this soil are those on both sides of Flat Creek near Jenkins, and that occurring in a belt about 6 miles wide across the southeastern corner of the county, through the center of which meanders White River. Areas too small to be outlined are included with Rough stony land. The type occurs as irregular areas the largest of which are nearly level or gently sloping, but extend into steeper rocky hill lands on the outer, upper slope and drop off into rough, broken, and eroded steep slopes on the lower side. Drainage is good except in the areas of dark soil around small stream heads. Massive rock beds in places interfere with the under-drainage.

In those parts of the county in which areas of this soil occur it is an important soil agriculturally; in many places it is the only type

under cultivation. Probably 75 per cent of it is farmed. In forested areas the growth consists of post oak, black oak, blackjack, and chinquapin.

Corn, wheat, clover, oats, and pasture grasses are the principal crops. Alfalfa is grown to a very small extent. Yields are not so high as on the typical Hagerstown gravelly loam.

Land values on this type range from \$25 to \$40 an acre.

Associated with the Hagerstown gravelly loam are small areas of a dark, almost black clay loam, overlying, in some cases, the solid limestone at less than 3 feet, and in others a heavy, mottled clay. This soil usually occurs on slopes and in places is subject to seepage in the spring and early summer. It occurs in small areas too small to map, and consists of the Gasconade clay loam. It is a good corn soil, except where very shallow, and is everywhere a good hay or pasture soil. It contains more organic matter and lime than the Hagerstown soils.

Hagerstown gravelly loam, slope phase.—The Hagerstown gravelly loam, slope phase, is a brown to reddish-brown gravelly silt loam of friable nature, underlain at 6 to 15 inches by reddish-brown to dull-red clay loam to clay, without mottling or with only slight mottling and friable in structure. In places mottling similar to that of the subsoil of the Baxter silt loam occurs. Distributed over the surface and through the soil and subsoil are fragments of chert, and in some places of sandstone. These are usually small, ranging from one-half inch to 2 inches in diameter, and are not sufficiently abundant to interfere with cultivation, varying from about 10 to 40 per cent of the soil mass. In most places at depths ranging from 20 to 30 inches, beds of angular chert are encountered in the subsoil. Small areas of dark-gray to black soil usually occurring below limestone ledges and around seepy places are included with this type.

This soil occurs as long, narrow strips in many places bordering the outer edge of the valleys of the larger streams in the central and northwestern parts of the county. In many places it is separated from the present flood plains by a narrow terrace or second bottom, the soil of which is very similar to the Hagerstown gravelly loam. Where too narrow to be outlined as a separate type these narrow terraces are included with this type. On the outer or valley side the gravelly loam covers the lower part of the slope, which is usually not too steep for easy cultivation. As the adjacent gravelly or stony soils are reached the slope usually becomes steeper. These narrow strips, varying in width from only a few rods to almost one-fourth mile, where widest, extend along the larger stream valleys for considerable distances, broken here and there by the entrance into the valley of small tributary streams with accompanying alluvial fans. The most important areas of this type are along the valley of

Shoal Creek and its tributaries, and along Flat Creek. Small areas occur on nearly all the larger streams in the central and north-western parts of the county.

The topography is smooth and sloping, the surface being steepest on the outer and upper side and gently sloping to almost level on the lower side. Drainage is good except in seepy spots where water which follows the underlying rock beds comes to the surface.

On account of its limited extent this is not a very important type. It is practically all under cultivation, and the crops are the same as those grown on the Hagerstown silt loam. The yields probably average somewhat lower. The type is farmed in connection with other soils.

HAGERSTOWN SILT LOAM.

The typical Hagerstown silt loam is a brown silt loam, which at a depth of about 10 to 16 inches grades into reddish-brown silt loam of somewhat heavier texture. With increasing depth the color changes to deeper reddish brown or to dull red, and the texture to silty clay loam or clay of a moderately friable structure. In places the soil is reddish brown. There is little or no mottling in this type. The soil material to a depth of 36 inches or more is usually without gravel, but in places gravel is found embedded in the clay in the lower part of the subsoil.

The principal areas of this type occur along the upper course of Flat Creek, near Washburn. There are smaller areas west and north-west of Seligman, and a few in other parts of the county. The topography is undulating, the slopes being gentle or well rounded. Both surface drainage and underdrainage are good.

On account of its small total area this is not an important type, but as a whole it is the most productive upland soil of the county. It is practically all under cultivation. Where forested it supports a growth of walnut, elm, white oak, and other hardwoods. It is used principally for corn, wheat, and clover. Corn yields 30 to 45 bushels or more and wheat 12 to 18 bushels per acre.

Land values range from \$35 to \$50 an acre. The growing of legume crops, the use of manure, and better crop rotations are needed on this type, as on the other upland soils of the county.

BOONE STONY LOAM.

The Boone stony loam consists of fine and very fine sandy loam areas in which fragments of sandstone are so abundant as to interfere with cultivation. It occupies hilly areas and steep slopes. In places it forms the steep slopes of ridges, the Boone very fine sandy loam or its rolling phase occurring on the crest of the ridge above it.

Only a few small areas of this type are cultivated. These are principally west and northwest of Seligman and near Flat Creek

south of Jenkins. Numerous areas of this soil on account of their small size are included with other types. A part of the type is used as pasture.

BOONE VERY FINE SANDY LOAM.

The Boone very fine sandy loam is a gray or light grayish brown very fine sandy loam, grading into a light-yellow or yellowish-red very fine sandy loam, which is slightly heavier in texture. At depths ranging from about 15 to 18 inches this grades into a mottled yellowish-brown, gray, and red fine sandy clay. This in places extends to a depth of 3 feet, but in most places the underlying sandstone is reached at a depth of 24 to 30 inches. Small sandstone fragments are scattered over the surface and through the soil, but these are not present in sufficient quantity seriously to influence the crop value of the type.

The principal areas of this type lie immediately north and a short distance south of Seligman, occupying undulating to rolling upland. The surface drainage and underdrainage are good.

The greater part of this type is under cultivation, but owing to its small area it is not an important soil in the agriculture of the county. It is used for the ordinary farm crops of the region, and to some extent for berries, sweet potatoes, and tomatoes. It is easily cultivated, but its natural productiveness is rather low. Corn yields 15 to 25 bushels and wheat 8 to 12 bushels per acre. The soil is handled in much the same way as the adjacent Baxter, Lebanon, and Hagerstown soils. It requires the same treatment as those soils for its improvement, but is more in need of organic matter.

Land values on this type range from \$20 to \$35 an acre.

Boone very fine sandy loam, rolling phase.—The Boone very fine sandy loam, rolling phase, differs from the typical soil chiefly in that the surface is more rolling, the sandstone fragments are more abundant, and the bedrock lies nearer the surface. The soil also seems to be lighter colored and looser or more sandy. The sandy clay subsoil occurs at greater depth or may be entirely wanting, the underlying sandstone being encountered usually within 24 inches of the surface. Sandstone fragments are in many places so abundant that they interfere with cultivation, and are picked up on the cultivated fields and placed in piles. The topography is much more undulating and hilly than that of the typical soil. The phase covers about the same area as the main type, but a much smaller percentage is under cultivation.

The principal area of this phase lies west and southwest of Washburn. Smaller areas are encountered west and south of Seligman. A small area near Scholten and two others near Golden vary somewhat from the prevailing soil.

Probably not over one-half of the area of this soil is under cultivation, the remainder being forested largely with scrubby post oak and blackjack oak. Crop yields and land prices are lower than on the typical Boone very fine sandy loam.

In the following table are given the results of mechanical analyses of samples of the soil and subsoil of the typical Boone very fine sandy loam:

Mechanical analyses of Boone very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
344213.....	Soil.....	0.0	0.6	0.5	14.1	34.1	41.2	9.1
344214.....	Subsoil.....	.3	.4	.4	10.0	28.2	36.3	24.1

GERALD SILT LOAM.

The Gerald silt loam consists of an ashy-brown to rather dark brown silt loam, passing at an average depth of about 8 inches into lighter brown or yellowish-brown silt loam. This grades into silty clay loam, which passes rather abruptly at 15 to 20 inches into a mottled, tough, plastic clay, forming a clay hardpan or claypan. This heavy clay is mottled red, dark red, or reddish brown, and drab or yellow in the upper part and yellowish and drab or gray below. The structure is more friable in the lower part of the 3-foot section because of a higher content of silt. In many places the heavy upper subsoil layer is almost or entirely lacking, the subsoil consisting of a yellowish-brown, rather friable silty clay loam. Areas of this kind alternate with areas of the typical soil so frequently that no separation can be made. The character of these areas is well shown along road cuts north of Wheaton.

Only one area of this type is mapped in Barry County, this being a southeastern extension of Olivers Prairie, which lies principally in Newton County, with a narrow strip extending across the county boundary north of Wheaton.

The surface is almost level to slightly undulating. Surface drainage is imperfect and the underdrainage, especially where the heavy clay subsoil occurs, is poor.

Practically all of the type is under cultivation, being used principally for corn, wheat, oats, and timothy. On account of the heavy subsoil and poor drainage the type is not well suited to clover. Crop yields of wheat, oats, and timothy are good.

Land values range from \$30 to \$50 an acre.

HUNTINGTON GRAVELLY LOAM.

The Huntington gravelly loam consists of a brown silt loam, 10 or 12 inches deep, carrying chert fragments and waterworn gravel, ranging in quantity from about 20 to over 70 per cent of the soil mass. The interstitial material of the subsoil is a silt loam to silty clay loam, of lighter brown color or locally reddish brown.

This type has a wide distribution, occurring in many places in the valleys of the larger streams, and along nearly all the smaller ones.

In the valleys of some of the small streams bordered by steep chert-covered slopes or by rough stony land the soil carries such large quantities of rock fragments that it is of little agricultural value, but where the valleys are wider and the slopes less steep and cherty, the soil is nearly all under cultivation and is fairly productive. Corn is the principal crop grown. The yield usually is lower than on the silt loam. The type is used to some extent for clover and other crops. The soil is more droughty than the Baxter soils occupying adjacent slopes.

HUNTINGTON VERY FINE SANDY LOAM.

The Huntington very fine sandy loam is a brown to light-brown fine to very fine sandy loam underlain at about 12 inches by slightly lighter colored material of about the same texture, which extends to a depth of 3 feet or more. In places below 24 inches the subsoil is heavier in texture, grading into a light silt loam somewhat redder brown in color.

This type extends as a strip, varying in width from a few rods to as much as 40 rods, along the first bottom of White and Kings Rivers, throughout their course across the southeastern corner of the county. The surface is nearly level or gently sloping. Much of the area occupied is subject to overflow.

A considerable part of the type is under cultivation, being used for the production of corn, wheat, oats, clover, alfalfa, and melons. The yields are about the same as on the Huntington silt loam.

HUNTINGTON SILT LOAM.

The Huntington silt loam consists of a brown, mellow silt loam which grades at about 10 or 12 inches into lighter brown silt loam. In places the subsoil contains some clay, and consists of silty clay loam. Also the subsoil color is locally reddish brown. Some gravel usually is scattered over the surface and distributed through the soil and subsoil. In many places gravel beds are found in the lower subsoil, but these usually are covered by 18 to 24 inches of soil which is almost gravel free. The type also includes many long, narrow strips of Huntington gravelly loam, which on account of their small size are not mapped separately.

The Huntington silt loam is a first-bottom alluvial soil, consisting of material washed largely from the adjacent Baxter and Hagerstown soils, but to some extent from other upland soils. Narrow strips of colluvial material, terraces, and alluvial fans have been included with the type.

Strips of this type varying in width from only a few rods to over one-fourth mile extend along all the larger streams in the county, except the White River and the streams which flow directly into it. In the more nearly level parts of the county strips of this type occupy the valleys of the smaller streams.

The surface is fairly smooth, with a gradual slope from the outer valley edge toward the stream and also a slight slope down stream. In places it is separated from the stream channel by one or more low terraces.

Ordinarily this type is classed as a first-bottom soil subject to overflow, but in this region of rapidly eroding streams the channels are soon cut so deep that except in cases of unusual precipitation they do not overflow their banks and much of the type is not subject to overflow, although distinctly lower than the adjacent terraces. The greater part of the type has good surface drainage and under-drainage.

Although occupying a comparatively small total area, the Huntington silt loam and the closely related Huntington gravelly loam and Huntington fine sandy loam are, on account of their high agricultural value and wide distribution, very important in the agriculture of the county. The Huntington silt loam is practically all under cultivation and was the first soil in the county to be cleared and farmed. It originally supported a heavy growth of large white, red, and Spanish oak, walnut, elm, sycamore, and maple.

The important crops are corn, wheat, oats, and clover. Some alfalfa is grown. The type is used largely for growing feed for the live stock of the county. Corn yields 30 to 50 bushels, wheat 12 to 18 bushels or more, and oats 30 to 50 bushels per acre. Clover yields two cuttings of three-fourths ton to 1½ tons each. Alfalfa gives three cuttings. Plate III, figure 1, shows a first cutting of a field of red clover on this type near McDowell.

Much the same equipment and methods are used on this type as on the level Hagerstown and Lebanon soils. Fertilizers, excepting manure, are rarely used on this type.

Owing to its occurrence in long, narrow strips few farms are located wholly on this type. Where it is the predominating soil well-improved land sells at as high as \$50 an acre.

This soil, although naturally productive and durable, has been injured by continuous cropping to corn and grain. It can best be built up by using it to a greater extent for pasture, by growing and

plowing under clover, and by growing cowpeas in the corn and in crop rotations, following wheat and oats.

DUNNING SILT LOAM.

The Dunning silt loam is a dark-gray or dark-brown to black silt loam which grades downward into heavier material. At about 12 inches the color is slightly lighter, and faint mottlings of gray appear. With increasing depth the mottling becomes more pronounced, and the texture heavier, a dark-brown clay mottled with drab and rusty brown being encountered at 18 to 24 inches. The lower part of the subsoil is a gray or drab silty clay. The type is quite variable; there are included patches in which black, tenacious clay approaches the surface and others in which the color is lighter brown to gray and the texture silty.

The principal areas of this type occur as long, narrow strips in the valley of Shoal Creek. There are a few small areas near Washburn which are not typical.

The type is level and represents poorly drained areas of the stream valleys, the other parts of which are occupied by the Huntington soils. Many small areas of the type are included with the Huntington.

The greater part of this type is under cultivation, the principal crops being corn, wheat, and oats. On account of the poor drainage, crop yields, especially in wet seasons, are not so good as on the Huntington silt loam. The soil, because of poor drainage, is not well suited to the growing of red clover, although in other sections soil of this type is used quite extensively for the production of alsike clover.

The principal needs of this type are the improvement of the surface drainage and of the underdrainage, preferably by the use of tile.

In the following table are given the results of mechanical analyses of samples of the soil and subsoil of the Dunning silt loam:

Mechanical analyses of Dunning silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
344209	Soil.....	0.0	1.4	1.0	3.0	7.1	69.0	18.6
344210	Subsoil.....	.0	.1	.3	1.9	4.6	55.0	38.2

RIVERTON GRAVELLY LOAM.

The Riverton gravelly loam is a light-brown to yellowish-brown gravelly silt loam, passing at 8 to 12 inches into a lighter brown gravelly silt loam. At an average depth of about 15 inches this grades into a reddish-brown to red, friable clay which carries a large percentage of gravel. Much of this gravel is well-rounded chert, but there are also present angular fragments of chert and some sandstone.

This type is found in the southeastern part of the county, where it is the principal type, occupying a strip 1 mile to 3 miles wide, through the center of which flow White and Kings Rivers.

It occurs as a high terrace or bench 100 feet or more above the present flood plain of the streams along which it occurs. The surface is flat to undulating, and the edges of the terrace are in most places steep and rocky or badly gullied.

The greater part of the type is under cultivation. It is used in the production of the common crops of the region, and is a productive soil.

RIVERTON SILT LOAM.

The Riverton silt loam is a light-brown to brown silt loam which passes into lighter colored silt loam at 8 to 12 inches. At 12 to 15 inches it changes to a reddish brown, and becomes a darker red with increasing depth. The upper part of the subsoil is a heavy but friable clay loam, which usually is more silty in the lower part of the 3-foot section. In places this soil differs but little from the Huntington silt loam, except in the lower subsoil, which usually has a deeper red color. In other places, especially where flat and poorly drained, the surface is almost gray and the subsoil heavy and mottled. Such areas really represent local areas of the Robertsville silt loam, but are not of sufficient extent to be shown satisfactorily on the soil map. In places the type carries a rather high percentage of gravel, especially in the subsoil, much of this being well rounded and water-worn.

This type occurs as small, detached, second-bottom areas along the outer edge of stream valleys, mainly along Shoal Creek, Flat Creek, and White River. These second bottoms, or terraces occur at elevations of 40 to 75 feet or more above the stream channel. The line marking the drop from the terrace to the flood plain is in most cases sharp and well defined, but on the outer side of the valley the terrace grades into the adjacent slopes gradually, so that its exact limits are often difficult to outline.

The drainage, except in a few small, flat areas, is good. As a whole, the type is considered somewhat less productive than the adjacent areas of the Huntington silt loam, but it is nevertheless a valuable, productive soil. The same crops are grown and the same methods used as on the Huntington silt loam. The type is nearly all under cultivation. Plate III, fig. 2, shows a field of oats on this type along Flat Creek near Cassville.

Riverton silt loam, high phase.—The high phase of the Riverton silt loam is quite a different soil from the typical. If found in areas of considerable size it would be correlated with some other soil. It is lighter in color than the typical soil, has a heavier, more compact

subsoil approaching that of the Lebanon silt loam in character, and has a native growth of post oak. It occurs in a few small areas in the southeastern part of the county, being associated with the Riverton gravelly loam. In crop yields and treatment it approaches the Lebanon nearer than the typical Riverton silt loam or the Hagerstown soils.

In the following table are given the results of mechanical analyses of samples of the soil and subsoil of the typical Riverton silt loam:

Mechanical analyses of Riverton silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
344223.....	Soil.....	1.2	2.0	0.9	2.9	5.9	73.4	13.5
344224.....	Subsoil.....	.4	.7	.5	3.1	10.2	61.5	23.5

ROUGH STONY LAND.

Rough stony land comprises areas in which exposures of bare, massive, irregular limestone rock, known locally as "glades," and rocky slopes, ledges, and outcrops are so abundant that the land is nonarable, and has no value in agriculture except that it may be used as pasture. With such areas are included some cherty slopes too steep for cultivation.

The areas mapped as Rough stony land include some patches that might be put under cultivation. These consist of small, high benches of the Hagerstown gravelly loam or narrow ridges and steep slopes of the Baxter stony loam or gravelly loam, but on account of their small size they can not be shown on the soil map. For the same reason a number of small areas of Rough stony land are included with the types mentioned.

The principal areas of Rough stony land are found in the east-central, southeastern, and southern parts of the county. The upper or outer boundary is approximately outlined by outcrops of the "cotton rock" of the Jefferson City limestone. It occurs as strips in places around the edges of the high benches, as glades on the tops and at the points of ridges, and as steep, almost bare slopes.

Rough stony land supports a growth of native grass which affords considerable pasturage. On the steeper rocky slopes there is a growth of cedar, and where the land is less rocky there is in the eastern part of the county some pine. Varieties of oaks are the tree growth in many areas.

Prices of land of this character range from less than \$5 to about \$10 an acre.

SUMMARY.

Barry County lies in the southwestern part of Missouri, about 200 miles south of Kansas City. It is about 29 miles long, from north to south, and about 27 miles wide, and contains 791 square miles, or 506,240 acres.

The topography ranges from undulating and rolling in the northwestern part to rough and broken in the eastern and southern parts. The uplands have a maximum elevation ranging from about 1,300 feet above sea level near the northwestern corner to about 1,550 feet in other parts. The depth of stream cutting ranges from about 150 feet along Clear Creek to 600 feet along the White River. The region is well drained by several large streams which with their numerous tributaries reach into all parts of the county.

Barry County was organized in 1835. The early settlers came largely from the mountains of Kentucky and Tennessee, and their descendants form the principal part of the present population along the larger valleys and in the rougher parts of the county. In other parts there is a considerable German, French, Polish, and Italian population. The total population of the county is reported in the 1910 census as 23,869. Monett, the largest town, had a population of 4,177 in 1910.

The county is only in part supplied with railroad facilities.

The climate is temperate and well suited to a wide range of agricultural operations. The mean annual temperature is about 57° F., and the mean annual precipitation about 44 inches. The normal growing season is 185 days long.

Agriculture is developing along three principal lines, general farming, often combined with dairying; live-stock raising on large ranches; and small farming, with especial attention to strawberries and other crops requiring intensive cultivation.

The farm equipment on the larger valley and upland farms is good, but in much of the county it is inadequate.

The important crops of the county are corn, wheat, oats, and hay. According to the latest census the total value of the stock, chiefly hogs and cattle, sold or slaughtered, nearly equals that of the crops produced.

There are nearly 3,500 farms, of an average size of nearly 103 acres, in the county. About 70 per cent of the area of the county is reported in farms, and of the farm land a little over 62 per cent is reported improved. The prices of farm lands range from less than \$10 to \$50 or more an acre.

The upland soils are residual in origin, being derived from the weathering of the underlying rock beds. The alluvial and bench soils are formed from material washed from the uplands. There are 17

soil types, including Rough stony land. These are classed with 8 soil series.

The Lebanon soils have a nearly level to rolling topography. They are characterized by light-colored surface soils and a mottled, compact layer in the upper subsoil. This series is represented by two types, the gravelly loam and silt loam.

The Baxter soils have a rougher topography than the Lebanon, carry considerable rocky material, and have a red subsoil, but no compact layer such as that of the Lebanon. Three types are mapped in this county, the Baxter stony loam, gravelly loam, and silt loam.

The Hagerstown soils have a light-brown to reddish-brown color throughout the soil section, but no mottling. The Hagerstown gravelly loam and silt loam are recognized in this county.

The Boone soils have pale-yellow surface soils and a sandy clay subsoil. They are important in the agriculture of the county. The Boone very fine sandy loam and stony loam are mapped.

The Gerald series is represented by one type of small extent, the silt loam. The surface soil is brownish, and grades through lighter colored material into mottled heavy clay.

The Huntington very fine sandy loam, gravelly loam, and silt loam are the important alluvial first-bottom soils.

The Dunning series is represented in the county by a single type, the silt loam. This soil is dark colored and grades into lighter colored, mottled, heavier material.

The Riverton soils occur as comparatively recent terraces along the larger streams and as high terraces along the White and Kings Rivers. The gravelly loam and silt loam of this series are mapped.

Rough stony land, covering large areas in the southeastern part of the county, is practically nonagricultural except for grazing purposes.

In general, Barry County seems to offer good opportunities for the extension of the small-fruit business, dairying, and for the development of a much larger live-stock industry.



[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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