

Issued August 9, 1913.

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.

SOIL SURVEY OF MACON COUNTY, MISSOURI.

BY

H. KRUSEKOPF, OF THE UNIVERSITY OF MISSOURI, AND
FLOYD S. BUCHER, OF THE U. S. DEPARTMENT
OF AGRICULTURE.

J. E. LAPHAM, INSPECTOR IN CHARGE NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1911.]



WASHINGTON:
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., November 27, 1912.

SIR: The accompanying report and soil map cover the survey of Macon County, Missouri, one of the projects undertaken by the bureau during the field season of 1911. This work was done in cooperation with the Missouri Agricultural Experiment Station, F. B. Mumford, director, and the selection of the area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this area and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1911, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

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MAP.

Soil map, Macon County sheet, Missouri.

SOIL SURVEY OF MACON COUNTY, MISSOURI.

By H. KRUSEKOPF, of the University of Missouri, and FLOYD S. BUCHER, of the U. S. Department of Agriculture.

DESCRIPTION OF THE AREA.

Macon County is situated in the north-central part of the State of Missouri. It is bounded on the north by Adair and Knox Counties, on the east by Shelby, on the south by Randolph and Chariton, and on the west by Chariton and Linn Counties. Save for an offset at the northeastern and the southwestern corners, the county is a square. It has an area of 827 square miles, or 529,280 acres.

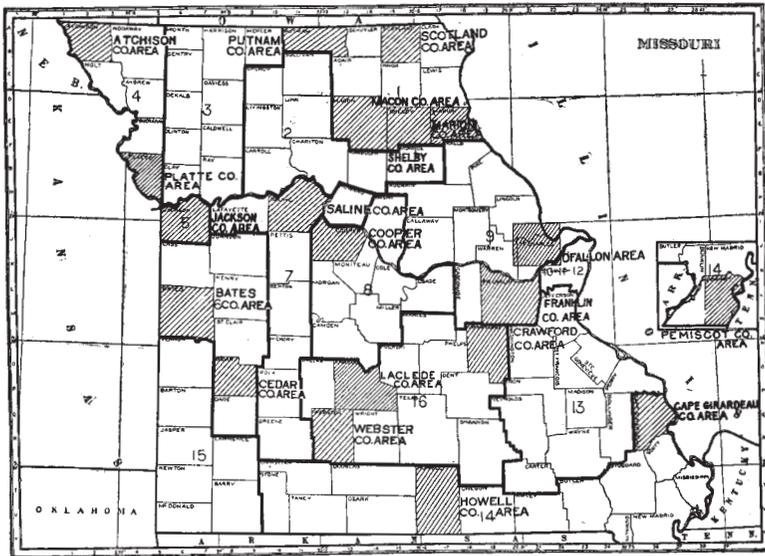


FIG. 1. Sketch map showing areas surveyed in Missouri.

Macon County is included within the two physiographic divisions of Missouri known as the Flat Prairie of northeastern Missouri and the north Missouri Rolling Prairie. The Grand Divide, lying between these two divisions, forms the watershed of the Missouri and Mississippi Rivers. This divide runs north and south. The eastern part of the county, included in the prairie region, consists of a smooth to gently rolling plain, with a gradual slope to the southeast. The western part of the prairie is almost flat, but along the eastern border of the county the streams have cut down to depths varying

from 25 to 100 feet, making the surface undulating to gently rolling. This smooth to very gently rolling topography of northeast Missouri is characteristic of the flat-prairie region.

The western two-thirds of the county varies in topography from gently rolling to rolling and hilly. It belongs to the rolling-prairie region. Along the border it forms the margin of the Grand Divide, where it is broken and eroded by the numerous and widely branching tributaries of the East Fork of Chariton River. The region between East Fork and the Chariton itself is marked by a rolling surface, long, narrow ridges, and gentle slopes. The flat ridges vary from a few rods to a mile in width, and are frequently 3 to 6 miles in length. All of this region is drained by tributaries of the Chariton River, which are fed by widely branching systems of smaller streams heading in the plateaus. The roughest part of the county is found west of the Chariton River, where the surface is broken by many short ravines and rounded ridges. In general, however, the western part of Macon County is not as completely and deeply dissected as is the rolling land in Sullivan and Linn Counties to the west.

The chief characteristics of this topography are the combination of level plains and slopes, varying from gently inclined to steep. This configuration, due entirely to erosion, has been developed upon what was originally a wide, unbroken plain, sloping gently to the south. The remnants of this plain, which constitute the flat prairie and minor plateaus, are steadily being encroached upon by the streams.

The average altitude of the flat prairie land varies from 830 feet in the southern part of the county to 950 feet in the northern part. The elevation of Chariton River Valley varies from 650 feet to 780 feet, and that of East Fork from 700 to 800 feet. The variation between the valleys and the adjoining uplands is rarely more than 100 feet, and the slopes are seldom too steep for cultivation.

There are two drainage systems in Macon County. The eastern, or Mississippi system, has Bear Creek, Middle Fork of Salt River, and Tennile Creek as its main tributaries, which have their outlet into the Mississippi River through Salt River. The general direction of this drainage is south and southeast. The western system, or Missouri system, includes Chariton River, with such tributaries as Mussel Fork, Brush, Walnut, Turkey, and Stinking Creeks, Middle Fork and East Fork. Only the larger of these streams head outside the county, but all unite after leaving it and drain into the Missouri through the Chariton River. A characteristic feature of all these streams (and this in general is true for all north-central Missouri drainage) is that they flow due south. With the exception of the larger creeks, the streams have no perennial source of supply and are dry except during rainy seasons.

The valley of the Chariton River varies in width from 1 to 3 miles. As a whole the bluffs on the western side are steep and on the eastern side gently sloping. The river, which has a fall of only 2 feet to the mile, meanders from side to side of this valley.

Crescent-shaped ponds, occupying depressions representing former channels, occur at irregular intervals throughout the valley. These are usually shallow, rarely have an outlet, and are supplied by overflows from the main stream and drainage waters from the adjacent uplands. These ponds are rapidly filling up and will soon cease to exist.

Middle Fork also meanders through a comparatively wide valley. The fall of this stream is about 4 feet to the mile. East Fork in general approaches the eastern bluff. Its fall is greater than that of Middle Fork.

Springs are of rare occurrence in the county. Occasionally places are found along the foot of stream bluffs where small quantities of water seep from seams at the junction of sandstone and shale formations, but no springs of importance are known to occur in the area. There is, however, no difficulty in securing an abundance of water by digging wells. The latter are usually 35 to 65 feet in depth, though borings are made to 165 feet. The depth of the wells is generally equal to the thickness of the layers of unconsolidated material.

At the time of the first settlements more than half of the county was covered with forest. This growth was most extensive in the western part of the county, and in a general way occupied all the area known in this report as the Shelby loam. In the stream bottoms elm, hickory, walnut, maple, sycamore, and oak predominated, with post and black oak, some hickory, elm, and walnut on the uplands. Walnut was most abundant west of the Chariton River and around Callao. At the present time no commercial timber remains. The wooded areas are now confined to narrow strips along the larger streams, and represent the roughest land in the county. The larger areas are in the southwestern and western parts of the county, but these are being rapidly cleared.

Coal mining as an industry in the county dates back to 1861, and for many years the county has led in the production of this mineral. The center of the mining district extends from Bevier to Ardmore. In recent years the industry has lost much of its importance, owing in part to the exhaustion of some of the coal fields. The output for 1909 is given as 816,306 tons.

Macon County was settled in 1827, the first settlers locating near the present site of the village of Callao. Most of them were Kentuckians and Virginians from the neighboring counties of Howard and Randolph, who entered the area to the south by way of the Missouri River. The county was organized in 1836. At that time Bloomington was the county seat and an important junction point at

the intersection of State roads from Glasgow and other Missouri River towns to the north into Iowa and from the Mississippi River on the east. Macon, formerly called Hudson, was made the county seat in 1863.

The lines of three important railroad systems traverse the county. The Des Moines branch of the Wabash Railroad passes through the center of the county from north to south, connecting with the St. Louis and Kansas City branch of the same system at Moberly.

The Chicago, Burlington & Quincy Railroad crosses the southern part of the county from east to west, connecting with the Wabash at Macon. The double-tracked line of the Atchison, Topeka & Santa Fe Railway passes diagonally through the county from La Plata on the north to Hart on the west, offering an excellent route to Chicago and Kansas City. No part of the county is more than 10 miles from a railroad. Several large markets are within easy and direct reach of the county. St. Louis is 160 miles away, Kansas City 140 miles, Chicago 325 miles, St. Joseph 116 miles, and Des Moines 150 miles.

The public roads as a rule follow land lines, and in general are fairly well kept. Changing the roads from land lines to follow the topography of the county would, in the rougher regions, often prove advantageous. Rural free delivery of mail and telephone service reach all parts of the county.

The census of 1910 credits the county with a population of 30,868, two-thirds of whom live on farms, and the majority of the remainder in towns of more than 500 population. Macon, at the junction of the Wabash and Burlington Railroads, with a population of 3,584, is the county seat and the largest town in the county. Bevier, in the center of the coal-mining district, has a population of 1,900; La Plata, at the junction of the Wabash and Santa Fe Railroads, has a population of 1,605, and is the center of a rich farming district. Atlanta, Elmer, Ethel, New Cambria, Callao, Excello, and Anabel are all railroad towns. Ardmore is supported by mining industries.

CLIMATE.

The climate of Macon County is essentially the same as that of all northern Missouri. It is continental in type. The mean annual temperature is about 60°. Zero weather is rare during December, but occurs during January and February, although it rarely lasts more than three days at a time. The fall months are marked by beautiful weather. The growing season is about 6 months, the average date of the last spring frost being about April 15 and of the first killing frost in autumn about October 16. Periods of warm weather in the spring are frequently followed by cold snaps which generally cause some damage to fruit, but in general complete crop failures are unknown.

The mean annual precipitation, computed from Weather Bureau records covering the last 25 years, is 36.7 inches. The average annual precipitation for the growing season, from April to October, inclusive, is about 28 inches. From November to March, inclusive, the precipitation is usually general in character, but during the summer months the greater part occurs as local showers. The average seasonal snowfall is about 16 inches.

The prevailing winds are southerly, but during the winter north-westerly winds prevail a considerable part of the time. Hot winds, such as occur in the western plains region, are unknown.

The following tables give the salient climatic data as recorded at Macon and at Darksville, Randolph County. The latter station is situated a few miles south of the Macon County line; its records are representative of the climatic conditions in the area covered by the present survey.

Normal monthly, seasonal, and annual temperature and precipitation at Darksville, Randolph County.

Month.	Temperature.					Precipitation.					
	Mean of 16 years.	Absolute maximum in 16 years.	Absolute minimum in 16 years.	1909	1910	Mean.	Total amount for driest year in 15 years.	Total amount for wettest year in 15 years.	1909	1911	Snow average depth.
	° F.	° F.	° F.	° F.	° F.	° F.	In.	In.	In.	In.	In.
December.....	31.0	67	- 4	21.1	53.6	1.52	1.92	1.10	2.73	2.94	.....
January.....	28.6	72	-17	30.6	30.2	2.01	1.42	4.82	2.15	.96	.....
February.....	26.7	69	-27	34.6	27.5	1.92	.80	2.10	2.55	3.04	.....
Winter.....	28.8	.....	.....	28.8	37.1	5.45	4.14	8.02	7.43	6.94	.....
March.....	40.0	90	- 4	41.5	55.8	2.75	3.10	6.50	2.25	1.54	.....
April.....	53.6	90	15	53.0	54.0	3.31	2.05	3.43	4.00	5.65	.....
May.....	64.5	92	28	61.2	59.2	5.36	1.22	10.60	4.30	1.27	.....
Spring.....	52.7	.....	.....	51.8	56.3	11.42	6.37	20.53	10.55	8.46	.....
June.....	72.7	101	40	71.7	69.9	5.60	1.62	8.30	4.75	.57	.....
July.....	76.1	99	52	75.2	76.2	4.20	3.85	5.60	5.25	3.03	.....
August.....	75.5	102	49	79.4	74.2	3.00	1.55	1.90	0.00	1.86	.....
Summer.....	74.8	.....	.....	75.4	73.4	12.80	7.02	15.80	10.00	5.46	.....
September.....	68.6	99	30	66.7	67.4	3.67	1.25	5.35	7.13	8.87	.....
October.....	57.1	92	19	54.9	58.5	1.65	1.16	2.89	5.25	3.87	.....
November.....	42.7	77	2	52.6	40.6	1.68	.45	1.65	2.60	2.49	.....
Fall.....	56.1	.....	.....	58.0	55.5	7.00	2.86	9.89	14.98	15.23	.....
Year.....	53.1	102	-27	53.5	53.7	36.73	20.39	54.24	42.96	36.11	16

Average precipitation and temperature at Macon, Mo., and direction of prevailing wind at Columbia, Mo.

Month.	At Macon.				At Columbia.
	Average number of days with 0.01 inch or more precipitation (7 years).	Mean temperature (8 years).	Highest temperature (8 years).	Lowest temperature (8 years).	Prevailing direction of wind (19 years).
January.....	7	32.6	72	-16	NW.
February.....	7	25.8	68	-27	NW.
March.....	9	41.7	81	0	NW.
April.....	8	54.0	92	23	SE.
May.....	11	64.3	93	23	SE.
June.....	9	72.0	102	39	S.
July.....	9	76.3	111	53	S.
August.....	8	76.5	102	48	SE.
September.....	7	68.1	102	27	SE.
October.....	5	58.5	94	25	S.
November.....	5	43.8	77	7	SW.
December.....	6	30.1	66	-21	SW.
Annual.....	89	53.3	111	-27	S.

Average date of last killing frost in spring at Macon, Apr. 20; of first in autumn, Oct. 16. Date of earliest killing frost in autumn, Sept. 29; of last in spring, May 9.

AGRICULTURE.

The agriculture of Macon County is essentially the same as that of all northern Missouri. The early settlers devoted themselves mainly to the production of the staple crops—corn, wheat, oats, and grass—and the raising of live stock. These still constitute the dominant features of the agriculture of the county.

The first settlers found much of the country covered by an exceedingly rank growth of prairie grass, broken only by belts of forest along the stream courses. They settled along the streams, where wood and water were available. Wild fruit, game, and fish were abundant. A few acres were cleared of the forest trees and planted to wheat, corn, and tobacco. Usually a few acres of prairie land were broken and used for corn and wheat. The wheat was taken to Glasgow and Brunswick to be milled. All the corn was consumed locally, as there were no means of transportation to outside points. Cattle and hogs were the chief source of revenue. The former found abundant and excellent grass on the range throughout the year. The latter were permitted to run wild and fatten on the mast. The live stock was driven to market at St. Louis or to the nearest river town, whence it was transported by boat. The advent of the railroad gave a great impetus to agriculture. New settlers

came into the country in large numbers, the open range was rapidly taken up and fenced in, and better methods of farming were introduced.

Around 1860 tobacco became the principal money crop of the Macon County farmers. Callao became an important center for the handling of this crop, as much as 700,000 pounds of this product being shipped in one season from this place. It was the only profitable crop for the farmer in the interior of the State before the advent of the railroads, as there was practically no market for country produce and grain. Even as late as 1874 the total tobacco shipments from the county exceeded 2,000,000 pounds. Wheat at this time was a crop of secondary importance. The period from 1865 to 1875 saw many changes in agricultural conditions and methods. The acreage in tobacco rapidly declined, and wheat was no longer a general crop. Corn, oats, rye, and grass in conjunction with live stock became the leading products. About 1874 one-half of the county was still in forest. Woodland was valued at \$2 to \$8 an acre and improved land at \$15 an acre. Live stock of improved strains was imported, and tame grasses gradually displaced the wild prairie grasses. This marked the beginning of an era of prosperity and of improved agriculture which has continued to the present day.

Corn is at present the most important crop both in acreage and value. In 1910 about 95,000 acres, a little less than one-fifth of the total area of the county, were devoted to this crop, and the production was 3,418,164 bushels. The largest fields are in the prairie region. Yellow corn is most generally grown. According to experiments conducted by the Missouri Agricultural Experiment Station, Boone County White, St. Charles White, and Silvermine of the white varieties, and Reid's Yellow Dent, Leaming, and St. Charles Yellow of the yellow varieties are best adapted to this region. The improvement of the different strains is receiving much attention in Macon County, and the impression is general that the yield per acre is increasing as the result of better seed and improved methods of culture. Practically all of the crop is used for the feeding of live stock within the county. The corn is generally "snapped," the husks being left on the ear, or sometimes husked, leaving the husk with the stalk in the field. Many farmers are adopting the practice of level cultivation with excellent results.

Wheat is now a secondary crop in Macon County. It has never been extensively grown, although it received much more attention two decades ago than at present. In 1910 only 5,000 acres were planted as compared with 15,000 acres in 1880. At present it is grown most extensively in the vicinity of Callao and on the flat prairie lands in the eastern part of the county. The red winter

varieties are grown exclusively. It is probable that the decline of this crop in favor is due to the fact that corn under the local conditions has proved more remunerative.

As a nurse crop and as a fixed member of a rotation wheat is highly desirable and it should be given a more important place in the agriculture of the county. The Fulcaster, Fultz, Poole, and Turkey varieties are best adapted to the soils of the county. A marked increase in the acreage planted to this crop has resulted from the success attained in recent years by farmers devoting their attention to its production. These men have demonstrated conclusively the adaptability of the soils of the region, particularly the prairie soils, to small grain.

When preparing the land for wheat it is usually plowed in August. The seed is sown the latter part of September at the rate of 1 to 1½ bushels per acre. Yields range from 10 to 30 bushels per acre.

What has been said of wheat applies as well to oats. There were about 4,500 acres devoted to this crop in 1910 as compared to 30,000 acres in 1880. Under favorable conditions large yields—from 35 to 60 bushels per acre—are obtained, but occasionally the crop is almost a total failure. The oats crop is not primarily a money crop, but is grown to fill out the rotation, as a nurse crop for clover, or as feed for horses. The recommended varieties are the White Tartar, Silvermine, Red Rust Proof, and Kherson.

About one-fifth of the area of the county is devoted to hay and forage crops. Timothy is grown extensively for hay, red clover being often grown with it. Very little of it is harvested for seed. After the hay is cut the fields are generally used for pastures. Land is frequently kept in mowings for 4 to 8 years, though such a plan results in decreased yields and poor quality of hay. In this region timothy sod should rarely stand more than 3 years before being plowed for a cultivated crop. In old meadows bluegrass will gradually replace the timothy in about 2 years. Seeding is at the rate of 6 to 8 pounds per acre, and it is done either in fall or early spring.

Bluegrass is indigenous to the soils of Macon County, as of all northern Missouri. The glacial clay soils are admirably adapted to this grass, and it is for this reason that Macon County is preeminently suited to stock raising. Land that is not cultivated will be taken by bluegrass in 2 or 3 years. It is used as a pasture grass exclusively. On the poorer land it requires 2 to 3 acres to support a steer for 6 months, but in general 1 or 1½ acres per steer is considered sufficient. If the pastures are not cropped too closely, the fall growth of grass provides excellent pasturage until about the first of December. Many farmers make the mistake of turning the cattle on pasture too early in spring, which frequently results in injury to the sod.

Clover is grown in all parts of the county, but the acreage is comparatively small. The decline in fertility of the land makes it imperative that more attention be given to the growing of leguminous crops, such as clover, and since practically all of the soils are adapted to this crop, its acreage should be greatly increased. Frequent injury is done to the plants during the winter months by heaving. This can be prevented to a large extent by providing good drainage and by incorporating organic matter in the soil. An increase in the acreage of wheat would doubtless result in the growing of more clover. Yields of clover hay range from 1 to 2 tons per acre. The seed is usually sown in spring on wheat land at the rate of 6 to 8 pounds per acre. When wheat or oats are used as nurse crops, seeding of the grain should not be as heavy as when sown alone, in order to give the clover a better chance to grow.

Millet, rape, vetch, and sorghum are all grown to a small extent, and are used primarily to supply feed. Millet is sown in midsummer, usually in July, and yields 2 to 4 tons per acre. The acreage varies from year to year, but is greatest in dry years. Sorghum is grown for sirup, the best quality being secured from the crop on the poorer phase of the Shelby loam. From 50 to 100 gallons per acre is considered a fair yield. It is probable that the acreage of sorghum will be greatly increased when once the farmers learn to appreciate the feeding value of this forage crop.

Attempts to grow alfalfa¹ have been only fairly successful. It is probable that the subsoil of the upland types is too heavy to permit this crop to thrive well. It should be tried, however, especially on the well-drained bottom lands and on the better areas of the Shelby loam.

The growing of cowpeas is as yet in an experimental stage, but once their value as a forage crop and as a soil renovator is appreciated they will become an important crop. Cowpeas will thrive on all the Macon County soils. Their use is strongly recommended, especially for areas where clover is a failure. The profit from the crop is fully as great as from clover when the method of handling is once understood. Cowpeas improve the land, whether grazed, cut for forage, or turned under. Occasionally a crop turned under green would be of great value, particularly in the case of the heavier soil types. The seed can be broadcasted or drilled in the corn at the last cultivation with fair success, or it can be planted in the row with the corn where corn is not planted too early. When grown alone, a good method is to drill the seed with a grain drill, sowing from 4 to 5 pecks to an acre. Seeding should be delayed until a couple of weeks after corn-planting time, when the ground is thoroughly warmed up. The first week in

¹ Bul. No. 72, "Alfalfa Growing in Missouri," issued by the Agricultural College of the University of Missouri, gives valuable information on this subject.

June is considered the best time. Such varieties as Whippoorwill, Black, and New Era should be sown.¹

Tobacco was at one time a leading crop of the county, although in late years it has been abandoned entirely. While it will probably never regain its former rank or take the place of grain and stock raising, it could be made a source of revenue by many farmers, who might cultivate a few acres in addition to other crops. Heavy fertilization is necessary to produce a satisfactory quantity and quality of leaf on the soils of this county.

Fruit growing has received considerable attention at various times, and small orchards of 1 to 10 acres are found on most of the farms. In the vicinity of Macon there are commercial orchards of several hundred acres in extent. The business has not proved profitable, and most of the orchards are at present badly neglected. This lack of success is not due to the soil, for the trees thrive. The climate is usually held to be the cause of failure, but this is true in part only, and if orchards are properly cared for—cultivated, pruned, and sprayed—the yields and quality of fruit can be materially improved. Small fruit and garden truck are grown for home use only.

In the production of live stock Macon ranks among the first twelve counties of the State. It is especially noted for its horses, mules, and cattle. The last census (1910) reported 42,927 head of cattle, 18,264 horses, 4,405 mules, 46,865 hogs, and 30,466 sheep, valued at \$4,285,474. The excellent bluegrass pastures, the central location of the area in the corn belt, and an abundant water supply all combine to make stock raising profitable. With the exception of wheat, practically all the crops grown in the county are fed on the farm.

A great many colts and mules are raised each season, and are usually sold at the end of one or two years. The farm horses are of the heavier types, weighing on an average about 1,100 pounds. In former years considerable attention was given to the raising of saddle and driving horses, but this has practically been abandoned.

Many cattle are fed and marketed each year. Feeders are shipped in, usually from Kansas City, and are prepared for market. The native cattle are mostly grades. Purebred males are used almost exclusively. The Hereford is the most popular, and there are several excellent herds of this breed in the county. A few herds of Short-horns and Angus were also noticed.

Sheep raising is of minor importance, but should be extended, as much of the land, especially in the western part of the county, is well suited to this industry. The Shropshire is the most popular breed. Hogs are kept on practically every farm, and are an important source of income. Berkshire, Duroc-Jersey, and Poland-China are

¹ Monthly Bulletin No. 9, "Growing Cowpeas in Missouri," by the Missouri State Board of Agriculture.

the leading breeds. In proportion to the number of cattle, Macon County does not produce as many hogs as do the counties in the northwestern part of the State, as corn, the essential feed in pork production, is grown more extensively in the latter region.

In the growing of live stock each farmer usually specializes in horses, mules, or cattle. There is a general tendency toward the keeping of the most improved types of live stock, and progress along this line is steady and consistent.

Dairying has as yet received very little attention, although a few farmers ship cream and milk to local markets. In the vicinity of Callao there are several herds of Jerseys, and it is here that interest in dairying is most pronounced. The excellent pastures, the abundance of grain and forage, and ample shipping facilities combine to make this an ideal dairy region. There is no better system of agriculture for maintaining or increasing the productiveness of the soil. The Jersey and Holstein cattle now in the area would make an excellent foundation for increasing the dairy herds.

The cultural methods in Macon County are, as a rule, good. The most improved implements are used in all farm operations. When sod lands are to be broken up plowing is usually done in the fall. When wheat follows corn the land is prepared by disking and harrowing without plowing. The cultivation of corn is usually thorough.

In general, level cultivation is to be recommended in preference to ridge cultivation. Deeper plowing is also advisable, particularly in this region of heavy clay subsoils, as by this means the depth of the soil is increased and erosion checked.

Over the rolling sections of the county one of the important problems of soil management is the control of soil erosion. On the slopes particularly the productivity of the soils is seriously impaired by the constant removal of the surface soil through washing. Contour plowing and a gradual deepening of the tilled surface, thereby increasing the moisture-holding capacity of the soil and reducing the amount of surface run-off, will do much to check damage from this source. A winter cover crop should be kept on sloping fields wherever possible. Such treatment has the further advantage of improving the condition of the land for growing crops. The steeper slopes should be kept in permanent pasture.

Macon County is not a small-grain county, and with the absence of litter barnyard manure is not made in large quantities. This is an unfortunate condition. It is true that large quantities of manure are made and distributed in the feeding of large numbers of cattle, but the supply from this source is not adequate to the needs of the soils. The waste of manure on most of the farms is a very serious matter. Only a small part of the urine is saved, and much of the solid excrement is so exposed to leaching processes that its value

is greatly lessened. Unless it can be properly protected manure should be put on the land at the earliest possible moment after it is made. Since the supply is limited in this region, the combined use of stable manure and leguminous crops is the most practicable way of supplying the needed organic matter to the soils. Of the leguminous crops red clover and cowpeas are of the most general use for this region. Occasionally one of these green crops should be plowed under. Cornstalks should also be plowed under rather than burned, for in a region of heavy subsoils such as are found in Macon County it is necessary to incorporate a large amount of organic matter with the soil to insure its best physical condition, aside from the question of supplying plant food.

Corn for two years, followed by oats and grass in as many years, has been the standard rotation since early days, and is still generally retained by many farmers. Frequently the oat crop is not profitable. In the present rotation corn is the only cultivated crop. It is profitable and will continue to be so under good soil management. It should be the basic crop in all rotations in this region, but small grains and legumes should be combined with it in rotations which will maintain the supply of organic matter in the soil.

Improvements on the farm are usually of good quality, and indicate a general prosperity among the owners. However, more barns and sheds should be provided for live stock and for the housing of the farm machinery.

In general, the agricultural practices in the area surveyed have grown up gradually and are undoubtedly the most profitable and practical under the existing conditions. Stock raising will always be one of the chief industries. With it usually goes the growing of corn and grass on an extensive scale. However, there is every reason to believe that the growing of small grain, particularly wheat, will be of much more importance in the years to come. The demand for small grain will not only necessitate this; but wheat is needed to fill out a well-balanced rotation, and also to permit the more extensive growing of clover and other legumes. Comparatively few farms are changing hands, improvements that are made are usually of a permanent character, and the people are assuming that stability in their methods of living which is characteristic of a long-settled community.

Opportunities for improvements lie along the line of a more systematic rotation of crops, maintaining the humus content of the soil by plowing under leguminous crops, checking soil erosion, and more careful attention to manurial and fertilizer treatments.

The average size of the 4,012 farms in the county is 120.5 acres, and the average number of improved acres per farm is 98. Land values range from \$20 to \$150 an acre. The higher prices prevail on the smoother and more favorably located land, principally in the

eastern part of the county. The lower-priced land represents the rougher areas along the Chariton River. Rentals are usually on the share basis, one-third or one-half of the crop. Where a cash rent is paid it varies from \$1 to \$5 or \$6 an acre, depending upon the character of the land. About 78 per cent of all the farms are operated by their owners.

SOILS.

The soils of Macon County are of glacial and alluvial origin. Every part of the county was covered by the ice during the Kansan glacial epoch. The glacier with its deposits filled the valleys and covered the highest elevations, and upon receding left behind it a comparatively uniform deposit of drift, consisting of yellow and blue clay containing considerable sand and gravel, 20 to 150 feet deep. Occasional bowlders weighing several hundred pounds are found. East of the Wabash Railroad the drift is not as deep as in the western part of the county. In the former region it rarely exceeds 30 or 35 feet in depth, while in the latter section the mantle is often more than 100 feet in thickness. This condition may be due to the fact that before the Glacial epoch the western region was more deeply eroded and of a lower level than the eastern portion. The shallow drift has a much larger proportion of the underlying residual material incorporated in it than the deeper till. Whatever residual soil that may have been formed from the underlying rocks—limestones, sandstones, and shales of the Carboniferous age—now lies deeply buried beneath this drift. Only in a few places along the deep stream cuts do outcrops of the rock occur.

Overlying the gravelly, sandy, and clayey Kansan till is a uniform mantle of stone-free and gravel-free material from 5 to 10 feet in thickness. It is highly silty at the surface and downward to a depth of 10 to 16 inches. Below this it is heavier. Its origin is not definitely known, though by many it is considered to be of wind-blown derivation. It seems to have covered the whole area of the county at one time, but severe erosion has removed it from the surface, except in the more level prairies and the wide ridges known locally as prairie. In the eastern part of the county, where erosion is least advanced, most of this layer remains, and it is the weathering of this material that gives rise to the soil type mapped as Putnam silt loam.

On the crest of the narrow ridges and along the outer border of the Putnam silt loam, where weathering and erosion have modified it to a greater extent, this material has been mapped as a phase—the Putnam silt loam, well-drained phase. It differs from the Putnam silt loam in that it has a slightly more rolling surface and a loamier structure.

As already stated, the entire county was a smooth plain after the deposition of the glacial till. The material being susceptible to erosion, it became greatly modified in topography, so that now it has the appearance of a thoroughly dissected plain. The surface few feet have also been modified by leaching and oxidation, and the carrying away in suspension of the finer particles of earth, leaving a yellow to reddish-yellow sticky sandy clay with a surface accumulation of sand. The amount of sand is usually greatest in those places where erosion has been most active.

The color of the unstratified Kansan boulder clay, as seen in some places at the bottom of deep cuts, is blue. The change in color in the upper portion is due to oxidation. The effects of weathering extend 20 to 40 feet below the surface. The iron salts have oxidized extensively, as is indicated by the brown, reddish-brown, or reddish-yellow color of the soil particles. These colors in a soil and subsoil invariably indicate that condition of the mineral and organic constituents which may be considered the normal state of a good productive soil in this region. Such thoroughly aerated and oxidized soils have very few if any undesirable chemical or physical properties, and are well suited to general farming. Many lime pebbles and calcareous streaks, together with occasional iron pipes, are found. It is this modified drift material that gives rise to the soil mapped as Shelby loam.

The alluvial soils are derived from material eroded from the uplands, carried in suspension, and redeposited by the streams. They are all quite uniform and are closely related, since they have been deposited by streams in the same stage of development. They range from fine sandy loam to clay, and are characterized by good depth and a rather high content of organic matter. They have been mapped as the Judson fine sandy loam, Wabash silt loam, Wabash silty clay, and Wabash clay, with a second-bottom or bench-land type, the Chariton silt loam. Along the smaller streams occurs a soil that is both alluvial and colluvial in origin. This has been given the name of Judson loam.

The following table gives the name and extent of each soil mapped in this county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Shelby loam.....	220,608	47.9	Judson loam.....	13,184	2.5
Heavy phase.....	33,250		Wabash clay.....	12,480	2.4
Putnam silt loam.....	69,568	29.8	Judson fine sandy loam.....	4,096	.8
Well-drained phase.....	88,320		Wabash silty clay.....	3,520	.7
Wabash silt loam.....	68,288	12.9			
Chariton silt loam.....	15,936	3.0	Total.....	529,280	.....

PUTNAM SILT LOAM.

The surface soil of the Putnam silt loam to a depth of 10 to 15 inches consists of a dark-gray to black friable silt loam, containing sufficient clay to make it slightly plastic when wet. From 18 to 36 inches the material is composed of a dark-brown to grayish-brown plastic clay gradually becoming heavier with depth. The subsoil is usually mottled with brown and black iron stains and in many places the lower stratum is a heavy, grayish clay. The line of demarcation between soil and subsoil is well defined. The latter has a close structure which tends to retard the movement of water, in which respect it resembles the "hardpan" found in some other types. The surface material to a depth of a few inches is rather pervious to water. With a fair content of organic matter the soil does not run together after heavy rains or following freezes and thaws.

This type comprises practically all of the smoother land in the county. The largest areas of the type lie east of the Wabash Railroad. Smaller areas are found in all parts of the county, particularly between East Fork and the Chariton River, where they occupy the tops of wide, flat ridges. The topography is smooth, but as a rule there is sufficient slope to give good surface drainage.

Originally the Putnam silt loam was covered with a growth of wild prairie grass, all traces of which have disappeared. The prairie sod when once plowed does not come in again. All of the type is in a high state of cultivation. Corn, grass, oats, wheat, and clover are the important crops in the order named. In recent years the acreage of wheat has greatly increased, and excellent results have been obtained. Although many farmers say that the Putnam silt loam is not as good a soil as the Shelby loam; the improvements found on it would indicate a prosperity which is not equalled on any of the other soil types.

One of the chief objections to the Putnam silt loam is that it is not very drought-resistant. The structure of the soil permits the rapid evaporation of the soil moisture. Moreover, the almost even surface and the heavy subsoil combine to give poor internal drainage during periods of excessive rainfall. Many farmers are laying tile drains with good results. These should not be placed deeper than $2\frac{1}{2}$ feet, and in filling the ditch surface soil should be put next to the tiles. Deep plowing is also recommended as a means to increasing the zone of root extension. Fall plowing, which allows the soil to freeze to a greater depth, is also practiced extensively on this type. Frequent shallow and level cultivation is recommended. Throughout the corn belt it is customary to pasture the cornstalks during the winter and often late in the spring. The trampling of the cattle frequently leaves the soil in poor condition for working, puddled,

and with a tendency to clod. As a result, tilth is impaired and crops suffer in consequence. These conditions are aggravated if the season should be dry. A poor stand of corn will result, if the field is put in corn, and a compact baked soil, unfavorable for growth, if put in oats. Sometimes farmers do not wait for their soils to dry sufficiently to work well, and a puddled soil results. This is especially true if cropping has reduced the amount of organic matter below that necessary to maintain a good tilth.

Yields on this type will average about 45 bushels of corn, 18 bushels of wheat, and 1 ton to 2 tons of hay per acre. A suggested rotation is corn with cowpeas, corn, wheat or oats, clover or clover and timothy for one or two years, and pasture one year. Land of this type ranges in price from \$60 to \$150 an acre.

Putnam silt loam, well-drained phase.—The surface soil of the Putnam silt loam, well-drained phase, consists of a dark-gray to black, loose, friable silt loam 10 inches deep, becoming slightly lighter in color with increased depth to 18 inches. The subsoil is a brownish-gray heavy clay grading at 30 inches into a yellow or grayish clay with a noticeable sand content. The surface soil of the phase is not as deep and contains more fine sand than the main type. This is especially true in the vicinity of Bevier and portions of the southwest corner of the county, where erosion has reduced the silty clay to a thin covering, the subsoil usually consisting of the glacial till or yellow clay loam.

The areas mapped as a phase represent sections of the Putnam silt loam, modified in surface features and structure by erosion. They include all of the narrow ridges and a belt surrounding the more level areas of the main type. The topography is gently rolling, the surface drainage being generally good. This phase is not usually found on slopes steep enough to allow of any destructive washing, hence erosion is not a serious problem in soil management.

The boundaries between the type and its phase are of necessity somewhat arbitrary, since the two grade into each other almost imperceptibly. The erosion tends to convert the outer edge of the rolling phase into Shelby loam, while the flat prairie is gradually being converted into the shallow phase by the same agency.

Like the typical Putnam silt loam, the well-drained phase is all under cultivation. It is used for the same crops and the soil treatment is identical with that of the main type. It is not as droughty, however, and is generally considered the most desirable of the upland soils. In very dry or very wet seasons it is more productive, as it has better surface drainage than the flat prairie land. What has been said on tile drainage, crop rotation, and cultivation for the Putnam silt loam will also apply to the well-drained phase.

In the central part of the county, particularly in the drainage area of the East Fork, many of the narrow ridges mapped as Putnam silt loam, well-drained phase, are rather inferior in point of productiveness. The surface soil has largely been removed from the ridges and the heavy clay subsoil, low in organic matter, is left exposed. These areas are generally covered with a scrubby growth of white oak and black oak. Where cleared they are being used for pastures. When cultivated they require large additions of organic matter to improve the physical properties of the soil and to insure fair yields.

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

Mechanical analyses of Putnam silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
342003.....	Soil.....	0.0	1.2	1.0	0.6	0.6	76.5	19.9
342004.....	Subsoil.....	.1	.7	.6	.8	.5	46.4	50.7

SHELBY LOAM.

The surface soil of the Shelby loam consists of a friable loam, 6 to 8 inches in depth. The color varies somewhat with the topography, the more rolling areas being a dark yellowish gray, while the gentle slopes are darker in color, due to a higher content of organic matter. As a rule the soil has enough sand to give it a good texture, but much of it is deficient in organic matter, a condition which contributes to excessive washing. The proportion of sand varies, but is greatest where erosion has been most severe. The finer particles are washed away, and the coarser material remains.

The subsoil, to a depth of 10 to 40 inches, is a heavy yellow sandy clay, the yellow being pronounced in the upper portion and where exposed. Small gravels, lime concretions, and calcareous streaks occur throughout the subsoil. Its principal constituent is clay, but the content of sand is sufficient to give it a somewhat friable structure, and to make it sufficiently porous to allow some percolation of water. The upper part of the subsoil contains more or less organic matter, which gives it a yellowish-gray color. The lower subsoil is bright yellow, except locally where it is brown or reddish.

The Shelby loam as found in the western part of the county contains more sand, lime concretions, and calcareous streaks, is more granular, and is considered a better soil agriculturally than in the eastern section. In the latter region where the drift material is comparatively thin, it is probably largely derived from the underlying shale. The type has many characteristics of a shale soil.

Where the drift is of greater depth, probably all of it is derived from foreign material.

The Shelby loam is the most extensive soil type in the area, and includes all of the rolling and hilly land. The topography varies from gently rolling to hilly, the greater proportion being rolling and easily cultivated. The hilly areas occur in the western townships, and in the northern part of the county along the Chariton River.

The type is derived from the glacial till, and occupies all of the uplands except where covered by the loess. In the eastern part of the county the type is confined to strips of varying width, but in the western section it embraces all of the upland except the flat ridges.

Since all of this type is more or less rolling, surface drainage everywhere is excellent and occasionally excessive. During heavy rains the rather compact subsoil does not absorb the water fast enough, resulting in destructive erosion. This is most marked on the steeper slopes and where the soil is deficient in organic matter. To check washing, many of the steeper slopes and the land adjoining draws should be seeded to grass, or, in some cases, used as forest land. The necessity of incorporating a large quantity of organic matter in the soil so that it can absorb more water is obvious.

Originally all but the more gently rolling land of the Shelby loam was forested, but at the present time only the rougher land along the larger streams carries a forest growth.

The type is used for the production of all the staple crops, to which it is well adapted. The greater part is in grass. Bluegrass is indigenous to the type and will take possession of the land in two or three years. When well supplied with organic matter it is a better corn soil than the Putnam silt loam. Clover thrives on it, and alfalfa would probably be a success on the better drained areas. The sandier phase of the type is well suited to the growing of truck and small fruits, and watermelons of high quality are grown on it. The average yields on the Shelby loam are probably slightly lower than on the Putnam silt loam.

As a rule it is not advisable to apply fertilizers to this soil type except where ample provision is made for increasing the organic matter content and preventing soil loss through erosion. The fertilizer should not be used as a top dressing but thoroughly mixed with the plowed soil before seeding down to wheat and clover. The maintenance of a good organic-matter content and the prevention of erosion are the two important considerations in the management of this type. For the economical and permanent improvement of the soil a good rotation of crops, of which one-third should be legumes, the plowing under of all stubble and straw except grain where this system of farming is practiced, and the making and conservation of as much manure as

possible in live-stock farming, are recommended. In addition to the foregoing, annual applications of about 200 pounds of raw phosphate rock per acre should be made.

A suggested rotation consists of corn, wheat or oats, clover and pasture one or two years. If oats follow corn, cowpeas can be drilled in the corn at the last cultivation.

Land of this type ranges in value from \$20 to \$120 an acre, the cheaper land usually representing the forested and eroded portions farthest from the railroads and towns.

Shelby loam, heavy phase.—The heavy phase of the Shelby loam differs from the typical soil in that it has a more grayish color, contains less sand and proportionally more clay, and is agriculturally inferior. These differences may be due to the fact that this phase is more largely derived from shale than is the typical Shelby loam.

The heavy phase reaches its greatest development in the south-central part of the county, occupying most of the territory drained by the East Fork of Chariton River. Much of the Shelby loam in the eastern part of the county resembles this phase.

The surface soil to a depth of 7 inches consists of a dark-gray or grayish silt, containing some very fine sand. It is friable, but contains very little organic matter. The sand content varies somewhat, depending upon the extent of erosion, the effect of this agency being similar to that noted in the Shelby loam.

The subsoil to depths varying from 8 to 36 inches consists of a yellow to yellowish-gray sandy clay loam, lighter colored and containing less gravel and coarse sand than the typical Shelby loam subsoil. In the lower strata sand-free, light-gray clay streaks are encountered. The smaller content of sand tends to give the phase a heavier structure, making it more plastic, but it is comparatively easy to handle.

A small part of the heavy phase is covered with forest, but most of it is used as pasture. Corn and small-grain crops are grown to a small extent, but the yields are not large, except where especially good management is found. Supplying organic matter and preventing erosion are the important problems of this phase.

The coal-mining industry has reached its greatest development within the region of this phase, and owing to this fact the soil has not been farmed as carefully as that of other parts of the county. In many cases coal mining has proved more remunerative than farming.

WABASH SILT LOAM.

The surface soil of the Wabash silt loam is a dark-gray or gray, mellow silt loam, varying in depth from 10 to 12 inches, almost black when wet, and slightly plastic. The subsoil consists of a heavy silt loam, grading at 30 inches into a silty clay, dark to ashy gray in

color, and streaked or mottled with brown and yellow. Small, rounded iron concretions and iron-stained material occur throughout the soil profile. Areas of this type that were until recently forested are much lighter in color, owing to a smaller content of organic matter than in the cultivated areas.

The Wabash silt loam is the most important of the bottom-land types, comprising the greater part of all the stream valley soils. It is composed of material washed from the uplands, principally from Putnam silt loam areas, reworked by the streams and deposited along their flood plains. Near the streams and in the narrower valleys the material is usually coarser than in the vicinity of the bluff line, but this difference is of relatively small importance.

The type as a whole is characterized by a high silt content and a generally friable structure. In many places, particularly where the smaller streams enter the bottoms from the uplands, the soil is black and rich in organic matter. Such areas occupy relatively higher positions than the adjoining bottom land, and are constantly receiving new material. They are considered more productive than the main body of the type, but are similar in physical properties and so have been included.

Most of the type is in cultivation. It is largely used as cornland. The acreage planted in any one season depends somewhat on the early spring precipitation and is greatest in dry seasons. Practically all of the type is subject to overflow, but as most of these come when there are no crops in the ground little damage is done. In a few places in the wider bottoms artificial drainage is necessary before crops can be grown successfully. Tiling can be installed at low expense, outlets are easily had, and ditching is accompanied with no difficulties. Overflows could be prevented or their period of duration shortened by straightening the stream beds and clearing them of debris and by the construction of levees.

Corn and grass are the principal crops grown. The yield of the former averages about 50 bushels per acre. The yield of hay also is large, but in quality it is rather coarse. As a corn soil the Wabash silt loam is without equal in the county. The higher lying areas are admirably adapted to red clover and alfalfa. Alsike clover thrives on this soil and should be grown on those areas too wet for red clover. The occasional turning under of a green legume crop is of prime importance in the management of this soil type.

WABASH SILTY CLAY.

The Wabash silty clay consists of 10 to 12 inches of black, friable silty clay, underlain by a silty clay, grading into a heavy tenacious clay at a depth of 30 inches. The color varies from black or dark gray in the upper portion to a gray or yellowish gray with brown iron stains at a lower depth, usually about 24 inches.

The type occurs in small areas, usually adjacent to the upland in the larger flood plains. Like the Wabash silt loam, it is alluvial in origin, has a level surface, and is subject to overflow.

This soil is easily cultivated and very productive. It is used almost exclusively for the production of corn and grass, of which large yields are obtained.

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

Mechanical analyses of Wabash silty clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
342023.....	Soil.....	0.0	0.0	0.1	0.2	0.2	65.5	33.9
342024.....	Subsoil.....	.0	.1	.1	.4	.5	39.1	59.8

WABASH CLAY.

The Wabash clay, to a depth of 15 inches, consists of a heavy, black, sticky clay, becoming heavier in texture and lighter in color with depth. It is underlain by a gray or bluish clay streaked with brown iron stains. This type is commonly known as "gumbo" land, its cultivation being attended with considerable difficulty unless handled under the proper moisture conditions. It clods badly when plowed too wet, and when dry cracks and breaks up into small cubical pieces at the surface. Clods formed by plowing the wet soil are extremely difficult to pulverize.

The Wabash clay is of alluvial origin, being formed by the deposition of the finer soil particles from quiet waters. It has also been influenced in many places by poor drainage conditions. It is found where the larger flood plains are widest and reaches its greatest development in the Chariton River valley. It occurs most frequently in shallow basinlike depressions.

The soil occupies a lower position than any of the other bottomland types. All of it is subject to overflow, the lower lying areas being inundated for several months each year.

The Wabash clay is known as "prairie bottom," from the fact that it has never carried any forest growth. Much of the type is used for the production of wild grass, from which large yields of coarse hay are obtained. The cultivated areas are used for corn and wheat. Good yields are usually obtained. Clover and timothy do well if the moisture conditions are made favorable. Many farmers owning land of this type are tilling it with good results. By extending the drainage ditches already constructed, by building of levees, and by thorough cultivation with occasional applications of ground limestone, the moisture and physical conditions of this soil can be greatly improved.

JUDSON FINE SANDY LOAM.

The Judson fine sandy loam is a black, dark-brown or dark-gray silty fine sandy loam. At a depth of about 15 inches this dark soil grades into a heavier fine sandy loam, somewhat lighter in color, which extends to a depth of 3 feet or more. In many places the subsoil is almost a silt loam.

The type occurs in small areas and represents the overwash material from small streams, or the talus from nearby valleys washed into the bottoms. Usually the fine sandy loam lies slightly higher than the adjoining bottom land, and as a rule it is not subject to inundation.

All of the type is in cultivation, and is highly prized as a corn, clover, and alfalfa soil.

JUDSON LOAM.

Along the streams in every part of the county is usually found a narrow belt of soil both alluvial and colluvial in origin, which has been mapped as Judson loam. This type is quite variable in texture, but in its typical development appears as a black sandy loam or loam. Along the steeper slopes, where washing is more marked, the soil is generally quite sandy, while over the gently rolling areas the sand content is relatively low. At a depth of 18 inches it grades into a black or dark-gray silty clay, carrying some sand, and continuing to a depth of 3 feet or more. There is usually not enough sand in the subsoil to give it a friable texture, and the lower portion is almost sand free.

Judson loam is characterized by its high content of organic matter and the ease with which it is cultivated. The type lies higher above the streams than any of the other bottom land soils and is rarely overflowed. Its structure allows rapid percolation and the drainage conditions are good.

All this type is under cultivation, and it is considered one of the most fertile soils in the county. It is used almost exclusively for corn and grass, to which it is well adapted. Clover, oats, and wheat give good yields. As a truck soil it is one of the best in the area. It is very probable that alfalfa will grow successfully on the sandier phases of the type.

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

Mechanical analyses of Judson loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
342011.....	Soil.....	0.0	0.9	1.6	16.1	21.8	39.4	20.0
342012.....	Subsoil.....	.2	1.8	2.7	13.4	11.5	39.1	31.1

CHARITON SILT LOAM.

The surface soil of the Chariton silt loam consists of a mellow silt loam, ranging in color from a dark gray or dark brown to black, and extending to a depth of 12 inches. From 12 to 18 inches it grades into a gray silt or silty clay containing a few iron concretions. The subsoil is encountered at a depth of 18 inches, and consists of a grayish-brown or dark-gray, heavy, tenacious clay, slightly stained with brown. The surface drainage of the type is usually good, and it is easily cultivated except in extremely wet seasons, when cultivation is somewhat difficult.

The type occurs principally on the west side of the Chariton River Valley, though smaller areas are found along Mussel Fork in the western part of the county. The largest area lies east of Ethel. The type is a second bottom or bench-land type, and is found in strips varying in width from a few rods to $1\frac{1}{4}$ miles. The terrace rises 10 to 15 feet above the adjoining lowland and is nearly always separated from the latter by a well-defined line.

The surface is smooth with an almost imperceptible slope toward the stream.

The origin of the type is doubtful. Aside from its topographic features, many characteristics indicate wind-blown or glacial rather than alluvial origin. In many respects it closely resembles the Putnam silt loam, being slightly darker in color and having a greater depth. In texture and character of subsoil the two types are practically identical. The darker and more pronounced coloring of the bench lands is probably due to deposition of material washed down from the uplands. At the time of the deposition of the loess the bench land was undoubtedly a flood plain, but the stream subsequently cut through this material, removing most of it, so that at present only a few remnants of the original plain exist.

Originally the Chariton silt loam was covered with a rank growth of prairie grass. All of the type is now in a high state of cultivation, and it is considered one of the most desirable soils in the county. Corn, grass, oats, wheat, and clover are the principal crops. The yields are large, corn averaging 45 bushels and wheat 20 bushels per acre. The rather heavy subsoil will prevent the successful growing of alfalfa. A liberal use of organic manures and occasional applications of rock phosphate or bone meal are the essentials in manurial treatment of this soil type. Applications of ground limestone or burnt lime would also prove beneficial both in overcoming any acidity and in improving the physical condition of the soil.

SUMMARY.

Macon County is situated in the north-central part of Missouri. It has an area of 827 square miles or 529,280 acres. The topography varies from smooth or very gently rolling in the eastern part to rolling

in the western section. The average altitude is about 850 feet above sea level. Surface drainage is generally good throughout the county, drainage waters leaving the area to the south through the Chariton River.

The climate is mild and well suited for the general farming carried on in the county. The annual precipitation is about 37 inches, well distributed throughout the year.

Stock raising and the growing of corn, grass, some wheat, and oats are the principal forms of agriculture in the county. Wheat could be grown more extensively with excellent results. With the exception of the small-grain crops, all crops grown are fed on the farm.

Clover is grown and considerable attention is given to crop rotation. The fertility of the soil has been well maintained, although parts of the county have been seriously damaged by erosion and continuous cropping to corn. More attention should be given to the growing of legumes and the conservation of manure. The farmers are in a prosperous condition and present farming practices in general are good.

The soils of the area may be divided into two groups—the upland and the bottom land. The upland soils have been derived from the glacial till and mantle of loess overlying it. The till gives rise to the Shelby loam and the loess to the Putnam silt loam. Both of these types are excellent agricultural soils, and are used for the production of all of the staple crops.

The alluvial soils are found along all the streams, but reach their greatest development in the Chariton River Valley. They are nearly all silt or clay loams, and are noted for their high fertility. In many places they must be ditched and levees built to insure their greatest utilization.

Eight separate soil types, including two phases of types, were mapped in the county.



[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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