

Issued March 14, 1914.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF CHRISTIAN COUNTY,
KENTUCKY.

BY

RISDEN T. ALLEN AND T. M. BUSHNELL.

HUGH H. BENNETT, INSPECTOR IN CHARGE SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1912.]



WASHINGTON:
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1914.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., July 22, 1913.

SIR: During the field season of 1912 a soil survey was made of Christian County, Ky., for the purpose of securing such information relative to the individual characteristics of the soils and their crop adaptabilities as would lead to a further development of the agricultural resources of the area.

I have the honor to transmit herewith the manuscript report and map covering this work and to request their publication as advance sheets of Field Operations of the Bureau of Soils for 1912, as authorized by law.

Very respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

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MAP.

Soil map, Christian County sheet, Kentucky.

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SOIL SURVEY OF CHRISTIAN COUNTY, KENTUCKY.

By RISDEN T. ALLEN and T. M. BUSHNELL.

DESCRIPTION OF THE AREA.

Christian County is situated in southwestern Kentucky, in the southern tier of counties. It is bounded on the north by Hopkins and Muhlenberg Counties, on the east by Muhlenberg and Todd Counties, on the west by Trigg and Caldwell Counties, and on the south by Montgomery and Stewart Counties, Tenn. It includes an area of 725 square miles, or 464,000 acres.

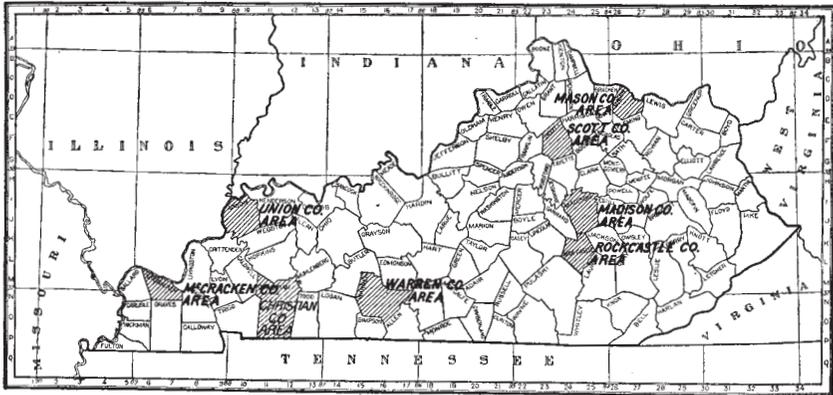


Fig. 1.—Sketch map showing areas surveyed in Kentucky.

Christian County comprises two important physiographic divisions: (1) The Highland Rim, which occupies a considerable portion of southwestern Kentucky and a large part of Tennessee, and (2) the coal-fields region, which represents a portion of an outlier of the Appalachian Plateau known as the western coal fields of Kentucky. The northern division, or coal-fields region, includes the area lying to the north of an irregular line which approximately extends west from Honeygrove, on the east county line, through Hopkinsville, at about the center of the county, to the west line, about halfway between Bainbridge and Gracey. The country in this division is a badly dissected plateau, with elevations varying from about 400 feet to 800 feet above the sea. In general it is very irregular in topography, consisting principally of narrow, steep ridges, trending roughly in the directions taken by the larger streams. The main drainage divides between Bluff, Bull, Coal, and McFarland Creeks and West Fork of Pond River are approximately parallel. The individual hills and ridges within these main divides are winding and irregular. The crests of many of these ridges are occupied by nearly

flat to undulating plateaus, generally narrow. Most of the lateral and sublateral ridges and the hills have sharp crests and tops. The slopes are mainly steep, frequently too steep for cultivation, which in many cases would be followed by severe erosion. Many of the slopes are, however, sufficiently gentle to allow cultivation. Around Crofton and to the west, north of Era, there is a considerable section which varies from flat to undulating, the more nearly level areas having inadequate drainage.

The southern division, the Highland Rim region, is characterized by slightly rolling to undulating surface features, becoming slightly broken along the larger stream courses. A large number of limestone sinks occur throughout this part of the county, but the greater part of it is topographically suited for cultivation, though some of the steeper slopes should be used largely for soil-binding crops, such as grass, in order to prevent erosion. There are several low, flat bodies that must be ditched or tiled to establish proper drainage.

The county is traversed by a network of streams and branches. Pond, Tradewater, and Little Rivers and the Big West Fork of Red River are the principal streams. Pond River flows in a northwesterly direction, forming the boundary line between Christian and Muhlenberg Counties. Into this river flow West Fork of Pond River and Coal, Bull, McFarland, and Bluff Creeks, with a number of other smaller branches and tributaries. Tradewater River heads to the south and east of Kelly, flowing in a northwesterly direction into Hopkins County. As in the case of Pond River, many tributaries flow into this creek, draining the northwestern part of the county. The most important of these are Dripping Spring Branch and Tugler, McKnight, Castleberry, Camp, and Clifty Creeks. Little River heads to the east and north of Hopkinsville, flowing in a southwesterly direction through the south-central part of the county into the Cumberland River. Big West Fork of Red River traverses the southeastern corner of the county and serves as the principal drainage channel for that section.

In practically all instances the various creeks have cut deep to moderately deep, winding valleys. The bottom lands vary in width from a few feet to as much as a half mile. At present practically all the bottom land is subject to overflow with heavy rainfall. The principal bottoms occur in the northern part of the county along Pond River, West Fork of Pond River, Tradewater River, Bluff and Clifty Creeks. Small areas are also found in the southern part of the county.

The first records of any settlement in Christian County date back to the years between 1740 and 1750, when a few pioneers worked their way west in search of game, settling in the hill section of the county. Later a number of families settled where the town of

Hopkinsville now stands. Up to this time agriculture had been given little or no attention. With the organization of the county in 1795 settlement was quite rapid throughout its southern part, and with the growing scarcity of game more attention was given to farming. By 1840 the population had steadily increased and agriculture had become the chief source of livelihood. The early settlers grew the subsistence crops. Cotton, tobacco, and corn were the principal crops.

At the present time the population of Christian County is largely composed of the descendants of early pioneers from North Carolina and Virginia, there being exceptionally few foreigners. In recent years a few settlers have moved in from Illinois, Indiana, Ohio, and other Northern States. There are few negroes in the northern part of the county, but they constitute a considerable proportion of the population of the southern part, especially of the city of Hopkinsville. The population of the county, according to the census of 1910, was 38,845.

Christian County was formed from a part of Logan County in the year 1797, and between 1817 and 1821 was reduced to its present area by detaching portions of it in the formation of Hopkins, Todd, and Trigg Counties.

Hopkinsville, the county seat and chief town, is located in the central part of the county, on the main line of the Louisville & Nashville Railroad and branch lines of the Tennessee Central and Illinois Central Railroads. It has a population, according to the Thirteenth Census, of 9,419, about one-half being negroes. Hopkinsville is a thriving town, with all the modern conveniences of a city. Pembroke, with a population of 731, and Crofton, with a population of 402, are the next towns of importance in the county. Both are located on the main line of the Louisville & Nashville Railroad. Other railway villages of some importance are Gracey, Howel, Herndon, Edgoten, Kennedy, Thompsonville, Casky, and Kelly. A number of villages are scattered throughout the county off the railroads, the most important ones being La Fayette, with a population of 266, and Garrettsburg, in the southern part of the county. Hopkinsville is the center of this section for shipping tobacco and other farm products. A few farmers in the extreme southern part of the county market their crops in Clarksville, Tenn. Casky, a small station on the Louisville & Nashville Railroad, is perhaps the largest shipping point for wood and lumber, while Mannington and Empire are the only shipping points for the small quantity of coal mined in the northern part of the county.

The Louisville & Nashville Railroad enters the county from the north, extending south to Hopkinsville, thence southeast out of the county. It gives excellent freight and passenger service direct to

Louisville, Cincinnati, and all points North and South. The Tennessee Central Railroad traverses the county as far north as Hopkinsville and a branch line of the Illinois Central extends from the west county line to Hopkinsville, connecting with the main line at Princeton. A branch of the Louisville & Nashville Railroad also extends from Clarksville, Tenn., to Gracey, affording the southwestern portion of the county ample facilities for transportation of farm products.

County roads are numerous. Some of them along the stream courses and ridges through the northern part of the county are extremely rough, rocky, and hilly. Pikes surfaced with limestone rock have been established from Hopkinsville in several directions through the southern part of the county. At the present time there are perhaps 300 miles of pike roads extending from Hopkinsville.

The county has good transportation connections with Cincinnati, Louisville, Nashville, Chicago, and other points. Much of the tobacco grown in this section is shipped to New York, whence the greater part of the heavier grades is exported to European countries.

The county has very few manufacturing enterprises of any sort, and with the exception of the small quantity of coal mined in the northern part and a few sawmills here and there, its interests are entirely agricultural. Throughout the southern part of the county there are many beautiful homes, well kept and neatly painted, with such conveniences as telephones, rural free delivery, and acetylene lights. These are evidences of the general prosperity prevailing in this section. At present the northern part of the county is much behind the southern, a fact due largely, no doubt, to the poor condition of the roads, as well as to the agricultural inferiority of the soil. However, this section is noted for the superior quality of its dark export tobacco, which is the only crop of any importance grown. Taken as a whole, Christian County is one of the most important agricultural counties in the State.

CLIMATE.

There is no Weather Bureau station located within Christian County, but data are obtainable from the records at Earlington, in the adjoining county of Hopkins, about 30 miles north from Hopkinsville. The figures given probably represent local conditions, although the records of a voluntary observer at Hopkinsville make the average date of the first killing frost in fall a few days later than those of the Earlington station. No doubt slight differences in the climatic conditions exist in different parts of the county. For instance, fall frosts are earlier in the hill section bordering the bottom lands than in the more level limestone country to the south. In years when crops are necessarily planted late owing to spring rains this difference is likely to affect some crops.

The mean annual temperature for Earlington, as shown by the appended table, is 58° F., with an absolute maximum of 106° and an extreme minimum of -28°, giving an extreme range of 134°.

Extremely cold spells occur during the winter months, but are of short duration. Snowfalls occur usually during December, January, and February, with an average annual depth of 14.7 inches. The summers are usually very pleasant, although there are a few days that are extremely hot. Such periods, however, are rarely long and the heat of the day is broken by cool nights. The hottest month in the year is July, with a temperature of 78° F.

The rainfall is usually sufficient for all crops and is well distributed through the year. The records at Earlington range from 38.2 to 56.3 inches, with an annual mean of 48.4 inches.

The average date of the last killing frost in spring at Earlington is April 7 and of the first in fall October 17, while the earliest frost in fall occurred on September 30 and the latest in spring on April 23. This gives a growing season of 172 days, which is ordinarily ample for the maturing of the various crops grown.

The following table, compiled from the records of the station mentioned, gives statistics of rainfall and temperature in detail:

Normal monthly, seasonal, and annual temperature and precipitation at Earlington, Hopkins County, Ky.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	40	74	-10	3.8	5.6	3.1	3.0
January.....	36	74	-5	4.0	1.7	4.0	5.0
February.....	37	76	-28	4.0	1.2	5.9	5.1
Winter.....	38			11.8	8.5	13.0	13.1
March.....	47	82	5	5.6	4.4	2.3	1.4
April.....	58	92	26	4.4	3.0	1.5	T.
May.....	68	95	34	5.3	2.5	6.2	0.0
Spring.....	58			15.3	9.9	10.0	1.4
June.....	76	100	40	3.6	2.6	8.8	0.0
July.....	78	106	48	4.3	2.6	7.3	0.0
August.....	77	99	48	3.4	4.1	2.7	0.0
Summer.....	77			11.3	9.3	18.8	0.0
September.....	70	97	32	2.9	4.8	2.1	0.0
October.....	60	91	24	2.4	3.8	3.8	0.0
November.....	48	79	11	4.7	1.9	8.6	0.2
Fall.....	59			10.0	10.5	14.5	0.2
Year.....	58	106	-28	48.4	38.2	56.3	14.7

AGRICULTURE.

The first settlement recorded in the area now included in Christian County dates back to the early part of the eighteenth century, when a small colony from North Carolina and Virginia came westward, settling in the hill section of the county. These settlers, being familiar with the culture of tobacco and corn, began growing these crops, along with small patches of wheat, oats, cotton, and flax. Sheep raising at this time was also given some attention, the wool being manufactured into cloth on hand looms. With the organization of the county in 1797 settlement became quite rapid throughout all parts of its area. The smoother country to the south, which up to this time had been considered undesirable on account of the scarcity of game and water, was found to be well suited to the production of tobacco and the other crops grown at that time, and large numbers from the hill section moved southward to engage in farming. Tobacco was the principal money crop. It was packed into hogsheads and hauled to Linton, on the Cumberland River, and shipped on flatboats to New Orleans. This point was also the source from which the early settlers bought most of the necessaries which could not be produced on the farm. New settlers began to come in after the close of the Revolutionary War, and with the opening of near-by local markets on the Cumberland River the acreage in tobacco steadily increased to the time of the Civil War. During the war there was a marked decrease in the production of all crops. With its close, however, and the building of the Louisville & Nashville Railroad, giving direct connection with outside markets, the acreage in all crops was materially extended.

According to the census of 1880 there were 370,306 acres in farms, of which 209,339 acres were improved. The production of the leading crops was: Corn 1,430,154 bushels, tobacco 12,577,574 pounds, wheat 437,668 bushels, oats 64,341 bushels, hay 3,824 tons, sweet potatoes 25,479 bushels, and Irish potatoes 20,837 bushels. In addition to these products some cotton, rye, clover, Canada field peas, beans, sorghum, and garden truck were produced. Orchard and forest products were also of considerable importance. In 1890 there was an increase in the production of corn to 1,584,952 bushels, oats had nearly doubled, and wheat had increased by 150,000 bushels, while the production of tobacco decreased about 1,000,000 pounds. A small acreage of broom corn was also planted, yielding 4,140 pounds. In 1900 there was a noticeable increase in the acreage of the three staple crops, the greatest being in the case of wheat, which shows about 50 per cent increase, with a total yield of about 711,860 bushels. The acreage in tobacco increased about 40 per cent, with a total yield of about 16,000,000 pounds, and that of corn was increased

by about 7,000 acres, though the production was only slightly greater than in 1890. A slight increase occurred in orchard products, while forest products showed a marked decline. Grasses and leguminous crops totaled about 13,060 acres, showing an increase over 1880 of nearly 9,000 acres. In 1910 the most noticeable change was the decrease of about 13,000 acres in the area devoted to wheat, with a yield of 732,692 bushels, or about 31,000 bushels more than in 1900. Tobacco and corn showed a normal increase in production. According to the census of 1880, the average size of farms in Christian County was 145 acres, in 1890 it was 158 acres, in 1900, 100 acres, and in 1910, 107.1 acres. These figures represent approximately the average size of the farms in the northern part of the county, but the average size is undoubtedly much greater in the southern part, where some of the farms are rather too large, probably, for the best results. This apparent discrepancy is caused by the tabulation of each tenancy as a farm.

From year to year there has been a decrease in the percentage of farms operated by the owners, until at present 40 per cent is a conservative estimate, the remaining 60 per cent being operated by tenants. There are a number of lease systems throughout the county, the general plan being based on share rents, the tenant retaining one-half of the crops produced. Under this system the landlord furnishes tools, horses, and everything necessary to produce the crops and pays one-half the cost of the fertilizer. In many instances the landlord directs the cultivation personally and dictates the crops to be grown. Under this system only plowed crops, such as corn and tobacco, are allowed to be grown. Few farms are rented for cash, but where this is done the rate ranges from 50 cents to \$6 an acre.

Although there are a sufficient number of negroes in the county to furnish labor for all purposes, in some parts of the county difficulty is being experienced in obtaining help when most needed. Most of the laborers are employed by the day at wages ranging from 75 cents to \$2, the average being \$1. The higher price is paid only during the tobacco-cutting season. When laborers are employed by the month the wage ranges from \$14 to \$20, with board.

Tobacco, wheat, corn, and hay constitute the principal crops of the county, although small areas are planted to Irish potatoes, sweet potatoes, sorghum, rye, broom corn, alfalfa, millet, and Canada field peas. Small patches of garden truck are produced, along with orchard products, such as apples, peaches, pears, plums, and cherries, for home use.

Tobacco is the most important crop and is grown in all parts of the county. The principal varieties are Big and Little Oronoco, Blue and Yellow Pryor, Yellow Mammoth Boyd, Beat All, and Clardy. Of these varieties it seems to be generally recognized that the Little

Oronoco is the best suited to local conditions. It cures well and makes an excellent grade of heavy export tobacco. The different soils of the county vary considerably in the yield and quality of the tobacco produced. The Dekalb soils in the hill section of the county are noted for the superior quality, excellent color, and light weight of the tobacco grown on them, while the Clarksville soils, especially the heavier textured types, produce a much darker and heavier leaf, rarely, if ever, grading up to that produced in the hill section. The difference in quality, however, is partly or largely made up by the heavier yields obtained on the Clarksville soils. In the rough section of the northern part of the county, locally known as the Hills, tobacco is usually grown on the hillsides and slopes, and great care is necessary to prevent erosion.

At present no definite rotation of crops is practiced, except in a few localities, this being due mainly to the large area of virgin soil available and the frequent disinclination of the growers to improve those fields in which the yields have diminished below the point of profit. For hillside lands rye or other grain sown after the cultivated crops would help to check erosion during the winter, and at the same time furnish winter pasturage and a supply of valuable organic matter to be plowed under. Where such crops are followed by tobacco, the vegetation should be turned under early enough in the spring to insure complete rotting of the material before planting time. To grow a fine quality of tobacco and at the same time maintain the productiveness of the soil, it is good practice to sow clover and timothy in wheat, following tobacco, and to use it for pasture for two or three years before planting tobacco again. Common rotations practiced are as follows: (1) Tobacco, (2) wheat, (3) clover, (4) corn, and (1) tobacco, (2) wheat, (3) clover. Other legumes than those mentioned may be employed in maintaining productiveness.

Vetch can be used to good advantage as a winter cover crop, especially where tobacco follows tobacco. It should be sown with rye, early in the fall, at the rate of half a bushel of vetch and half a bushel of rye to the acre. Vetch is a trailing vine, which must be supported by some other crop where it is to be cut for hay. If the vetch is to be plowed under in early spring, little grain is needed to support it. Cowpeas and soy beans also can be used to advantage as sources of vegetable matter and as gatherers of atmospheric nitrogen.

At present very little commercial fertilizer is used in the county, and this in a rather indiscriminate way, there appearing to be little knowledge as to the requirements of the crop or soil. The practice of mixing the ingredients at home and recording the results secured with varied mixtures or with the ingredients used alone on the different types of soil for different crops would materially advance

efficiency in the use of commercial fertilizers. Results secured by the State Agricultural Experiment Station on soils occurring in the southern part of the county indicate that tobacco is benefited by phosphatic fertilizers, these not only increasing the yield, but causing a much longer and broader leaf. Potash showed some gain when used alone and in combination with other materials, but the increase in yield was not so great as in the case of carriers of phosphoric acid.

For the lighter Dekalb soils a high-grade complete¹ commercial fertilizer would undoubtedly increase the yield, especially if the land were properly supplied with organic matter.

Land for tobacco is usually broken in early spring and harrowed in order to pulverize the clods and to smooth the surface. It is then laid off into checks, varying from 3½ to 4 feet, so as to allow cultivation both ways. The plants are transplanted largely by hand at the intersection of the checking furrows. At present only a few tobacco setters are in use in the county. Cultivation is generally done on the larger farms with improved machinery throughout the southern part of the county and on the flatter areas of the Dekalb silt loam in the northern part of the county. The first plowing is rather deep, the furrow being run close up to the plants. Light cultivation is practiced after the plants are well started. Considerable hoeing is done in some sections. Hilling up of the plants is practiced generally after the last plowing throughout the northern part of the county, and, to a more or less extent, in the southern part.

In the northern part of the county it is commonly said that "tobacco is made in the barn," while in the southern part it is "made in the field." Great care is given to the curing in the northern hill section. Here three "firings" are made, requiring 60 days, the leaf being allowed to air between the firings. In the southern part more than two firings, requiring an average of 40 days, are made only in rare instances. The results of such different treatment are quite noticeable in the finished product. Longer firing is said to give a more uniform or "solid" color and a better grade of leaf. Short firings have a tendency to leave the leaf streaked or spotted with a variety of colors, which is considered an undesirable quality.²

Wheat ranks next to tobacco in the agriculture of the county. According to the census reports, there has been an increase in the yields of this crop from 10.9 bushels per acre in 1879 to 15.6 in 1909. This increase is no doubt due largely to the better preparation of the seed bed, the incorporation of organic matter, seed selection, and the use of commercial fertilizers. Greater quantities of fertilizers are used for this crop than for the others grown in the county. In the smoother limestone country wheat is usually sowed with drills

¹One containing nitrogen, potash, and phosphoric acid.

²For further discussion of the curing of tobacco see bulletins of the U. S. Department of Agriculture.

and harvested with the reaper or binder, while in some parts of the hill section the seed is sowed broadcast by hand and harvested with the cradle. Very little wheat is grown, however, in this rougher portion of the county, and that largely for home use.

Corn is also a crop of considerable importance, but it is not grown in sufficient quantities to supply the home demand. In the more nearly level country the seed is planted with a planter, fertilizer being put in at the same time. The plants are grown usually in rows spaced about 18 inches in the row, the rows being about $3\frac{1}{2}$ feet apart. Cultivation is done largely with cultivators and double-shovel plows. Hoeing is practiced also in the hill section. Another method of planting is in checks about $3\frac{1}{2}$ feet apart, the field being cultivated both ways. This is usually the method practiced on the more nearly level Clarksville silt loam and the flat phase of the Dekalb silt loam.

Instead of ridge cultivation, except in the poorly drained areas, it is better to practice level cultivation. The first plowing should be fairly deep and close to the plant, in order to loosen and aerate the ground and to encourage root extension. Subsequent cultivations should be shallow and frequent, so as not to disturb the spreading roots and to conserve moisture by keeping the surface well mulched, thus cutting off surface evaporation.

The production of clover hay is quite an important item throughout the southern part of the county, while timothy and redtop are grown almost exclusively in the hill section. The bottom lands give the largest yields, although fair yields are often obtained on the hillsides and ridges.

Irish potatoes, sweet potatoes, millet, broom corn, and alfalfa are crops of some importance.

At present very little rye is sowed. Its use for pasturage, as a protection on slopes, and as a source of vegetable matter for turning under deserves more attention.

The orchard products of the county consist principally of apples, peaches, pears, plums, cherries, and berries. It has been recommended in the discussion of the Dekalb silt loam that the slopes and ridges of the rougher areas in the northern part of the area could be used most profitably for apples, where such land is used at all, than for the ordinary farm crops.

At present very few cattle are raised in the county. Sheep raising is carried on to a limited extent, and on account of the low yields obtainable from some of the cultivated crops, especially in the hill section, this industry should be given more attention. In many places wild vetch makes a luxuriant growth on the slopes and with other wild plants would afford excellent pasturage. Where cattle raising is carried on, the farmer simply turns his herd out in early spring,

leaving the animals to provide for themselves throughout the hills until fall, when they are rounded up for winter feeding.

Careless methods of farming employed under the tenant system are an important factor in soil deterioration. Frequently the tenant is only assured of one or two years tenure, which leaves him little or no incentive to follow the approved methods for permanent agriculture. In some instances the tenant is wholly to blame for the soil depletion, though the landowner himself is often indifferent to the treatment his soil shall receive and insists only that the tenant shall be able to pay the rent. With the short-term tenant system the landowner can not expect the tenant to practice careful crop rotation, to adopt a system requiring the keeping of much live stock, to plow under crops supplying organic matter, or to adopt any of the methods, often laborious and without immediate returns, which are necessary in the proper management of the soil.

SOILS.

Christian County includes a part of the coal-field region of western Kentucky and a part of the relatively low western extension of the Highland Rim region, the main body of which lies to the east and southeast in Tennessee. The Highland Rim, which represents the upland region of the Limestone Valleys and uplands soil province, is more typically developed to the south in Tennessee, where it is a moderately high plateau surrounding the lower limestone soils of the Central Basin of Tennessee. The coal-fields region of western Kentucky is an outlier of the Appalachian Mountains and plateau soil province. This portion of the Appalachian Plateau has a considerably lower elevation (the highest elevation being about 850 feet in Christian County) than the main development of this division which crosses eastern Kentucky, but the dominant rocks of the two sections are the same. In addition to the two regions already described, the county also includes a considerable area of the stream-bottom lands, the soils of which belong in the River Flood Plains Province.

The upland soils are residual, from cherty limestone, chert-free limestone, limestone and sandstone, and sandstone, with some shale. Those belonging in the Appalachian province, the Dekalb soils, are confined almost entirely to the northern half of the county, or, to be more exact, to the territory lying north of an irregular line extending from Honeygrove, on the east county line, to Hopkinsville, about the center of the county, and thence to the western line, about halfway between Bainbridge and Gracey. The other residual soils, those derived from limestone or interbedded limestone and sandstone, dominate the southern part and cover a large total area in the north-eastern part.

The Dekalb soils, including the silt loam and a flat phase of this type, the fine sand, and the stony silt loam, are derived largely from fine-grained sandstone and shales belonging to the coal measures of the carboniferous period. These soils are characterized by the gray to pale-yellow color of the surface portion and by the yellow color of the subsoils. Some patches of land have been included in which the subsoil has a reddish color, such areas representing bodies of Hanceville soils or soils whose characteristics approach those of the Hanceville series. These have not been mapped on account of the small size of the areas. The reddish color of the subsoils of such areas appears to have resulted from a more complete oxidation of the iron components as affected by better drainage and consequent better aeration.

The Dekalb soils occur over the highest portions of the county on the smoother high plateaus and the flanking slopes. The flat phase of the Dekalb silt loam, which has an extensive development in the vicinity of Crofton, may be considered as belonging to a subordinate division of the Appalachian plateau; that is, relatively low country which conforms topographically rather closely with the limestone areas giving the Hagerstown and Clarksville soils.

The Clarksville series is represented by a single member, the silt loam, which in its typical development is characterized by the grayish color and floury structure of its surface soil and by the yellow color and crumbly structure of its subsoil. The greater part of the material entering into the composition of this soil seems to be derived from a moderately cherty limestone. Some chert fragments occur in local areas on the surface and throughout the soil mass, while fragments of chert are usually present in the substratum, generally at depths below 4 or 5 feet. The topography of the Clarksville silt loam varies from almost flat to undulating and gently rolling.

Another silt loam having the same origin as the Clarksville silt loam is the Guthrie silt loam. This type occupies low, flat areas having poor drainage, and the light-gray to white color of the surface soil and the mottled gray and yellow color of the subsoil of this type have been brought about by this condition.

The Hagerstown soils are characterized by the grayish-brown to brown or reddish-brown color of the surface portion, and by the reddish-yellow to reddish-brown or dull-red color of the subsoils. In a good many places the subsoil, especially of the clay loam type, has a well-developed brick-red color, some areas approaching closely to the color of the Decatur subsoil. Occasionally chert fragments are encountered in the substratum and to a less extent within the profile, but the Hagerstown soils have come largely from a chert-free limestone. It is believed that the material of this soil is derived from a limestone which contained more calcium carbonate than that from

which the Clarksville silt loam has been formed, possibly from a less siliceous limestone. The supposition is supported by the fact that the Hagerstown soils are naturally more productive than the Clarksville soils, although having very nearly the same drainage and topographic features. Generally soils derived from the more calcareous limestones are more productive than those derived from the argillaceous and siliceous limestone where existing under practically the same conditions of drainage and topography.

The Hagerstown soils in Christian County do not seem to be quite so productive as those of the Central Basin of Tennessee, the bluegrass region of Kentucky, and the Appalachian Valley region of Tennessee, Kentucky, Virginia, Maryland, and Pennsylvania. This may be due to a less calcareous parent limestone or possibly to a somewhat lower content of organic matter in this area. The difference is, however, very little.

The Colbert stony clay, which is the only member of this series in Christian County, is also derived from chert-free limestone. This type differs markedly from all the other limestone soils of the area in the very plastic and sticky character of the subsoil. This type is largely confined to the lower slopes of the ridges in the northeastern part of the county. It generally extends from the banks of the smaller streams or from the margin of the alluvial bottoms of streams up the slopes to the boundary of the Christian or Dekalb soils. Occasionally it reaches up to the crests of the lower hills and ridges of this section. This is a yellow to greenish-yellow, stiff, plastic, impervious heavy clay with numerous outcrops of limestone and small and large fragments of limestone scattered over the surface and disseminated through the soil body. The yellow color and very plastic structure of this soil can not, it is believed, be entirely accounted for by incomplete oxidation, as the surface of the type favors rapid and complete drainage. Incomplete oxidation probably does partly account for the absence of red coloring in the material, but the little advancement made by oxidation is certainly due to the very dense structure and imperviousness of the heavy clay, which it seems is a direct resultant of the argillaceous character of the parent rock.

The Christian soils, including a silt loam and a stony loam, are derived from both limestone and sandstone, in places from interbedded limestone and sandstone, and elsewhere from limestone influenced by material from capping strata of sandstone. These soils occur as undulating and gently rolling relatively low country, as steep slopes of the higher ridges and as low ridges in the northern part of the county. The soil is grayish-brown to brown and reddish-brown in color, while the subsoil consists of a moderately friable or crumbly silty clay to clay of a reddish-yellow, reddish-brown, or red color. In many

places the subsoil has practically the same red color as the Decatur soils. Fragments of limestone, chert, and sandstone and outcrops of these rocks are of common occurrence throughout the stony loam type, while fragments of these rocks are seen here and there on the surface and throughout the subsoil of the silt loam type, with a higher content of such fragments in the substratum.

The alluvial soils of the county are represented by a single type, the Huntington silt loam. This is a brown silt loam occupying the bottoms of streams. The Huntington silt loam is subject to overflow and thus to repeated deposits of alluvial material.

Rock outcrop is a classification used to designate bare areas of rock, occurring either as cliffs or more nearly horizontal exposures of bedrock.

The several soil types mapped are discussed in more detail in subsequent pages.

The following table gives the names and extent of the several soil types. Their distribution is shown on the accompanying map by means of colors and symbols.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Hagerstown silt loam.....	173,952	37.5	Christian stony loam.....	5,440	1.2
Dekalb silt loam.....	142,336	32.7	Colbert stony clay.....	5,120	1.1
Flat phase.....	9,600		Guthrie silt loam.....	3,776	.8
Huntington silt loam.....	29,440	6.6	Rock outcrop.....	832	.1
Clarksville silt loam.....	26,048	5.6	Dekalb fine sand.....	640	.1
Christian silt loam.....	25,792	5.5			
Hagerstown clay loam.....	21,568	4.6	Total.....	464,000
Dekalb stony silt loam.....	19,456	4.2			

HAGERSTOWN SILT LOAM.

The Hagerstown silt loam consists of a yellowish-brown to brown, mellow silt loam, underlain at about 6 to 12 inches by a buff, reddish-brown, or brown, slightly more compact and heavier silt loam to silty clay loam, which, at about 15 to 20 inches, passes into a moderately friable or crumbly silty clay of a reddish-brown color. The color generally becomes more nearly red with increase in depth, the lower portion and subsoil being of a dull-red color. Fragments of chert are much less numerous than in the Clarksville silt loam, although some are occasionally seen in the substratum.

This type is a residual soil, derived from the St. Louis limestone through those processes of weathering in which carbonated waters have dissolved the greater part of the calcium carbonate of the original limestone rock, leaving behind the siliceous and other insoluble constituents. The parent limestone consists of a hard, dull-blue or gray rock.

The Hagerstown silt loam is found in the southern part of the county in large unbroken areas, becoming broken and irregular in outline near the rolling areas of Dekalb silt loam. This soil extends up a number of stream valleys into the general region occupied by the Dekalb soils, where erosion has removed the sandstone material and exposed the limestone, from which the material of this type is derived. Throughout these areas fragments of rock and rock outcrop are of frequent occurrence, especially near the heads of streams. These areas, however, are of such small extent that their separation on a map of the scale used in the soil survey was impracticable.

Topographically this type lies admirably for farming. The surface varies from gently undulating to gently rolling and rolling, areas of the latter configurations occurring along the Big West Fork of Red River, in the southeastern part of the county. Even the most uneven areas, except in rare instances, can be cultivated. The frequency of sink holes caused by the dissolution of the underlying limestone has much to do with the surface inequality of the type. These sinks vary in size, the larger ones rarely covering an area of over 5 acres. The soil in a number of these sinks resembles the Guthrie silt loam, the subsoil being mottled yellow and gray. Some of it probably does represent true Guthrie silt loam, but it is not practicable to map such bodies, on account of their small size.

The Hagerstown silt loam is considered the best agricultural soil of the county. It is especially well adapted to the crops grown in this section. When well supplied with organic matter, as on a number of the better farms, the soil has an open and crumbly structure, giving excellent aeration, and aiding in the retention of moisture. Until recently the true value of this type was not fully appreciated by the farmers, and the methods of cultivation and general farm management were such as seriously to impair the productiveness of the soil. Continued clean culture had put the soil in poor physical condition, and large tracts were supposed by the farmers to be "worn out," and accordingly allowed to grow up in sassafras and weeds. In the last few years, however, farmers have been practicing crop rotation more generally than before, and have begun the use of commercial fertilizers. They have also given the land more thorough cultivation, plowing deeper and harrowing repeatedly. These improved methods have had the result of increasing yields.

The rotation most generally practiced is tobacco, followed by wheat, then corn, and then clover, clover and timothy, or timothy or red-top alone. The grass is cut for hay or used for grazing. Oats are rarely grown except in small patches, seldom having any important place in the rotations. Many of the farmers, as elsewhere, follow tobacco with tobacco year after year, then seed the field with clover or grass, or both, and after a year or two plant in tobacco again.

Under the best treatment this soil gives excellent returns. The yields under most favorable conditions are tobacco, 1,500 pounds; corn, 90 bushels; clover hay, 4 tons; wheat, 40 bushels per acre. As tobacco is the principal money crop, a large acreage is planted each year, the average yield being about 1,000 pounds per acre. A few small patches of alfalfa are grown, with good results. Although this section is not included in the main bluegrass area of the State, small fields and patches along the roadside were seen. These seemed to be in an exceptionally thrifty condition. This grass could be grown to advantage on many farms for grazing horses and cattle. To maintain the productiveness, the land should be kept supplied with sufficient organic matter to prevent it from compacting. This can be done by growing cowpeas, clover, or other legumes, and plowing them under.

Crop rotation should be practiced in order that the soil may not be impaired by continuous planting to the same crops. The legumes have a highly beneficial effect upon the soil and should be included in any rotation adopted. Barnyard manure gives good results with all crops, as do also high-grade mixtures of complete commercial fertilizers and occasional applications of lime.

It is difficult to state any definite price for this land, especially since the piked roads have enabled the farmers to reach the markets so easily. The price ranges from \$25 to \$125 an acre, these values varying with the proximity of the land to the improved roads, or to Hopkinsville or some of the local markets.

HAGERSTOWN CLAY LOAM.

The Hagerstown clay loam is a rather variable soil comprising patches of clay loam and silt loam so intricately mixed that a satisfactory separation of the two was found to be impracticable. The silt loam areas really represent the Hagerstown silt loam, although the average depth of the soil of this portion of the Hagerstown clay loam as mapped is probably not so deep as that of the true Hagerstown silt loam, mapped as such. The clay loam portion is a reddish-brown to red silty clay loam, underlain at about 4 to 8 inches by a red, moderately plastic clay. The color of the subsoil varies from a dull red or reddish brown to almost as red as the subsoil of the Decatur.

The largest and most typically developed areas of this type lie southeast of Garrettsburg and north and west of Edgoten, along the Tennessee-Kentucky line, other smaller areas occurring along Big West Fork of Red River, east of Pembroke along Montgomery Creek, southwest of Julien, and along Sheridan Creek. Other areas are scattered throughout the limestone region in the southern part of the county.

Typically this soil occupies slopes where erosion has removed the silty surface material. The prevailing topography is gently undulating to gently rolling.

The materials forming the Hagerstown clay loam have the same origin as those forming the Hagerstown silt loam, both types being derived through weathering from the St. Louis limestone. The difference in the texture of the two types may in places be due to some extent to differences in the proportion of siliceous material in the original rock, but it is probably largely the result of erosion.

This type is considered the strongest soil in the area for general farming and the yields reported support this general appraisal. The principal crops, as in the case of the Hagerstown silt loam, are tobacco, wheat, corn, clover, and grasses. The heavier areas are especially adapted to wheat and clover. Tobacco does not do so well as on the Hagerstown silt loam. The yield is heavy, but the leaf is inferior.

In order to obtain the best yields from this type moderate applications of fertilizers are generally used for such crops as tobacco, grain, and corn. With deeper plowing, the incorporation of vegetable matter, and occasional applications of lime, the expenditures for fertilizers may be considerably reduced. The soil has a tendency to erode, and cover crops, such as rye, vetch, and oats, should be sown to protect the land during the winter months. A good rotation consists of tobacco, wheat, clover, corn, or, if a shorter course is desired, tobacco, wheat, clover.

On account of the suitability of this soil for the production of the general farm crops, especially the small grains, it is highly esteemed by the farmers. It is held at prices ranging from \$30 to \$100 an acre.

CLARKSVILLE SILT LOAM.

The Clarksville silt loam consists of a gray or yellowish-gray floury silt loam, underlain at an average depth of about 10 inches by a pale-yellow silty clay loam to silty clay having a moderately friable or crumbly, compact structure. Slight variations in the subsoil are of rather common occurrence, restricted areas showing a reddish or reddish-yellow color. Fragments of chert are of common occurrence in the substratum, on the surface, and throughout the soil section of those areas occupying eroded slopes. An occasional chert fragment is also seen on the surface of the less rolling areas. In some of the low-lying areas there appears to have been a washing in of silty material from adjoining slopes, and in such situations the depth of the surface soil is greater than in the typical higher lying bodies.

When in a proper moisture condition this soil is easily cultivated, but if handled too wet it puddles, becoming hard on drying, and forming clods which offer some resistance to subsequent cultivation.

Large areas of the Clarksville silt loam occur north of La Fayette and south of Bennettstown. The type is also developed north of Pembroke, and in a strip extending eastward from the Trigg County line through Peedee to Durham. Other small areas occur scatteringly throughout the Hagerstown silt loam.

This type has been derived from cherty limestone of the St. Louis group. This rock is dull blue in color and very hard.

The topography varies from nearly level to undulating and gently rolling. Surface drainage in the main is good, but some of the more nearly level areas could be improved by tiling. On some of the more gently rolling areas the surface soil has been partially removed by erosion. This has had the effect of bringing the subsoil material near enough to the surface to be turned up by ordinary plowing, so that newly plowed fields have a spotted yellow and gray appearance.

The Clarksville silt loam gives moderate to fairly good yields of corn and small grain and good yields of high-grade tobacco. On the whole the yields are somewhat less than those obtained from the Hagerstown silt loam. Corn yields on an average 20 to 35 bushels, wheat 15 to 25 bushels, oats 20 to 40 bushels, and tobacco about 1,000 pounds per acre.

Recently more attention is being given than formerly to the improvement of this land through crop rotation, but there is still a considerable proportion of the type which is cultivated continuously to one crop. The commonly used rotation consists of tobacco or corn followed by wheat, then grass (timothy or reedtop and clover), the last being pastured from two to three years. Lespedeza, or Japan clover, flourishes everywhere on this type and furnishes some pasturage for hogs and cattle. With good treatment this soil responds well in the production of corn, tobacco, and grasses, but it is not so well adapted to wheat as the types already described.

To obtain maximum yields ground phosphate rock and heavy applications of finely ground limestone, with incorporation of organic matter, such as could be supplied by turning under cowpeas, rye, or clover, is recommended. The legumes should be included in rotation with other crops, cowpeas and soy beans in summer and vetch and clover in the winter. A plow depth of at least 8 or 10 inches should be maintained.

The selling price of this type varies with locality. It can be had at prices ranging from \$15 to \$75 an acre.

CHRISTIAN SILT LOAM.

The surface soil of the Christian silt loam consists of a grayish-brown or brown mellow silt loam about 6 to 16 inches deep. Variations in the color characteristics of this type are quite frequent, and

no definite description can be given for the larger areas. Along a number of the slopes in the northeastern part of the county, noticeably to the north of Fruit Hill and in and around Green Grove Church, small, isolated areas of a dark or drab clay loam approaching closely the characteristics of Colbert clay loam were encountered. These areas vary in size from one-half acre to 2 acres. In practically all the areas of this type limestone outcrop and large fragments of sandstone are of frequent occurrence, but not to such an extent as seriously to disturb cultivation.

The subsoil to a depth of 18 to 20 inches consists of a yellowish-brown to red or reddish-yellow, friable silty clay loam, which quickly grades into yellowish-red to brick-red, compact, brittle clay. In some places the heavy clay lies directly below the surface soil without the intermediate layer. Below 30 inches and in the substratum of a number of small areas there is an occasional gray mottling, and a few scattered cherty limestone fragments. On the slopes the bed-rock is frequently encountered within the 3-foot section, and even in the more typically developed areas the weathered material does not extend to depths greater than 40 inches.

The areas of the Christian silt loam occur in irregular bodies along the boundaries between the sandstone and limestone soils and scattered throughout the Dekalb silt loam and its associated types. The most typically developed areas lie northeast of Bluff Spring, along the Christian-Todd County line, and bordering Buck Fork, Bluff Creek, and West Fork of Pond River. Other important areas occur north of Fairview, in and around Ovil, Laytonsville, Antioch, Old Bainbridge, north and east of Bainbridge, and south of Macedonia, in the northwestern part of the county.

The occurrence of this type on the slopes and along the ridges of the hills gives it a rather varied topography. Usually, however, the surface features vary from gently rolling to rolling. The more desirable areas, as far as topography is concerned, lie southwest of Laytonsville, northeast of Bluff Spring, south of Macedonia, and north of Bainbridge. The most rolling areas occur mainly in the northeastern part of the county as small patches or strips on the steeper slopes. With the exception of those areas lying on the slopes of the more prominent ridges, where the drainage is usually excessive, this type has good surface drainage.

The Christian silt loam is a residual soil derived from the weathered products of limestone and sandstone. In places the rocks are interbedded and mixture has resulted from such intimate association of the rock strata; elsewhere the materials are probably more largely from limestone but modified by material from strata of sandstone lying higher upon the slopes or capping the ridges.

The forest on this land consists principally of hardwoods, with an undergrowth of huckleberry. White oak, chestnut oak, some cedar, maple, beech, hickory, and dogwood are common species.

Owing to the natural productiveness of this type, it is considered one of the best soils for general farming in the northern part of the county. It is especially adapted to the production of corn, wheat, grasses, and dark grade of tobacco; but only in rare instances, where the Dekalb silt loam occurs on the same farm, is it planted to the last-named crop, being largely used for small grains and grass. On some of the steeper slopes, where erosion has removed a large part of the surface soil, leaving the parent rock near the surface, crops suffer from drought. At present more than one-half of this type is under cultivation, giving the following approximate yields: Corn from 15 to 25 bushels per acre, with a maximum of 60 bushels on the most highly improved farms; wheat from 18 to 25 bushels an acre, and as high as 40 bushels; oats from 20 to 30 bushels an acre; tobacco from 800 to 1,200 pounds an acre, and hay from 1 to 2 tons an acre. The quality of wheat and corn is said to be exceptionally good.

Very few orchards were seen. Owing to the favorable position of some of the type with respect to air drainage, more attention should be given to the culture of fruit. Apples, plums, and cherries should do well if the trees are given proper care, including spraying.

At present no systematic crop rotation is practiced, corn frequently being planted in the same field year after year. Plowing should be gradually deepened, until a depth of at least 8 to 12 inches is reached. This will provide a much more favorable environment for plants, allowing a more perfect development of the root system and providing a better supply and better circulation of moisture and air.

With an acreage application of from 1,000 to 2,000 pounds of burnt lime, or twice this quantity of ground limestone, and the incorporation of organic matter, such as barnyard manure, litter from the forests, and the turning under of green manuring crops, such as cowpeas, rye, and clover, there is no question that the land would be made considerably more productive. Applications of moderate quantities of complete mixtures of commercial fertilizer will increase the yields of crops, but the quantity needed can be materially lessened by deep, thorough plowing, by growing the legumes in rotation with the staple crops, and by supplying needed organic matter in the ways suggested.

The value of this type varies with proximity to local market. From \$10 to \$40 an acre represents approximately the range in price.

The following table shows the average results of mechanical analyses of samples of the soil and subsoil of the Christian silt loam:

Mechanical analyses of Christian silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
390808, 390813.....	Soil.....	0.2	0.4	0.3	1.0	1.4	75.1	16.5
390809, 390814.....	Subsoil.....	.1	1.2	3.7	11.0	4.9	56.2	22.8

CHRISTIAN STONY LOAM.

The Christian stony loam consists of a grayish-brown or brown to reddish-brown silt loam, underlain at about 5 to 10 inches by a reddish-yellow, yellowish-red or buff to brick-red, brittle silty clay or rather stiff clay. The color of the redder portions of the subsoil is practically identical with that of the Decatur subsoil. Along the boundary of this type and the Colbert stony clay patches of the latter too small to be separated have been included with the Christian type. Outcrops of sandstone and limestone and fragments of these rocks are everywhere abundant.

The principal areas of this type occur in the northeastern part of the county in strips varying from one-eighth to three-fourths mile in width. The most typical areas lie along Coal and Bull Creeks and West Fork of Pond River. Smaller areas were mapped on the slopes bordering the Colbert stony clay near Pond River. One small isolated area is found southwest of Macedonia, in the northwestern part of the county. The type occupies the slopes of ridges and hills, the tops of which are generally covered with soils of the Dekalb series.

As in the case of the Christian silt loam, this soil has been derived from interbedded sandstone and limestone rocks, the fragments present representing the more residual, siliceous portions of the original rock mass.

Most of the land is in forest, consisting principally of red oak, white oak, post oak, hickory, beech, and dogwood. A number of sawmills are operating in these forests. Greater care should be taken to leave a sufficient number of small trees to protect the slopes from erosion and to aid in the reestablishment of the forest cover.

No data were obtainable in the field on the yields of crops on this soil. Small patches are to be found on the slopes of a number of ridges which could be farmed after the removal of the larger stones. Such areas would, in all probability, give better returns with apples, peaches, and berries than with the ordinary field crops. The type affords some pasturage.

This land can be bought at prices ranging from \$1 to \$10 an acre, depending upon the topography and the quantity of merchantable timber.

DEKALB SILT LOAM.

The Dekalb silt loam is a gray to pale-yellow, floury silt loam, with a depth of 6 to 14 inches. In the more eroded areas northwest of Hopkinsville, where the shales have been exposed, small areas included with the type have a very decidedly reddish-brown color, and as a rule carry a considerably higher percentage of clay. Such areas, however, are of such limited extent that their separation was impracticable. There is no sharp line of demarcation between the soil and subsoil, the surface material, as a rule, grading gradually into a yellow silty clay loam, which becomes more intense in color and more compact and brittle in structure with increase in depth. In some places at about 30 inches a slight gray mottling, characteristic of the flat phase of the type, was noticed.

This type is derived from interbedded sandstone and fine sandy shales of the Chester group overlying the St. Louis limestone. This formation occurs as a cap varying in thickness throughout the northern hilly section of the county, where it rises above the general level of the basal limestone region of the southern part of the county. Small sandstone gravels and, in one or more instances in the vicinity of Apex and Sharbers Store, in the northern part of the county, a few shale fragments occur in the soil.

The Dekalb silt loam is the dominant type in the northern half of the county, and its area is broken only by small, irregular areas of other soils. The most typically developed areas lie along Tradewater River, in and around Red Hill, Empire, and to the southwest of Bluff Spring.

Topographically the Dekalb silt loam is somewhat varied. It occupies elevations ranging from 400 to 800 feet above sea level, or approximately 350 feet above the exposed basal limestone rock throughout the southern part of the county. It forms the smooth plateaus and gentle slopes of the ridges, becoming hilly and even semimountainous over a small area south of Ovil, along the Christian-Todd County line.

At present practically all of the more hilly areas and the steeper slopes are forested with hardwoods. The original growth consists principally of chestnut, red oak, white oak, chestnut oak, and dogwood. In abandoned fields sassafras, broom sedge, sumach, and crabgrass are characteristic plants. A number of sawmills located throughout the wooded areas of the type are rapidly cutting away the merchantable timber. Close cutting will result in much damage to the soil on the steeper slopes, as it erodes readily.

The principal money crop grown on this type is tobacco, the yield averaging about 750 pounds per acre. Corn is the crop of secondary importance. The average yield is about 15 bushels per acre. Wheat usually gives very poor returns, the yield rarely exceeding 15 bushels per acre even in favorable seasons and with the best soil management. Oats yield from 20 to 40 bushels, and hay from one-half to 1½ tons. Sweet potatoes are grown to a limited extent for home use and local markets, yielding about 50 bushels per acre. Irish potatoes and garden truck, such as lettuce, cabbage, beets, turnips, radishes, and tomatoes, do well.

Although few orchards were seen, scattering apple trees east of the West Fork of Pond River seemed to be in a very thrifty condition. During the survey these were laden with highly colored fruit. Peaches are very unsatisfactory owing to unfavorable climatic conditions.

Systematic rotation of crops is practiced by many of the farmers operating on this soil. Good rotations, especially those which include the legumes, are of prime importance in maintaining its productiveness. Tobacco is often grown year after year on the same land until the decline in yield compels the farmer to abandon the field for fresh land. The most progressive farmers, however, are beginning to realize the advantages of rotation. At present the common rotation is tobacco, followed by winter wheat, which is seeded to clover in the spring and followed the next year by corn. With this rotation and the addition of organic matter in the form of stable manure or green crops plowed under, the productiveness of this soil can easily be maintained or increased. Rye sown in the fall will protect the slopes from excessive wash and make a heavy growth to be turned under in the spring. Cowpeas should then be sowed and "hogged off" in the fall or cut for hay, so as to obtain a profit from the field and at the same time leave a large quantity of vines and roots to be incorporated with the soil. In this way the soil can be supplied with humus and nitrogen, two of the most important needs of any soil. Commercial fertilizers are of decided benefit in increasing yields on this grade of land. Liberal applications of lime, also, are highly beneficial.

The price of land composed of the Dekalb silt loam is variable, the value depending upon the proximity to the railroad and upon the character of the surface. The more nearly level areas near shipping points bring as much as \$25 an acre, while the more broken and eroded areas can be bought for from \$2 to \$15 an acre.

Dekalb silt loam, flat phase.—This phase of the Dekalb silt loam is characterized by the flat surface, relatively low elevation, and the lighter color of the surface material and mottled color of the subsoil. The soil consists of a pale-yellow or light-gray silt loam, which grades

abruptly into a gray or yellow silt loam, and this, in turn, at a depth of about 20 inches into a mottled gray and yellow silty clay loam. The surface is so flat that the soil is locally known as "flat-woods land."

The material of this phase is residual, and has been derived from identically the same rocks as the typical Dekalb silt loam. The characteristics distinguishing the phase from the typical soil are due to its topography, the flat surface having caused poor drainage, the factor which has brought about the light and mottled color of the material.

The most typical areas of this phase occur in and around Crofton, north of Era, and north of Mitchell School. Other areas occur in and around Knotty Oak and northeast of Laytonsville, in the eastern part of the county.

The wooded areas support a growth of red oak, white oak, post oak, hickory, dogwood, and elm. In abandoned fields of the better drained areas sassafras flourishes.

The flat phase is adapted to the same general crops as the typical Dekalb silt loam, and although not so productive as the latter, owing to its poorer drainage, it is, on account of its smooth surface, better suited to cultivation. At present a greater part of it is under cultivation. The yields are noticeably lower than on the better portions of the typical soil. Corn yields on an average about 15 bushels per acre, wheat from 2 to 10 bushels, tobacco from 600 to 800 pounds, oats from 15 to 20 bushels, and hay from one-half ton to 1½ tons. Sorghum does fairly well, the yields equaling those on the typical Dekalb silt loam.

Tile drainage would be the most effective means of improving the drainage of this soil, though more expensive than open ditches. Every farm on this land could be made much more productive by artificial drainage.

Applications of lime to this soil would prove beneficial. At least a ton, and, better, 2 tons, of burnt lime per acre, or twice this quantity of ground limestone, would probably not be excessive. Moderate applications of complete commercial fertilizers, barnyard manure, and the plowing under of green crops, such as cowpeas, clover, or rye, are also means recommended for improving the type.

Under proper drainage conditions this soil would be quite desirable for tobacco, and would also give excellent returns with grass, sorghum, oats, and corn. Modern labor-saving machinery could be used on every farm and the problem of securing labor simplified.

Although this phase does not produce as well as the Dekalb silt loam, its favorable surface features and location give it about the same value as the typical soil. In the vicinity of Crofton it brings from \$25 to \$35 an acre.

DEKALB FINE SAND.

The surface soil of the Dekalb fine sand consists of a gray to pale-yellow fine sand. There is little change in the texture within the 3-foot section, except in small areas where the bedrock comes within 2 feet or less of the surface. The subsoil is more uniformly yellow than the surface material. Usually in those areas having bedrock within the 3-foot section the subsoil is yellower near the contact with the rock, and a few sandstone fragments are scattered through the soil and subsoil.

The type is derived from interbedded sandstone and shale of the Coal Measure. The color of the parent rock is usually gray or only slightly yellow.

The Dekalb fine sand is confined to a few small areas of irregular outline. The most typical area lies along the boundary of the Colbert stony clay, about $1\frac{1}{2}$ miles northeast of Macedonia School. The other areas are found southeast of Flatrock School, southeast of Atkinson School, east of Apex, east of Jordons Store, and south of Liberty Church. The type occupies the slopes and crests of ridges.

Only a little of the Dekalb fine sand is used for farming, the greater part being in forests of chestnut, red oak, white oak, and hickory. As a rule the soil is of low productiveness, the average yield of corn being about 15 bushels per acre, oats 15 bushels, and tobacco 600 pounds. The quality of the tobacco is considered somewhat better than that of the leaf produced on the Dekalb silt loam, on account of the even coloring in the cured leaf. Sweet potatoes do fairly well, yielding from 50 to 70 bushels per acre. The yield of Irish potatoes is low—from 20 to 50 bushels per acre. A number of other vegetables could be grown to better advantage. On account of the droughtiness of the soil and the lack of room for root development, the type is not adapted to tree fruits.

The principal need of this soil is organic matter. This may be supplied in the form of stable manure where available, but in most cases recourse to green manuring crops will be necessary. The use of legumes in rotation with the staple crops will tend to supply the deficiency, even if only the roots and stubble are returned to the soil. Applications of commercial fertilizers will be more effective where the organic content of the soil is increased.

This land can be had for prices ranging from \$2 to \$15 an acre.

DEKALB STONY SILT LOAM.

The surface soil of the Dekalb stony silt loam is practically identical with that of the Dekalb silt loam, consisting of a gray to pale-yellow, floury silt loam. It is underlain by a heavy yellow silt loam to about 20 inches, where it grades into a yellow, compact, brittle, silty

clay loam. Numerous rock fragments varying from one-fourth of an inch to several inches in diameter are mingled with this fine earth in both the soil and subsoil, and in a few instances along the upper edges of the main slopes the surface material contains an appreciable quantity of fine sand. Outcrops and large fragments of rock are of frequent occurrence on the steeper slopes bordering a number of the larger streams.

This type is found principally in the northwestern part of the county, the most typical areas occurring along Clifty, Tugler, Camp, and Drake Creeks. Other areas are mapped along the upper courses of West Fork of Pond River, Coal Creek, and Pond River. The type occurs in narrow bands on the slopes of stream valleys, either extending down to the bottom land or being separated from the bottoms by strips of Colbert stony clay. The topography is rugged, the most broken areas occurring between West Fork of Pond River and Coal Creek, in the northeastern part of the county.

The soil owes its origin to the weathering of sandstone and shale, fragments of the more resistant portions of which are mixed with the fine earth, though in many places the fragments have fallen from formations higher up on the slopes.

At present practically all of this type is forested with hardwoods. Because of its susceptibility to erosion and its low agricultural value the land should be allowed to remain in forest. Like the Dekalb silt loam, this soil is naturally well adapted to fruit, particularly apples, but the roughness of the surface usually makes commercial orcharding impracticable. Thinly wooded areas should be forested with trees of quick growth, such as the locust. Where practicable the abandoned fields and cultivated areas of this soil should be seeded to grasses and used for pasture.

At present this land can be bought for from \$2 to \$10 an acre, the price being governed principally by its topographic position.

GUTHRIE SILT LOAM.

The Guthrie silt loam consists of a white to mottled grayish-brown and rusty brown silt loam of a compact, floury structure, underlain at 10 to 20 inches by a mottled gray, drab, and yellowish-brown, rather stiff clay loam. In some places the subsoil is a nearly white silt loam mottled faintly with different shades of brown, overlying, at a depth of about 30 inches, mottled gray, brown, and rusty brown silty clay loam. Some black oxide of iron concretions are present in the subsoil.

The type occupies flat-bottomed, low depressions, usually within areas of the Clarksville silt loam, and is locally called "lake flat country." The most important as well as the most typically developed area occurs to the north of La Fayette in the southwestern part

of the county. Other areas lie north and northwest of Edgoten and south of Bennettstown.

The soil has been derived mainly from the weathered products of limestone, and perhaps to some extent from wash from adjacent soils, the low degree of oxidation being due to very poor drainage conditions.

At present little or none of this type is under cultivation. It is forested largely with white oak, red oak, post oak, sweet gum, black gum, maple, hickory, ash, and elm.

On account of poor drainage conditions this soil is usually saturated with water in the lower depths for the greater part of the year. With the establishment of better drainage by tiling or ditching and with an acreage application of one or two tons of burnt lime or twice this quantity of ground limestone, it could be made to produce fair to good yields of corn, oats, wheat, and tobacco. It is better adapted, however, to grass crops. Redtop and lespedeza should give good yields of hay.

The price of the Guthrie silt loam, which at present depends largely on the forest growth, ranges from \$8 to \$50 an acre.

HUNTINGTON SILT LOAM.

The surface soil of the Huntington silt loam consists of a brown silt loam with a depth of 6 to 14 inches. The subsoil, to a depth of 3 or more feet, is usually a lighter brown silt loam to silty clay loam. Along Pond River, in the northeastern extremity of the county, the subsoil is unusually light in texture and varies in color from light brown to yellow. In the northern part of the county the areas occurring along many of the streams, noticeably Tradewater River and Clifty, Coal, and Bull Creeks, are a somewhat lighter brown than typical areas in the limestone region to the south. Another variation is noted in narrow strips along the immediate stream banks, where the soil often contains considerably more fine sand, and in depressions too small to map, where frequently an unusually high percentage of clay would place the type in a class heavier than silt loam. Some of these depressions are rather poorly drained and grayish in color, and resemble in some ways the Holly silt loam.

This type occupies the first bottoms along a number of streams in the county. These areas vary in width from about one-eighth of a mile to nearly a mile. The best developments occur in the northern part of the county along Pond and Tradewater Rivers, West Fork of Pond River, and Bluff, Coal, McFarland, Drake, and Tugler Creeks, and less extensively along Little River and Big West Fork of Red River, in the southern part of the county. The areas of this type are not always continuous, especially in the southern part of the

county, but are usually found in the most prominent bends of the streams. The surface is, as a rule, level, although sometimes sloping slightly away from the streams.

The Huntington silt loam is an alluvial soil derived mainly from the wash of sandstone and limestone upland soils. Along the streams in the southern part of the county the type has been derived wholly from the reworked materials of limestone origin. This type is subject to overflow and thus to repeated additions of alluvial deposits.

The soil has a fair organic content, and produces good crops when properly drained, without fertilization. Corn is the leading crop. Smaller areas are used for hay, oats, tobacco, and sorghum. A good many fields have been cropped continuously and handled in such a way as to cause some deterioration. Corn grown on such land yields an average of about 20 bushels per acre, oats 20 to 30 bushels, hay from one-half to 2 tons, sorghum about 40 gallons of sirup, and tobacco about 1,000 pounds. Somewhat better yields are obtained from the better grades of the type.

The most important need of considerable areas is the improvement of drainage conditions. Some areas could be drained simply by straightening and deepening the stream channels, but ditches or tile drains will be necessary in others. With good drainage the present yields would be materially increased.

Practically all of this type is at present under cultivation. Corn, alsike, clover, and grass (redtop and timothy) should be made the most important crops. Oats, sorghum, and cowpeas do very well.

Although this type is of limited extent, it has much to do with the value of the associated Dekalb and Christian soils in the northern part of the county, and when sold is usually included with the other soils, so its value could not be definitely determined.

COLBERT STONY CLAY.

The soil of the Colbert stony clay consists of a plastic, sticky, yellow, or greenish-yellow heavy clay. In places there is a thin surface mantle of grayish-brown silt loam; but most of the type consists of clay from the surface downward. Outcrops of limestone and large and small fragments of this rock are common throughout the type.

Areas of this type occur along the lower slopes of ridges in the northeastern and northern parts of the county. They are usually bordered above by the soils of the Christian series, although in some places they lie next to the Dekalb soils. The most typically developed areas are found along Buck Fork, Coal, and Bull Creeks and West Fork of Pond River and Pond River. Other smaller isolated areas occur throughout the northern part of the county.

This soil has been derived, through weathering, from a chert-free limestone.

Practically all of the type is forested with different oaks, hickory, dogwood, and black haw. The cultivated portion comprises a few small patches used for the production of corn and wheat. The difficulty of plowing this heavy soil is doubtless the most important reason for the preference of the Dekalb and Christian soils, as the stony clay is fairly productive. Wheat gives from 8 to 20 bushels per acre and corn from 10 to 25 bushels.

Probably the best use to which this soil can be put is the production of the grasses. Bluegrass, fescue, and other pasture grasses should be tried and the land used for grazing cattle and sheep.

This type can be bought for prices ranging from \$2 to \$10 an acre.

ROCK OUTCROP.

Rock outcrop includes the areas of limestone or other rock formations occurring as cliffs or as more nearly horizontal exposures. Such areas have no agricultural value. The largest areas occur along Sinking Fork Creek, to the northeast and southeast of Gracey, and smaller areas along Big West Fork of Red River in the southeastern part of the county, and in the vicinity of Hopkinsville.

SUMMARY.

Christian County is situated in southwestern Kentucky in the southern tier of counties. It comprises an area of 725 square miles, or 464,000 acres. In the northern part the country is a dissected plateau with elevations varying from 400 to 800 feet above sea level, while the southern part has a slightly rolling to undulating surface.

The county is well drained. Pond River receives the drainage from the northeastern part of the county, Tradewater River from the northwestern part of the county, and Little River and Big West Fork of Red River from the southern part of the county.

In 1910 the population of the county was 38,845. Hopkinsville, the county seat, with a population of about 10,000, is situated in the central part of the county. Numerous smaller villages, the most important of which are Pembroke, Crofton, and Gracey, are situated in different parts of the county.

The Louisville & Nashville, Tennessee Central, and Illinois Central Railroads supply the transportation.

Practically all the southern part of the county is in a high state of cultivation. The hill section is being rapidly cleared, but is not so favorable for agriculture. The building of pikes throughout this section will improve conditions somewhat.

Tobacco, corn, and wheat are the principal crops.

The climate of Christian County is mild. The rainfall is abundant and evenly distributed through the seasons.

The soils of the county belong mainly in two soil provinces, the limestone valleys and uplands and the Appalachian Mountains and plateaus. The former are derived from cherty or chert-free limestones, which give rise to the Hagerstown, Clarksville, Guthrie, Christian, and Colbert series. From the sandstones of the Appalachian province are derived soils of the Dekalb series.

The Hagerstown series is represented in the county by two members, the silt loam and the clay loam. The first named is considered the strongest soil in the county and is adapted to tobacco, corn, and wheat. Although little grass is grown on this type, it is undoubtedly a good grass soil. It lies admirably for farming, the use of all types of farm machinery being practicable. The clay loam member is adapted to all crops grown on the silt loam, and is perhaps even better suited to the production of small grains and grasses.

The Clarksville series is represented by only one member, the silt loam. It is well suited to the production of tobacco, corn, wheat, and grasses. This type is less desirable than the Hagerstown silt loam.

The Guthrie series is represented by the silt loam. On account of its depressed surface and consequent poor drainage, very little of this type is under cultivation. When drained, it is adapted particularly to grasses, corn, and small grains.

The Christian series is represented by two members, the silt loam and the stony loam. The silt loam produces excellent yields of corn, tobacco, and wheat. The stony loam at present supports a growth of hardwood, and is perhaps better suited to forestry and grazing than to the production of tilled crops.

Of the Colbert series but one type, the stony clay, is found. It is best suited to grazing.

The Dekalb series includes the silt loam, with a flat phase, the fine sand, and the stony silt loam. The Dekalb silt loam has a very rough topography. It is best suited to the production of tobacco, giving a medium-weight leaf of excellent quality. On the deeply weathered portions orcharding would prove profitable. The flat phase of this type when drained produces good yields of tobacco, corn, and wheat. The Dekalb fine sand is adapted to the production of vegetables and other garden truck. The stony silt loam should be left to forestry and grazing.

Only one alluvial soil has been mapped, the Huntington silt loam. The better drained areas of this type are particularly adapted to corn and grasses. Fair yields of the other staple crops are obtained.

[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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