

Issued March 10, 1914.

U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS—MILTON WHITNEY, Chief.  
IN COOPERATION WITH THE TENNESSEE GEOLOGICAL SURVEY,  
A. H. PURDUE, STATE GEOLOGIST.

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# SOIL SURVEY OF PUTNAM COUNTY, TENNESSEE.

BY

C. S. WALDROP.

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HUGH H. BENNETT, INSPECTOR IN CHARGE, SOUTHERN DIVISION.

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



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1914.

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., August 15, 1913.*

SIR: The soil-survey work in Tennessee is being continued under a cooperative agreement with the Tennessee Geological Survey. One of the projects undertaken in 1912 was the survey of Putnam County. This area was selected after a conference with Dr. A. H. Purdue, State geologist.

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

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

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

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### MAP.

Soil map, Putnam County sheet, Tennessee.



# SOIL SURVEY OF PUTNAM COUNTY, TENNESSEE.

By C. S. WALDROP.

## DESCRIPTION OF THE AREA.

Putnam County, Tenn., is situated in the north-central part of the State, or in the northeastern part of the division known as middle Tennessee. It is bounded on the north by the counties of Jackson and Overton, on the east by Fentress and Cumberland, on the south by White and Dekalb, and on the west by Smith County. The county has a very irregular outline, being about 40 miles long in an east-and-west direction, while the distance from north to south in the widest portion is about 15 miles. It comprises an area of about 40½ square miles, or 258,560 acres.

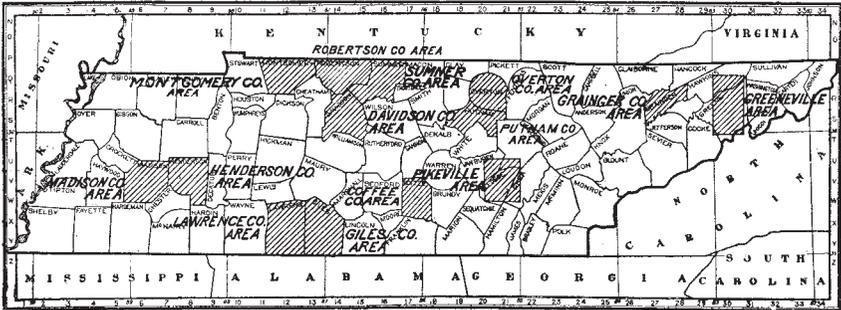


FIG. 1.—Sketch map showing areas surveyed in Tennessee.

The eastern third of the county is occupied by the Cumberland Plateau region, which has a range in elevation between 1,400 and 2,000 feet above sea level. This region includes considerable areas of comparatively level country, but erosion has dissected much of it, particularly along the western border, where it is characterized by very rugged topography, marking the transition from the higher plateau to the lower Highland Rim. The Highland Rim reaches out from the foot of the mountains to within a few miles of the western border of the county. It is a broad, undulating to gently rolling plain, ranging in altitude from 800 to 1,000 feet. Near the western

border of the county there is a transitional zone several miles wide between the Highland Rim and the Central Basin region in which the country is extremely rolling. Here deep, narrow valleys extend back into the Highland Rim and these valleys are flanked by steep, stony slopes. Between them there are ridges which are often sharp crested, especially toward their extremities. The Central Basin region occurs to the west of the Highland Rim and is represented by low, narrow valleys, with elevations lying between 400 and 600 feet.

The drainage of the southern and southeastern parts of the county is effected through Falling Water River and its tributaries. Caney Fork touches the western border of the county for a short distance and much of the drainage of this part of the county passes off through this river and its tributaries. The drainage of the northern part of the county is all toward the Cumberland River, which lies several miles beyond the northern boundary.

Putnam County was organized in 1854 largely from parts of the counties of Overton, Jackson, and White, with very small portions taken from Smith, Dekalb, and Fentress. The early settlers of the territory now included in the county came mainly from Virginia and the Carolinas, and many of the present inhabitants are descendants of these early settlers.

Cookeville, the county seat, is situated near the center of the county. It has a population of about 2,000 and is the largest town in the survey. Monterey, with a population of about 1,100, is situated on the Cumberland Plateau in the eastern part of the county. Algood, about 5 miles northeast of Cookeville, has a population of about 700. Other railroad stations are Brotherton, between Algood and Monterey, and Double Springs, Baxter, Boma, Silver Point, and Buffalo Valley, to the west of Cookeville. Bloomington Springs and Gentry are small villages in the northwestern part of the county, while Burton is a crossroad settlement in the southwestern part.

The rural free delivery service now reaches all parts of the county and practically all of the country post offices have been abandoned.

The Tennessee Central Railroad traverses the county in an east-and-west direction, while the Crawford branch extends from Monterey out of the county in a northeasterly direction. The Tennessee, Kentucky & Northern Railroad runs in a northerly direction from Algood to Livingston in the adjoining county of Overton. Though the railroad facilities are fairly good at the present time for the greater part of the county, they are not adequate for the proper development of the entire area. Another railroad is badly needed north and south across the county to give a more direct connection with northern and southern points, and it is probable that the

Tennessee, Kentucky & Northern Railroad will be extended to meet this need.

The county roads in the vicinity of the towns and railroad stations where pike roads have been built are fairly good, but, except in a few instances, dirt roads are encountered at a distance of 1 to 4 miles, and these become very muddy, in places almost impassable, during wet seasons, especially on the Highland Rim and in the valleys. The roads on the mountain sides are so rocky and steep that travel over them is very difficult, but those on the plateaus are easily kept in repair and, except after prolonged rains, are generally in fairly good condition. The county is badly in need of a better system of public roads, and the pikes should be extended, especially on the Highland Rim and in the valleys. Beds of chert and limestone are easily accessible to improve the roads, and as many of them have already been graded this work could be done at a relatively small cost.

Cookeville is the chief marketing center, although considerable trade goes to Algood, Monterey, Baxter, Buffalo Valley, and other stations along the main line of the Tennessee Central Railroad. Nashville is the nearest large market, and most of the corn, poultry, cattle, and hogs are sent there.

#### CLIMATE.

The climate of Putnam County varies somewhat in the different sections, the high altitude of the Highland Rim and Cumberland Plateau having quite a perceptible influence upon the local conditions. The summers are pleasant, being nearly free from oppressive sultry periods. As a whole they are too short to allow the growing of cotton as a staple crop. The winters are short and usually mild, except for occasional cold snaps, during which the mercury seldom falls below zero. Light snows of short duration occur every winter.

The mean annual precipitation is 49.8 inches and the normal annual temperature 59° F. During the winter months the rains are heavier and of longer duration than in summer, a considerable part of the precipitation during the growing season coming in the form of showers.

The early, warm days of spring and the erratic occurrence of killing frosts cause the fruit crops to be uncertain, except where special care has been used in locating orchard sites. The average dates of the last killing frost in the spring and the first in the fall are April 4 and October 23, respectively.

The data in the following table, compiled from records of the Weather Bureau station at Carthage, a few miles west of the county, may be taken as fairly representative of Putnam County:

*Normal monthly, seasonal, and annual temperature and precipitation at Carthage, Smith County, Tenn.*

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	67	- 4	3.8	5.2	4.8	1.0
January.....	38	72	- 9	4.6	5.3	12.8	2.2
February.....	41	73	-15	5.0	1.2	11.3	3.1
Winter.....	40			13.4	11.7	28.9	6.3
March.....	49	82	3	5.5	3.8	7.8	3.3
April.....	58	90	28	4.4	6.2	3.8	0.0
May.....	69	92	38	3.4	1.0	4.3	0.0
Spring.....	59			13.3	11.0	15.9	3.3
June.....	76	101	42	4.5	3.5	9.2	0.0
July.....	79	103	54	4.3	6.9	6.1	0.0
August.....	76	101	52	4.9	3.0	2.4	0.0
Summer.....	77			13.7	13.4	17.7	0.0
September.....	71	99	37	3.2	2.5	2.4	0.0
October.....	59	94	26	2.1	2.2	2.8	0.0
November.....	48	82	15	4.1	2.2	1.4	Trace.
Fall.....	59			9.4	6.9	6.6	Trace.
Annual.....	59	103	-15	49.8	43.0	69.1	9.6

#### AGRICULTURE.

The agricultural development of the area from which Putnam County was formed was begun in the early part of the last century. At that time transportation was difficult and markets were distant, and the early settlers gave their chief attention to such crops as could be consumed to advantage at home, including corn, wheat, oats, flax, hemp, cotton, tobacco, and vegetables. Some sheep were kept to produce wool, and cattle, hogs, and mules were raised and driven farther south, where they were sold to the cotton planters. Conditions improved gradually until the beginning of the Civil War, when nearly all of the farmers were free of debt and many were in very comfortable circumstances, but for some time following the war very little progress was made. While the effects of the war were less disastrous in Putnam County than in some other sections

of the South on account of the comparatively few slaveholders, yet they were severely felt by all classes. More money was needed, and the crops produced went more and more to market to meet this necessity. Manufactured articles could be obtained with greater ease, and the growing of hemp, flax, cotton, etc., for home use was discontinued, while the growing of such crops as corn, wheat, and tobacco and the raising of hogs, cattle, and mules increased. This system of farming is largely in practice to-day. The use of improved machinery in the county is being gradually extended, and the home surroundings generally indicate increasing prosperity.

According to the Thirteenth Census, 219,453 acres, or about three-fourths of the total area of the county, was in farms, of which 105,692 acres was improved. About one-third of the area reported as improved is used for pasturage. Of the cultivated areas, there were 34,952 acres in corn, producing 669,250 bushels; 6,369 acres in oats, producing 60,998 bushels; 3,487 acres in wheat, producing 26,548 bushels; and 4,655 acres in clover, grains, grasses, and millet cut for hay, producing 2,919 tons. Besides these crops, the county produces sweet and Irish potatoes, tobacco, rye, sorghum, cowpeas, and miscellaneous vegetables. Fruit is not grown on a commercial scale, but there are small apple orchards on nearly every farm and a few scattered pear and peach orchards.

According to the census of 1900, the orchard products were valued at \$29,768 and the forest products at \$60,690. Most of the merchantable forest growth, consisting largely of oak and hickory, has been removed from the undeveloped areas near the railroads, but there is still a great deal of standing forest away from the railroads. Stave, spoke, and ax-handle factories take a large part of the best oak and hickory.

Corn is the principal crop produced in the county, the acreage planted to it being more than double that of all other crops combined. It is grown upon all the soils, but does best on the limestone soils and the alluvial areas along the streams. Yields of 25 to 75 bushels per acre are obtained on these soils, while on the soils of the Highland Rim and Cumberland Plateau the yields range from 10 to 30 bushels per acre. The low average yield for the county—about 20 bushels per acre—is due to the fact that a large proportion of the corn is grown on the Highland Rim. Here the yields are invariably light unless good cultural methods are followed. The yields on all of the soils could be considerably increased simply by more thorough preparation of the seed bed, shallow cultivation, and proper selection of seed. By practicing a systematic rotation of crops or by applying sufficient quantities of stable manure, 30 to 50 bushels per acre could be produced.

Oats are the second most important crop and are grown on all of the more level upland soils. The more rolling and rocky areas are not planted to oats owing to the difficulty of harvesting. The crop is usually planted in the spring and followed by cowpeas or clover. Oats are coming more and more into favor, the production having doubled during the decade from 1900 to 1910.

Wheat is also grown rather extensively. The yields of this grain are fairly good, but the acreage planted to this crop is gradually decreasing. This is largely the result of increased interest in stock raising, which is proving a very profitable industry at present. The production of both wheat and oats should be extended. They may be pastured lightly in the spring, and make excellent winter cover crops.

Cowpeas, clover, and several varieties of grasses are grown to a small extent. The cowpeas are usually grown with corn or after oats, while clover is either sowed with oats or after oats are harvested. These crops are coming into favor both as soil renovators and as sources of forage. The principal grasses grown are redtop, orchard grass, and timothy. Redtop and orchard grass are used mostly in the Highland Rim section and timothy on the better limestone soils in the valleys. These grasses produce hay of an excellent quality and yield from 1 to 2 tons per acre. Alsike clover, redtop (herds grass), and lespedeza can be successfully grown on the moist soils such as the Huntington, Holly, and Guthrie. They will also succeed on better drained soils.

All of the soils of the county are well adapted to fruits, including apples, peaches, pears, cherries, etc. Apples receive most attention, small orchards being found on nearly all the farms. The varieties grown are Ben Davis, Arkansas Black, Winesap, and Black Twig. On account of the late spring frosts peaches are rather uncertain. Danger from this source could be minimized by locating the orchards on the higher ridges and on northern slopes, where blooming would be retarded and where the late frosts are less likely to occur. More care should be given the orchards. Many of the existing orchards show evidence of lack of care. Trees should be pruned or sprayed for insects and fungus diseases. Experiments in smudging should be tried, especially in the case of peaches.

Irish potatoes, as well as many other truck crops, can be grown successfully on practically all the soils of these regions.

During the last few years the growing of tobacco has been receiving much more attention than formerly. The census of 1900 gave only 72 acres planted to tobacco, while in 1910 there were 432 acres, yielding on an average about 700 pounds per acre. The tobacco grown is of low grade, but owing to the rather large yields it has proved a profitable crop at the ruling prices. Practically all of the soils on

the Highland Rim are well adapted to tobacco, being the same as those on which it is grown successfully in other parts of the State. The quality can doubtless be improved somewhat by better methods of cultivation and more care in curing the leaf.

Stock raising is an important industry in Putnam County, the census of 1910 giving the total value of farm animals as \$989,565. The industry is confined largely to the raising of hogs, cattle, and mules. The production of mules receives most attention and several carloads are shipped from the county annually. This line of animal husbandry may well be extended. Much of the land, too stony and rough for cultivation, affords excellent pasturage and can be utilized very profitably in grazing the young stock. While the raising of hogs and cattle has received much more attention within the last few years than formerly, there is still room for extension of the production of beef and pork. Improvement of the herds is badly needed. Pure-bred animals are the exception.

The raising of sheep receives very little attention. This industry could be carried on more extensively, especially on the rough, stony limestone soils, which afford an abundance of cheap pasturage.

Within the last few years poultry raising has made marked progress. Large quantities of eggs and poultry are shipped from the county throughout the year.

Systematic rotation of crops is not practiced by the majority of the farmers. Corn is often planted on the same land continuously year after year or alternated only occasionally with other crops. A few farmers follow corn with wheat or oats and after these are harvested sow cowpeas or clover to improve the soils.

Commercial fertilizers, though not used generally throughout the county, are coming more and more into use, especially in the Highland Rim and Cumberland Plateau sections. In 1910 the expenditures for this purpose amounted to \$14,447. As fertilizers are usually applied without any thought as to the manurial requirements of the soils for different crops, the increased returns do not always justify the expense. Experimentation is needed to guide the farmers in fertilizer practice.

The labor conditions in the county are not the best. The few negroes live mostly in Cookeville, where they find other employment than on the farms. The scarcity of labor, however, does not affect the farmers very seriously, as most of them operate on a small scale and depend upon their families for the necessary help. Laborers receive from 75 cents to \$1 a day and from \$18 to \$25 a month, with board.

Farms are usually leased on shares. When the owner furnishes the house, work stock, tools, and seeds he receives from one-half to

two-thirds of the crops, and when he furnishes only the house and land he gets from one-third to one-half the crops. Very little farm land is rented for cash.

According to the census report of 1910 the average size of farms is 79.6 acres. This is somewhat misleading, as each tenancy was classed as a farm, and the average holding is somewhat larger. However, there are very few large farms in the county. A few contain from 500 to 1,000 acres, but the majority of holdings range from 40 to 160 acres. About 58 per cent of the farms are operated by the owners and the remainder by tenants.

For the most part, land values in the county are still rather low. On the Cumberland Plateau the price ranges from \$5 to \$25 an acre, depending on the forest growth, surface features, improvements, and location. The lands in the Central Basin region around Buffalo Valley range from \$50 to \$125 an acre, depending mainly on the fertility of the soil. The soils on the Highland Rim range from \$10 to \$30 an acre, the prices varying with the growth of trees, improvements, and nearness to railroads and markets.

#### SOILS.

Putnam County includes three important physiographic divisions—the Cumberland Plateau, the Highland Rim, and the Central Basin. The rocks consist of sandstones, shales, and limestones, and the geological formations represented extend from the lower Silurian to near the close of Carboniferous time. The formations lie in nearly level beds, as originally laid down, and as a result only a few of them reach the surface, except where erosion has cut down into them. The surface of a large portion of the county is mountainous.

The soils of the county fall naturally into two general groups—namely, alluvial and residual. The alluvial soils, which have a very limited development, consist of materials transported from the uplands by the streams and laid down in their flood plains. The residual soils have been formed in place by decay and disintegration of the underlying rocks. Most of the geological formations show distinct characteristics and the soils vary directly with the different formations, so that the boundaries of the different types of soils agree closely with the boundaries of the rock formations from which they are derived.

On the Cumberland Plateau the main rocks are sandstones and shales. These give rise to soils having a uniform gray color and a high percentage of silt and sand. Four types belonging to the Dekalb series and one type belonging to the Hanceville series were mapped here. In some of the valleys of this region and on the escarpments which mark the transitional zone between the Cumberland

Plateau and lower lying Highland Rim, limestones are exposed, which give rise to Rough stony land and to one member of the Decatur and two members of the Hagerstown soils.

The Highland Rim is occupied almost entirely by the Fort Payne chert formation. Besides extending over the leveler sections of this region, it caps the ridges and higher outlying knolls near its western boundary. This formation consists of impure cherty limestone and gives rise to gray and red silty soils. The gray soils from this formation have been included in the Clarksville series and the red soils in the Decatur series. The poorly drained areas through the Clarksville silt loam were mapped as Guthrie silt loam.

Below the Fort Payne chert is the Chickamauga limestone. It is found at the bottom of many of the deep, narrow valleys which intersect this region, and is about the only surface formation in the Central Basin which is represented by the deep, narrow valleys in the extreme western part of the county. The Chickamauga limestone is a blue, massive to flaggy limestone carrying a rather large proportion of argillaceous material. It gives rise to four members of the Hagerstown series. The two members of the Westmoreland series, which occur in the Central Basin, are also probably derived in part from this formation.

The alluvial soils are quite variable. In a general way, however, they show relation to the different geological formations through which the streams flow. The bottom lands as a rule, through the limestone, shale, and sandstone soils, were mapped as Huntington silt loam, and those where the drainage is from the Fort Payne chert were mapped as the Holly silt loam.

In all 19 types of soil were recognized and mapped, 2 of these having phase distinctions. Their names and extent are given in the following table:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Clarksville silt loam.....	76,160	30.6	Dekalb silt loam.....	8,000	3.1
Rolling phase.....	2,880		Dekalb stony silt loam.....	7,168	2.8
Dekalb fine sandy loam.....	46,144	17.8	Decatur stony loam.....	3,776	1.5
Decatur silt loam.....	12,544	9.6	Holly silt loam.....	2,880	1.1
Cherty phase.....	7,552		Rough stony land.....	2,880	1.1
Eroded phase.....	4,672		Hagerstown silt loam.....	1,152	.4
Clarksville gravelly loam.....	22,080	8.5	Hagerstown stony clay loam..	768	.2
Westmoreland gravelly loam..	16,192	6.3	Westmoreland stony loam....	640	.2
Dekalb stony sandy loam.....	12,416	4.8	Guthrie silt loam.....	448	.2
Hagerstown stony loam.....	10,752	4.2	Hanceville silt loam.....	192	.1
Huntington silt loam.....	9,792	3.8			
Hagerstown stony clay.....	9,472	3.7	Total.....	258,560	.....

## CLARKSVILLE SILT LOAM.

The Clarksville silt loam consists of a gray to pale-yellow silt loam, 10 to 12 inches deep, underlain by a grayish-yellow to yellow silty clay loam of a moderately friable structure. In places the lower subsoil is a yellow silty clay, but generally the yellow silty clay loam reaches to a depth of 3 feet or more, especially in the more nearly level situations. In the lower depths the subsoil is rather compact, and frequently small fragments of chert are encountered in the 3-foot section, but the larger fragments of chert are not commonly found in the soil body of the more nearly level areas. They are of frequent occurrence, however, on the steeper slopes and in the usual red substratum, which is reached generally between 40 and 60 inches. This red substratum occasionally comes within 3 feet of the surface in the more rolling, eroded areas. In places the lower portions of this subsoil show faint mottlings of gray and yellowish brown, and even contain oxide of iron concretions. This is true principally in the poorer drained flat areas.

The Clarksville silt loam is the most extensive type of soil in Putnam County. It occupies the greater part of the Highland Rim, which occurs in a belt varying in width from 12 to 14 miles, running in a northeast-southwest direction across the county. Through all of the smoother sections it is almost continuous, but in the areas of rough topography of the south-central part of the county and near the western boundary it gives way to other types. The surface features range from level to gently rolling. Much of the type is rolling enough to be well drained, but large areas occur where there is only enough surface relief to afford fair drainage, while there are many local spots too nearly level to be properly drained. As there are but few streams of any consequence, much of the drainage is effected through shallow swales which contain running water only during wet seasons. The largest level areas occur north and south of Baxter and between Baxter and Cookeville. Another rather extensive level area is found northwest of Algood.

This is a residual soil derived from both chert-free and cherty limestone belonging to the Fort Payne formation, which consists of interbedded siliceous limestone and chert, some of the latter being of a porous, fossiliferous character. The formation gets more cherty with depth, which accounts for the greater amount of chert on the slopes.

The original forest on the Clarksville silt loam consisted of white oak, red oak, post oak, hickory, black gum, sweet gum, chestnut, poplar, and persimmon, and there are still large areas in forest. A large proportion of its area has been cleared, however, and probably more than half of the improved land of the county is of this type of soil.

Corn is the chief crop and yields from 15 to 20 bushels per acre. Wheat and oats are next in importance and yield from 10 to 20 bushels per acre. Other crops are sorghum, cowpeas, millet, and grasses. These yield fairly well, but are grown mainly for home consumption. Tobacco has not been grown on a commercial scale to any important extent as yet. This could be made an important crop, as the soil is the same as that on which tobacco is being grown successfully in other parts of the State. While small apple orchards and gardens to supply fruit and vegetables for home use are found on nearly every farm, practically none is grown for market. The growing of Irish potatoes and certain fruits, such as apples, strawberries, raspberries, and blackberries, doubtless would prove profitable if given the proper attention.

Naturally this land is of rather low productiveness, but, owing to its position and the ease with which it can be cultivated, it is one of the most desirable soils for farming in the county. It can be improved to the point of producing good yields very cheaply. This can best be done by applying stable manure and plowing under cowpeas and other green manuring crops as often as possible. The soil is usually slightly acid in reaction and lime should be applied to neutralize this acidity. A ton of burnt lime per acre probably would be sufficient for eight or nine years. As the soil is easily compacted, it should have a deep plowing in the fall and then be replewed in the spring in order to maintain it in the open, friable condition best for growing crops. Subsoiling every three or four years would probably be beneficial.

*Clarksville silt loam, rolling phase.*—The soil material of the rolling phase of the Clarksville silt loam is practically the same as that of the typical soil, the main points warranting the separation of the phase from this type being the more rolling surface configuration, the shallower depth of the soil portion, the nearer approach of the underlying red material to the surface, and the greater abundance of chert fragments on the surface and throughout the soil section. The larger content of chert is probably due in part to derivation from a more cherty limestone than that giving rise to the typical soil and in part to the accumulation of chert through continued removal of the fine soil material by erosion.

This phase occurs along stream slopes throughout the Highland Rim region, and also occupies rolling country near streams along the outer margin of the Highland Rim.

Owing to the rolling topography and gravelly character of the phase, it is not cultivated extensively. Much of it is forested with white oak, red oak, post oak, hickory, dogwood, and sourwood. The more gently rolling portions of the phase can be cultivated and are well adapted to the general farm crops, the yields comparing

favorably with those obtained on the Clarksville silt loam. Care should be used, however, to prevent erosion. The phase is best suited to grasses and probably it would be more profitable to follow this line of farming on the cultivable portions. The more broken areas can not be cultivated successfully and should be allowed to remain in forest.

#### CLARKSVILLE GRAVELLY LOAM.

The Clarksville gravelly loam consists of a gray to pale-yellow silt loam, 6 to 15 inches deep, underlain by a yellow silty clay loam which often grades into a red clay within the 3-foot section. Small angular fragments of chert occur strewn over the surface and throughout the soil section. The quantity of chert generally increases with depth until bed rock is encountered, which condition is usually reached below a depth of 3 feet.

The Clarksville gravelly loam occupies rolling and broken areas of the Fort Payne formation. It occurs on many of the stream slopes throughout the Highland Rim region and on the ridges near the western border of this region, capping all of the outlying peaks and extending down the slopes to the limestone soils. It reaches across the small valleys where the limestone has not been exposed.

Owing to the rolling topography the drainage is good, and were it not for the large quantity of rock fragments on the surface, erosion would be excessive. The stony character of the soil makes it porous, enabling the storing of more of the rain water, while stones on the surface retard the movement of the surface water to some extent and this also diminishes erosion.

This is a residual soil derived from the weathering of the Fort Payne formation. The more soluble portions of this rock have been gradually removed in the county drainage, leaving behind the siliceous residue and cherty material to form the permanent soil.

Much of the Clarksville gravelly loam is under cultivation, especially along the western border of the Highland Rim, where it occurs most extensively. The soil is rather difficult to till, on account of its rough topography and stony character, but it produces fair yields of the general farm crops, and by many is preferred to the Clarksville silt loam. Corn is the principal crop, yielding from 15 to 30 bushels per acre. Wheat and oats are grown to a less extent and with varying success. Some farmers are growing tobacco on a small scale and fairly good results are obtained. The soil, however, is mostly too rough for a crop like tobacco, which requires a good seed bed and careful, thorough cultivation. Clover and grasses can be grown successfully, though as a rule the production of these crops is not more than sufficient to supply local needs. The type seems better

adapted to the growing of fruits and vegetables than to the crops grown.

The addition of vegetable matter and a more thorough system of tillage would greatly increase the productivity of the soil.

The most of that part of the type which is too rough to cultivate is still in forest, the growth consisting of red oak, Spanish oak, white oak, hickory, chestnut, and poplar. Many of the rough areas could be converted into good pasture lands after the forest is removed, but the very broken areas should remain in forest.

#### DECATUR SILT LOAM.

The Decatur silt loam is a brown to reddish-brown, mellow silt loam underlain at about 5 to 10 inches by red clay. Chert fragments are rather common in the substratum and on slope areas throughout the soil section. On the knolls and steeper slopes there are small eroded areas of Decatur clay loam too small to map. The type also includes small areas of Clarksville silt loam. For the most part the organic-matter content of the soil is low, but the type as a whole is productive, easy to cultivate, and responds well to good cultural methods.

The largest areas of Decatur silt loam are found east and southeast of Cookeville. Smaller areas occur north and south of Algood. Other areas are found in the southwestern part of the county along Falling Water River and Cane Creek. The topography is rolling, and the drainage is very good. Some of the steeper slopes are inclined to erode unless care is used in cultivating the soil, but for the most part the type can be plowed safely.

The Decatur silt loam is derived largely from limestone associated with that from which the Clarksville silt loam is derived, and to some extent also from the Fort Payne formation which gives rise to the Clarksville silt loam. The parent limestone is believed to be mainly the Bangor. This is a much stronger soil than the Clarksville silt loam, and nearly all is under cultivation. Corn, wheat, and oats are the chief crops. Corn yields 25 to 50 bushels, wheat 12 to 25 bushels, and oats 20 to 40 bushels per acre. A small acreage is devoted to grasses, clover, millet, and cowpeas for hay, while sorghum for forage and sirup and other crops of minor importance are also grown.

Better cultural methods, whereby the organic matter content of the soil would be increased, should be practiced on this soil. Some of the steeper slopes should be used for grass or, where used for intertilled crops, seeded to a winter cover crop to prevent erosion. Instead of selling the grain crop, as is largely the practice now, it would be more profitable to raise a larger number of mules, cattle,

and hogs and use the grain in feeding. This would not only increase the revenue from the farm, but serve to keep the soils in a more productive state.

*Decatur silt loam, eroded phase.*—The eroded phase of the Decatur silt loam consists of a brown silt loam to silty clay loam about 4 to 8 inches deep underlain by a yellowish-red to red clay, which often has a moderately plastic structure. It includes many spots in which the clay comes to the surface and others where the silt loam mantle is deeper than usual.

This phase represents areas where much of the surface soil has been washed away by sheet erosion as a result of careless management. It has a very limited extent, occupying some of the stream slopes. It is not as a rule badly gullied.

Owing to its position on stream slopes this phase has a rougher topography than the typical soil. However, most of it can be cultivated successfully if care is used to prevent excessive erosion, and fair yields of the general farm crops are obtained. Corn yields from 12 to 20 bushels and oats from 20 to 30 bushels per acre. Wheat and grasses give fair to indifferent yields. The rejuvenation of this soil requires deep fall plowing, followed by winter cover crops, applications of lime, and the turning under of such crops as cowpeas and clover or liberal additions of manure. An acreage application of 1 ton of burnt lime in all probability would give marked benefits. The steeper portions of the phase could best be used for pasturage and the production of hay.

*Decatur silt loam, cherty phase.*—The soil material of the cherty phase of the Decatur silt loam is essentially the same as that of the typical soil, the most important difference being the presence of much fragmentary chert on the surface and throughout the soil and subsoil of the phase. The quantity of these fragments is sufficient to interfere with cultivation to some extent, but not enough to prevent it. This disadvantage is offset by the protection against erosion afforded by the fragments.

The phase occupies rather steep slopes throughout areas of Decatur silt loam and also occurs as a narrow band near the foot of the bluffs between the Cumberland Plateau and Highland Rim regions.

The soil is well adapted to the general farm crops, the yields comparing favorably with those obtained on the typical Decatur silt loam. Owing to its rough topography it is used more for hay and grass than the latter.

#### DECATUR STONY LOAM.

The Decatur stony loam consists of a reddish-brown to red, rather heavy silty clay or silty clay loam, 6 to 10 inches deep, underlain by

red clay which becomes very heavy in the lower depths. Fragments and bowlders of massive blue limestone occur scattered over the surface and throughout the soil section. Bedrock is exposed in places, and in some instances the rock outcrop is so general and the stones so numerous that it was necessary to map such areas as Rough stony land.

The Decatur stony loam is found in the central and south-central parts of the county. It occurs as a narrow band on the Cumberland Plateau escarpment just east of Algood and Cookeville. It also occurs in detached areas in the south-central part of the county. It is residual in origin and is apparently derived largely from the weathering of Bangor limestone. On many of the steeper slopes much of the fine earth has been removed by wash, causing an accumulation of limestone fragments and bowlders on the surface, and this gives rise to an extremely stony soil.

This is a strong, productive soil, and where cultivated it gives heavy yields of corn, grain, grasses, and clover. However, on account of its rough, stony character, much of it has been allowed to remain in forest. The forest growth consists mainly of oak, hickory, black walnut, chestnut, and poplar. The type is best suited for pasturage, and where not too rough could probably be utilized more profitably for this purpose than for general farming. The more broken areas can not be cultivated successfully and should be kept in permanent forest.

#### GUTHRIE SILT LOAM.

The Guthrie silt loam consists of a gray silt loam 8 to 10 inches deep, underlain by mottled gray and yellow silty clay loam. Usually at a depth of about 20 inches the subsoil becomes more mottled and stained with yellow iron oxide. When wet the soil is rather sticky and plastic, but when dry it readily crumbles into a fine flourlike material.

The Guthrie silt loam has a rather limited development in the county, being confined to a few small areas near Baxter and between Baxter and Cookeville. It occupies poorly drained depressions, generally about the heads of drainage ways. The material is the same in origin as that of the Clarksville silt loam, the peculiar characteristics having been brought about by processes of weathering unlike those at work in connection with the Clarksville silt loam; that is, the poor drainage has excluded the air and thus prevented the advance of oxidation in the body of the soil.

Owing to the poor drainage of the type, very little of it has been brought under cultivation and the most of it is forested with sweet gum, black gum, maple, water oak, white oak, and other hardwood

trees. Its proper utilization requires artificial drainage by tiling or ditching, applications of lime, and deep, thorough plowing. Following this practice good yields of the general farm crops, including corn, wheat, oats, and grain, can be obtained.

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

*Mechanical analyses of Guthrie silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
401433.....	Soil.....	0.1	0.2	0.3	1.5	13.9	74.8	9.2
401434.....	Subsoil.....	.2	1.2	1.6	7.4	11.7	63.9	14.1

WESTMORELAND GRAVELLY LOAM.

The Westmoreland gravelly loam consists of a brown, mellow silt loam, 12 to 25 inches deep, underlain by yellow, moderately crumbly silty clay. Fragments of chert up to about 5 inches in diameter are abundant on the surface and through the entire soil section. Along the lower slopes, where the surface soil is generally deeper, the fragments are somewhat less numerous than on the higher slopes. In addition to the chert fragments, thin, platy fragments of a black, carboniferous shale are of common occurrence. There are also some fragments of cherty limestone.

Areas of this soil occur on the slopes of the hills and ridges in the Central Basin region in the western part of the county. Although the topography is very rolling to steep, many of the cultivated slopes having a grade apparently close to 40 per cent, the resistance to erosion offered by this land is surprising. The fragments of rock make the soil porous and very absorbent and also hold the fine soil material in place.

The Westmoreland gravelly loam is derived from cherty or argillaceous limestone, which is either interbedded or closely associated with black shale. The soil is considerably more productive than the best of the Clarksville silt loam, and has a much darker brown color in the surface portion. There is present too much chert and shale for the type to be correlated with the Hagerstown, and in addition the subsoil material is too yellow for true Hagerstown material. The subsoil is more like that of the Colbert soils in color, but the characteristic plasticity of the Colbert subsoil material is wanting. There may be present more limestone material than is representative of the typical Westmoreland soils, but otherwise the type conforms closely with the dominant features of the Westmoreland series,

occupying about the same kind of slopes, having essentially the same characteristics of soil material, and being derived from both limestone and shale.

This is a productive soil and, though difficult to cultivate, owing to its steep topography and stony character, most of it is under cultivation. Corn, wheat, oats, clover, and grasses are the chief crops. Considerable attention is also given to the raising of hogs, cattle, and mules.

Under the present system of farming corn produces from 30 to 60 bushels, wheat 15 to 30 bushels, oats 40 to 60 bushels, and grasses and clover from 1 to 1½ tons per acre. Bluegrass is indigenous to this soil and grows luxuriantly where given a chance. Clover does well without any special care. Apples would probably do better than any other fruit.

#### WESTMORELAND STONY LOAM.

The Westmoreland stony loam consists of a brown silt loam, 4 to 8 inches deep, underlain by a yellow, moderately crumbly clay. Fragments of chert up to 10 or 12 inches in diameter occur on the surface and through the soil section. Thin, platy fragments of a black carbonaceous shale also occur, and there are also some fragments and outcrops of cherty limestone. The type is associated with the Westmoreland gravelly loam and differs from that type mainly in that it has less soil material and more and larger fragments of chert.

This type of soil occurs in the Central Basin region in the western part of the county. It caps the hills and ridges flanked by the Westmoreland gravelly loam. Its topography is steep and broken on the slopes, but fairly smooth on the ridge crests. For the most part the drainage is inclined to be excessive. However, the fragments of rock prevent erosion to some extent, making the soil more porous and absorbent and at the same time holding the fine soil material in place.

The Westmoreland stony loam has the same origin as the Westmoreland gravelly loam, being derived from cherty or argillaceous limestone, which is either interbedded or closely associated with black shale. Most of the type is too stony for profitable cultivation and is still in forest. The forest growth consists mainly of oak, hickory, and chestnut. Where the type is cultivated corn is the principal crop grown, and fair to indifferent yields are obtained. Grasses do fairly well. The cultivable areas of the type could probably be used more profitably for pasturage than for general farming. The more broken areas should be left in forest.

## HAGERSTOWN STONY CLAY LOAM.

The Hagerstown stony clay loam consists of a brown to dark-brown mellow clay loam, underlain at about 4 to 15 inches by yellowish-brown clay of a rather plastic structure, which grades at 20 to 24 inches into yellow, plastic, sticky, heavy clay. In places bedrock displaces the subsoil layer before a depth of 3 feet is reached. The average depth of the soil is about 10 inches, but there are spots in which the clay comes to the surface. Fragments of limestone are present in varying quantities on the surface and throughout the soil section, and limestone outcrops are common. Occasionally sandstone fragments from relatively thin associated sandstone strata are seen.

Areas of this soil occur in the Central Basin region in the western part of the county, and also in some of the narrow valleys near the western border of the Highland Rim. It is residual in origin, being derived from the massive Chickamauga limestone which outcrops in this part of the county.

The topography of most of the areas of this type is very steep and broken, as, for the most part, it occupies steep slopes, the tops of hills, and the crests of ridges. It also includes gently rolling, low valley lands. The drainage of the entire type is very good. The steeper portions are inclined to wash, but the presence of the rock fragments lessens this tendency. The cultivated slopes, however, wash to some extent, and it is likely that the land on the steeper ones will eventually be seriously damaged if cultivation is continued.

This is a strong, productive soil, and is prized very highly by the farmers. It is used principally for corn, and much of it, even where too steep for plowing, is used successfully for this crop, being cultivated with hoes. The yields of corn range from 40 to 60 bushels per acre. Bluegrass is indigenous to this soil and comes in naturally where allowed to grow, making the soil very valuable for grazing. The rougher, more stony areas are used for this purpose. Considerable attention is given to the raising of cattle and mules on this soil. Alfalfa is not grown, but should give excellent results. Clover does well without any special care.

The results of mechanical analyses of fine-earth samples of the soil and subsoil of this type are shown in the following table:

*Mechanical analyses of Hagerstown stony clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
401429.....	Soil.....	1.6	2.1	1.5	1.4	7.4	62.6	23.9
401430.....	Subsoil.....	.7	1.5	.9	1.2	5.0	59.4	31.2

## HAGERSTOWN STONY CLAY.

The Hagerstown stony clay consists of a brown to dark-brown clay of a somewhat crumbly structure, underlain at about 1 to 5 inches by plastic, waxy heavy clay of a yellowish-brown, yellow or greenish-yellow color. Fragments of limestone are found throughout the soil section, and limestone outcrops are abundant. Many patches are so stony as to be without agricultural value. These areas really represent Rough stony land, but they were too small to be shown on the map.

The Hagerstown stony clay occurs associated with the Hagerstown stony clay loam in the Central Basin region and in narrow valleys in the western part of the county. Small areas also occur on the Cumberland Plateau in the eastern part of the county. The soil is residual in origin and is derived from the Chickamauga limestone. There is also some sandstone influence, usually along the upper slopes, from the sandstone formation which generally caps the adjacent ridges.

The rough topography and stony character of this type prevent successful cultivation of the greater part of it, and as bluegrass and clover are indigenous to the soil and grow luxuriantly on it the land could be utilized most profitably for pastures. At present it is largely covered with oak, hickory, black gum, redbud, walnut, cedar, and maple. The more broken areas should be allowed to remain in permanent forest.

## HAGERSTOWN SILT LOAM.

The Hagerstown silt loam consists of a brown, mellow silt loam, 10 to 15 inches deep, underlain by yellowish-brown silty clay loam, grading at 20 to 24 inches into a stiffer clay of a slightly reddish brown color and moderately friable structure. Small fragments of partially weathered limestone are scattered over the surface in places and to a less extent through the soil. Occasionally the surface is broken by outcrops of massive limestone, but, except in such areas, the bedrock is not encountered within several feet of the surface. The soil is rather heavy in texture, but contains enough organic matter to make it loamy and easy to keep in good tilth.

The Hagerstown silt loam is of small extent. It occurs in patches associated with areas of Hagerstown stony loam in the narrow valleys near the western border of the Highland Rim, and also in areas of this type in the southern and southeastern parts of the county. It occupies undulating valley lands and the lower slopes of the valley walls. The topography is generally of a rolling character, except in a few areas near streams which range from nearly level to undulating.

The soil is residual in origin, and is derived from limestone of Silurian age.

Being naturally very productive and easy to handle, practically all of the type has been brought under cultivation. Corn, oats, and grasses are the chief crops. Corn yields from 20 to 50 bushels, oats 40 to 60 bushels, and grasses from 1 to 1½ tons per acre. Where the type is found in conjunction with the Hagerstown stony loam a great deal of attention is being given to the raising of hogs, cattle, and mules.

#### HAGERSTOWN STONY LOAM.

The Hagerstown stony loam consists of a heavy brown silty loam to silty clay loam, underlain at 8 to 12 inches by a light-brown to brownish-yellow clay loam, which grades into a heavy, brownish to reddish clay at a depth of 20 to 24 inches. Rock fragments and bowlders are strewn over the surface and disseminated throughout the soil section, and there are frequent outcrops of the underlying massive brown and blue limestone. Small areas occur where the outcrops are extensive enough to represent Rough stony land, but these were too small to be shown on the map.

This type of soil is found for the most part near the western border of the Highland Rim. It occurs at the bottom of the narrow valleys which have been cut back into this region. It also occurs in the southeastern part of the county at the bottom of some of the narrow valleys which intersect this part of the survey. The type occupies the lower slopes leading to these valleys, and in many instances the surface is so steep that the areas are very difficult to cultivate, and the soil is badly damaged by erosion where it is not handled carefully.

The Hagerstown stony loam is residual in origin, being derived from the decomposition of limestone of Silurian age. Its stony character is largely due to its position. It is so steep that much of the finer material is removed as fast as it is weathered, leaving the accumulation of unweathered rock fragments behind.

This is a strong, productive soil, and though difficult to handle much of it is under cultivation. Corn is the principal crop grown and gives yields of 25 to 50 bushels per acre. Wheat and oats also yield well; but, owing to the difficulty in harvesting, very little of the type is planted to these crops. The original forest growth of oak, hickory, and other hardwoods has nearly all been removed, and most of that part of the type which is too rough to cultivate is used for pasture.

#### DEKALB SILT LOAM.

The Dekalb silt loam is a gray to pale-yellow silt loam, 8 to 10 inches deep, underlain by a yellow, friable silt loam to silty clay

loam, which generally extends to a depth of 3 feet or more. In the poorly drained depressions and flat situations the soil color is lighter, and the subsoil is mottled yellow and gray. There are places where the parent sandstone comes within the 3-foot section, and usually just above the bedrock the subsoil material is decidedly more sandy. The type includes patches having a red or reddish color in the subsoil. Such areas represent the Hanceville silt loam, but they were too small to be shown on the map. Sandstone fragments are fairly abundant on many of the slopes where erosion has removed a portion of the fine material.

This type occurs in the eastern part of the county, and it occupies large, irregular areas several miles in width, which extend almost across the county north and south near the western border of the Cumberland Plateau region.

Notwithstanding the elevated position of this type, its surface is so nearly level that over a large part of it artificial drainage is necessary in order to secure the best results. In some places small areas are found where a semiswampy condition prevails.

The Dekalb silt loam is not a very productive soil, but, owing to its level surface and the ease with which it can be cultivated much of it has been brought under cultivation. Corn, oats, sorghum, and other crops are grown. Corn produces 15 to 20 bushels and oats 20 to 30 bushels per acre. Irish potatoes of an excellent quality can be produced. Peaches and small fruits also do well. The soil is in need of organic matter and special care should be taken to supply this deficiency by plowing under green crops and adding manure. The mineral fertilizers, potash and phosphorus, as well as light applications of lime, would be found beneficial. The uncultivated areas are largely forested with oak, chestnut, chinquapin, ash, hickory, poplar, and dogwood.

#### DEKALB FINE SANDY LOAM.

The Dekalb fine sandy loam is a gray to pale-yellow, light to heavy silty fine sandy loam 8 to 12 inches deep, underlain by pale-yellow or yellow fine sandy loam to fine sandy clay. In depressions and on hill-sides the top soil sometimes ranges from sand to sandy loam. A number of areas having a red to reddish-brown subsoil and too small to map occur in the type. These represent Hanceville fine sandy loam.

The sandstone from which this type is derived is sometimes encountered near the surface and outcrops occasionally occur. The soil mass, however, for the most part is free from stone, though large fragments of sandstone are sometimes scattered over the surface.

On the Cumberland Plateau, in the eastern part of the county, this is the prevailing type of soil. It occupies large areas the surface

features of which vary from level to gently rolling and also high mountain ridges—outliers of the Cumberland Plateau. The position of the soil at the top of the mountain and its relatively light texture insure ample drainage, but at the same time little damage is done by erosion. The soil is not retentive of moisture and crops are inclined to suffer from drought.

Very little of the type has been brought under cultivation and for the most part it is forested with oak, hickory, chestnut, poplar, and dogwood. There is a luxuriant growth of native grasses, which affords good pasturage during the summer season. Corn is the principal crop grown, the yields ranging from 12 to 20 bushels per acre. Some oats, cowpeas, sorghum, and other crops are grown and give fair to indifferent yields. The soil is easily worked and with the application of manure, the turning under of leguminous crops, and the addition of commercial fertilizers good yields of Irish potatoes and most all varieties of vegetables can be obtained. These products have an excellent quality and should find a ready sale at both local and distant markets. There is a good crop of apples, cherries, pears, plums, etc., almost every year. Peaches do fairly well on northern exposures, where they are not so apt to be killed by frosts. Some tobacco is grown for home use.

#### DEKALB STONY SANDY LOAM.

The Dekalb stony sandy loam comprises stony areas, the fine material of which is practically identical with that of the Dekalb fine sandy loam, consisting of a pale-yellow, light to heavy silty fine sandy loam, 8 to 12 inches deep, underlain by a pale-yellow or yellow, friable fine sandy loam to sandy clay. Boulders, fragments, and outcrops of sandstone are abundant on the surface and throughout the entire soil section.

This soil occurs on the Cumberland Plateau in the eastern part of the county in areas of Dekalb fine sandy loam. It occupies steep, rugged mountain sides and slopes leading down to streams. It finds its greatest development on the slopes bordering the Calfkiller River Valley to the south of Monterey. Other, smaller areas occur north and east of Monterey and to the south of Rocky Point Church. The water falling upon these steep surfaces flows swiftly away, carrying a large quantity of the finer soil particles with it. However, the heavy forest growth which covers most of these mountains prevents the excessive erosion which would result were it not for this protective vegetation.

The Dekalb stony sandy loam owes its origin to the weathering of the underlying sandstone, which belongs to the Coal Measures of Carboniferous age.

The type has a rough surface and for that reason the greater part of it is unsuited to cultivation. Most of it is forested with oak, hickory, chestnut, poplar, and other hardwood trees. Apples, peaches, pears, plums, and such truck crops as Irish potatoes, strawberries, and watermelons do well on this soil, but, owing to the rough topography and the consequent tendency to damaging erosion when cleared and put in cultivation it is best in most cases for it to remain in permanent forest.

#### DEKALB STONY SILT LOAM.

The Dekalb stony silt loam comprises areas the fine material of which is essentially the same as that of the Dekalb silt loam, consisting of a gray to pale-yellow silt loam, underlain at variable depths by yellow, friable silt loam to silty clay loam, which usually extends to a depth of 3 feet or more. There are places where the parent sandstone outcrops and sandstone fragments and boulders are abundant on the surface and throughout the soil section.

The type occurs in areas of Dekalb silt loam near the western border of the Cumberland Plateau region. It occupies steep slopes near streams and bluffs or mountain sides between the Cumberland Plateau and Highland Rim regions. The water falling upon these steep surfaces flows swiftly away, carrying a large quantity of the fine soil material with it. The heavy forest growth which covers most of these mountains, however, prevents the excessive erosion which would result were it not for the protection which it affords.

The Dekalb stony silt loam is residual in origin and is derived from the weathering of sandstones and shales belonging to Carboniferous age. The weathering has not been complete and as a result a large quantity of sandstone fragments and boulders are found in both soil and subsoil and scattered over the surface.

Owing to the rough, broken topography and stony character of the soil, very little of it has been brought under cultivation. For the most part it is heavily forested with oak, hickory, chestnut, poplar, and other hardwood trees. The more broken areas should be allowed to remain in permanent forest, but the more gentle slopes can be cultivated successfully. The soil produces fair yields of corn and vegetables, but owing to the difficulty in cultivating these crops, they are not very profitable. Peaches and small fruits of an excellent quality can be produced and these products could be made the most profitable crops on this type.

#### ROUGH STONY LAND.

Rough stony land includes slopes of rough and broken areas too steep and stony for cultivation. The fragments, ledges, and outcrops of rock include sandstone and limestone. The areas support a forest

growth and some grass for pasturage. By cutting off the timber and allowing native grasses to take possession all but the roughest stony areas can be developed into fairly good pasture lands.

The Rough stony land occurs in the south-central part of the county, occupying the rough, detached strips which are found here. The surface is very rough and sandstone and limestone outcrops are extensive, also fragments of these rocks are scattered over the surface. The soil material for the most part consists of a yellowish-brown to brown clay loam or clay 4 to 8 inches deep, underlain by a yellowish-brown stiff clay. Areas of this type too small to be shown on the map occur in the western part of the county.

A small proportion of the type has been cleared for pasturage, but the greater part of it is still forested with oak, hickory, poplar, and other hardwood trees.

#### HANCEVILLE SILT LOAM.

The Hanceville silt loam is a gray to reddish silt loam, 8 to 12 inches deep, underlain by a dull-red or brick-red clay.

The type is inextensive, the two small areas found aggregating only about 1 square mile. These areas occur immediately south and a few miles to the west of Brotherton. They occupy the crests of ridges and slopes. Other areas occur on the smoother plateaus in areas of Dekalb silt loam and Dekalb fine sandy loam, but these were too small to be shown on the map.

The Hanceville silt loam is residual in origin and is derived from sandstone and shale belonging to the Coal Measures. The topography is rather broken, and very little of the type is under cultivation. The uncultivated areas are forested with oak, hickory, and other hardwood trees; where cultivated fair yields of corn, oats, and other general farm crops are obtained. Corn yields from 12 to 20 bushels and oats from 20 to 30 bushels per acre. The soil is in need of vegetable matter, and green crops should be turned under or barnyard manure added to supply this much-needed element. Applications of lime would also help.

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

*Mechanical analyses of Hanceville silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
401445.....	Soil.....	0.2	0.5	0.6	19.6	18.1	42.6	18.1
401446.....	Subsoil.....	.0	.4	.2	15.0	12.6	30.8	40.7

## HUNTINGTON SILT LOAM.

The Huntington silt loam is an alluvial soil and consists of a brown, mellow silt loam, 10 to 15 inches deep, underlain by lighter brown or yellowish-brown silt loam to silty clay loam. The subsoil is somewhat variable in texture and profile arrangement. Occasionally it is a fine sandy loam or a silt loam interstratified with sandy material. In some of the narrower bottoms fragments of chert are common. The soil is easy to cultivate and a good tilth is easily maintained.

The type occurs as first-bottom land along Falling Water, Calf-killer, and Caney Fork Rivers, and also along Martins, Little Indian, Big Indian, Cane, and many other creeks and smaller streams throughout the Highland Rim and Central Basin regions. The areas vary from a few rods to one-fourth mile in width. The soil is subject to occasional overflow. For the most part it is well drained between overflows. A few of the depressed areas are in need of artificial drainage.

The type is composed of a mixture of sand, silt, and clay which have been washed in from the adjacent uplands. The soil is being constantly built up by each successive overflow, which brings in fresh materials from the uplands. A few small areas are developed slightly above the typical first-bottom overflowed soil. Also some patches occur in slight drainage-way depressions, where there is more or less colluvial influence.

Most of the Huntington silt loam is under cultivation. The un-cleared areas are confined mainly to low, wet strips immediately along the streams, these being forested with beech, oak, sycamore, elm, and birch. Corn is the principal intertilled crop, and when the seasons are good yields of 30 to 60 bushels are obtained. Considerable areas are devoted to grass, the yields of hay ranging from 1 to 2 tons per acre. Some areas are used for pasture. The best drained areas produce heavy crops of oats and sorghum. Millet and many other crops do well.

## HOLLY SILT LOAM.

The Holly silt loam is a gray silt loam, 8 to 12 inches deep, underlain by mottled gray and yellowish silt loam to silty clay, which frequently contains black oxide of iron concretions. It is an alluvial type and includes areas of bottom land, where the drainage is entirely or mainly from the soils of sandstone and limestone origin, principally the Clarksville soils. Under cultivation the soil bakes and clods badly and is not so productive as the Huntington silt loam.

This type is not extensive, but occurs along many of the streams in areas of Clarksville silt loam and Clarksville gravelly loam in the Highland Rim region. It finds its greatest development along the two prongs of Blackburns Fork in the north-central part of the county and along Bear and Turkey Creeks to the north of Algood. Other smaller areas occur scattered over the Highland Rim region. The areas are low and flat, poorly drained, and subject to frequent overflow. The water table is sufficiently near the surface to keep the soil wet and clammy in most places. Occasional small areas have been cleared and put in cultivation, but for the most part it is still covered with forest, consisting of white oak, water oak, sweet gum, black gum, and maple.

With artificial drainage, applications of lime, and deep, thorough plowing, good yields of corn, oats, grasses, etc., could be obtained on this soil. At present these crops yield fairly well when the seasons are favorable, but, owing to the frequent overflows, the yields are uncertain.

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

*Mechanical analyses of Holly silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
401453.....	Soil.....	0.8	2.5	2.2	9.2	18.1	58.1	9.0
401454.....	Subsoil.....	1.1	2.5	2.5	8.8	16.9	57.4	11.0

#### SUMMARY.

Putnam County is situated in the north-central part of Tennessee and has an area of about 404 square miles, or 258,560 acres. It includes portions of the Cumberland Plateau, Highland Rim, and Central Basin of Tennessee. The surface features vary from broad, nearly level areas to hilly and rough mountainous country. About one-half is rough and broken. It is drained by a number of small streams which flow into the Caney Fork and Cumberland Rivers.

The area which includes Putnam County was settled in the early part of the last century.

The main line of the Tennessee Central Railroad traverses the county. Branch lines leave the area at Algood and Monterey.

Cookeville is the county seat, with a population of about 2,000. Other important towns and stations are Monterey, Algood, Double Springs, Baxter, and Buffalo Valley.

The county has a healthful, mild, and pleasant climate, with only occasional extremes of heat and cold. The mean annual temperature is about 59° F. and the mean annual rainfall about 50 inches.

Cool nights through the summer months prevent cotton from becoming one of the staple crops. Erratic frost occurrence makes fruit culture rather uncertain.

Corn, oats, and wheat are the main crops. The raising of mules, hogs, and cattle is an important industry on the limestone soils of the county. Mules are usually shipped south into the cotton country. Nashville is the principal market for corn, hogs, cattle, and forest products.

Very little attention is paid to the systematic rotation of crops.

Commercial fertilizers are coming into general use on the lighter soils.

The farms generally contain from 40 to 160 acres. About 58 per cent of the farms are operated by the owners and the remainder mainly by tenants, the usual tenant holding ranges from 40 to 100 acres.

The labor conditions in the county are not very good. Farm laborers receive from 75 cents to \$1 a day and from \$18 to \$25 per month with board.

Land values as a whole are rather low. The best limestone soils in the Central Basin region range from \$50 to \$125 an acre, while on the Highland Rim the price ranges from \$10 to \$30 an acre, and on the Cumberland Plateau from \$5 to \$25 an acre.

The county embraces parts of three important physiographic divisions—the Cumberland Plateau, the Highland Rim, and the Central Basin. The soils are representative of these three divisions and have a direct relation to the underlying geological formations. Including Rough stony land, 19 types, 2 having phase distinctions, were mapped.

The Clarksville silt loam, the Clarksville silt loam, rolling phase, and the Clarksville gravelly loam occupy the greater part of the Highland Rim, which forms about one-half the area of the county. These soils are used principally for corn, oats, and wheat, though tobacco is being grown rather extensively on portions of the Clarksville gravelly loam. These are not naturally strong productive soils.

The Decatur silt loam, Decatur silt loam, cherty phase, Decatur silt loam, eroded phase, and Decatur stony loam are red soils of limestone origin, and for the most part are strong and productive. They are used extensively for corn, wheat, oats, forage crops, and pasturage.

The Hagerstown stony loam and Hagerstown silt loam occur in many of the narrow valleys, especially near the western border of the Highland Rim. They are excellent soils, giving good yields of corn and other general farm crops. The Hagerstown stony loam is too broken and stony in many instances for general farming, but it affords excellent pasturage where cleared and the native grasses and clovers allowed to come in.

The Hagerstown stony clay loam and Hagerstown stony clay occur in the Central Basin region. The former is an excellent soil for corn and other general crops and much of it is under cultivation. The latter is too rough for tilled crops, but makes good pasture lands. Bluegrass is indigenous.

The Westmoreland gravelly loam and Westmoreland stony loam have a limited development on the hills and ridges in the Central Basin region in the western part of the county. The Westmoreland gravelly loam is well adapted to the production of corn, oats, wheat, etc. The Westmoreland stony loam is a much lighter and more stony soil and for the most part too rough for successful farming.

The Rough stony land is practically all forested and should remain so.

The Guthrie silt loam is a poorly drained soil, occupying slightly depressed areas on the Highland Rim. If properly drained it can be cultivated and gives fair yields of the general farm crops. Much of it is forested.

The Dekalb silt loam, Dekalb fine sandy loam, Dekalb stony sandy loam, and Dekalb stony silt loam are the main types on the Cumberland Plateau in the eastern part of the county. The Dekalb silt loam is cultivated most extensively, the principal crops being corn, oats, wheat, sorghum, and cowpeas. It is well adapted to Irish potatoes, apples, pears, plums, cherries, and small fruits. The Dekalb fine sandy loam is not cultivated extensively. It is well adapted to Irish potatoes and most all varieties of vegetables. Corn and a few vegetables are the chief crops, and fair to indifferent yields are obtained. The Dekalb stony sandy loam and Dekalb stony silt loam are practically all in forest, and, owing to the serious erosion which results in most cases when these types are cleared, they should be used permanently for forestry.

The Hanceville silt loam has a very limited development in the county. For the most part it occupies the crests of hills and ridges on the Cumberland Plateau, and, owing to its rather rough topography, very little of it has been brought under cultivation. For the most part it is forested with oak, hickory, chestnut, chinquapin, poplar, and dogwood.

The Huntington silt loam is an alluvial type of small extent. It is very productive and is prized highly for corn and forage crops.

The Holly silt loam is an alluvial type occurring along many of the streams. It is wet and clammy most of the time and for this reason is not very productive. Very little of it is under cultivation. Small areas are devoted to corn and grasses and it is used to some extent for pastures.

[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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