SOIL SURVEY OF LOGAN COUNTY, KENTUCKY.

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DESCRIPTION OF THE AREA.

Logan County lies in the southwestern part of Kentucky, in the southern tier of counties. Muhlenberg and Butler Counties bound it on the north, Warren and Simpson Counties on the east, Todd County on the west, and Robertson County, Tennessee, on the south. Its greatest length from north to south, near the western margin, is about 29 miles, and its greatest width from east to west through Auburn is 24 miles. The area of the county is 559 square miles, or 357,760 acres.

With the exception of a strip of country surveyed by the United States Geological Survey, embracing about 70 square miles along the northern boundary, the base map used in the present survey was constructed by the soil-survey party, using the plane-table method.

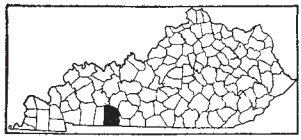

FIG. 26.—Sketch map showing location of the Logan County area, Kentucky.

With respect to its surface features, Logan County may be divided into two divisions, a northern and a southern.

The northern division includes that part of the county lying to the north of an irregular line which extends approximately east from Gordonsville, near the west county line, to Russellville, then southeast to near Corinth, from which point it continues in a northeasterly direction slightly north of Auburn to the county line.

The country within this division represents in general a thoroughly dissected plateau, the valley slopes breaking abruptly from the rolling to hilly tops of the ridges. Some comparatively level to undulating areas occupy the broader ridge crests or divides. The largest of these occur north of Gordonsville on the divides separating Wolf Lick, Duck Lick, and Elk Lick Creeks, north of Cavetts Store, and north of Cave Spring School. The prevailing topography, however, consists of narrow ridges with steep slopes, varied here and there by hills and knolls and deep, narrow valleys. The drainage of this division is northward, mainly through Wolf Lick Creek, Mud River, Dallam, Duncan, and Rock House Creeks, Gasper River, and several

short streams. The bottom lands are widest along Wolf Lick Creek and Mud River, where they range from one-fourth mile to 1 mile in width. A striking feature is the great number of streams which ramify this section and form an intricate drainage system.

The southern division is undulating and, topographically, embraces the least diversified country in the county. The proportion of cultivable land is much larger than in the northern division. Sink holes are numerous in this part of the county, and many streams, some of considerable size, enter these and disappear. Gasper River, Clear Fork Creek, Black Lick Creek, and other smaller streams have as their source "springs" or "blue holes" which are subterranean streams appearing at the surface. Most of the drainage of the southern part of the county is southwestward through Red River and its tributaries, North Fork, South Fork, and Whippoorwill Creek. These are bordered with narrow strips of bottom and terrace land.

Logan County originally embraced a large part of southern Kentucky. It was organized in 1792 and the county seat was established at Russellville, where it has since remained. Its present area was fixed when Simpson County was cut off in 1868 or 1870.

The pioneers came from Virginia and the Carolinas. They located in the hilly country north of Russellville, where wood, water, and game were plentiful. The southern part of the county was not forested at that time.

According to the 1920 census, Logan County has a population of 23,633, 86.7 per cent being classed as rural. The southern half of the county is the more thickly settled. Russellville, the largest town and county seat, has a population of 3,124. Adairville, with a population of 778, is the next largest town. Auburn has a population of 715 and Lewisburg 334. Olmstead, Oakville, and South Union are railroad points, and Keysburg, Richelieu, Homer, Gordonsville, and Schochoh are small trading points located off the railroad. Dunmor, partly within the county, affords shipping facilities and markets to the people in the extreme northwestern part. Franklin, in Simpson County, on the main line of the Louisville & Nashville Railroad, is a market for a part of the southeastern section of the county.

Logan County is traversed by the Louisville & Nashville Railroad, the Memphis Branch crossing it in a northeast-southwest direction through Russellville. This branch connects with the main line at Bowling Green, 18 miles beyond Auburn. The Owensboro & Nashville Division of the Louisville & Nashville Railroad passes through Adairville near the Tennessee line, Russellville, Lewisburg, and Dunmor. The northeastern corner of the county is the most remote from rail transportation.

Public roads traverse all parts of the county. In the northern part, especially, they are rough, rocky, and hilly, and during the rainy seasons of winter and spring become almost impassable because of deep, stiff mud. Pike roads surfaced with limestone radiate from Russellville and Auburn. North of Lewisburg there are no hard-surfaced roads. The Dixie Highway enters the county at Shakertown, near the eastern margin of the area, and extends through Auburn to Russellville and south through Adairville.

The southern part of Logan County presents a more prosperous appearance than the northern, owing chiefly to more productive soils better suited physiographically for agricultural pursuits, and more advantageous location with respect to markets and transportation.

Good roads greatly enhance farm values, and with the abundance of road-surfacing material at hand there is no apparent reason why all sections of Logan County should not enjoy improved thoroughfares.

CLIMATE.

The winters in Logan County are moderately cold, but very cold spells are usually of short duration. For the winter months—December, January, and February—the absolute maximum is 76° F. and the absolute minimum is —14° F. Snow frequently falls during these months and March. The summers are long and warm, with occasional periods of hot weather. The absolute extremes recorded for the summer months range from 42° to 103° F. The mean annual temperature is 58.5° F.

The mean annual precipitation, which is fairly well distributed throughout the year, is 46.55 inches. As a general rule the period of least rainfall is from August to November, a condition favorable to harvesting the crops. There is a variation from 29.85 inches to 59.51 inches between the driest year (1901) and the wettest year (1892) at Franklin, Simpson County, the conditions at this station being fairly representative of climatic conditions in Logan County.

The average date of the last killing frost in the spring is April 11, and of the first in the fall is October 21. The dates of the earliest and latest killing frosts in the fall and spring, respectively, are October 9 and April 25.

Killing frosts in spring do damage mostly to fruits, strawberries, and early garden truck, corn and tobacco rarely ever being planted so early. The damage from killing frosts in the fall is limited almost entirely to corn and tobacco. The length of the growing season is usually considered to be the number of days in each season between the date of the last killing frost in spring and that of the first killing frost in fall. This period ranges from 169 practically sure days to 179 to 203 probable days for this section.

The following table, compiled from the records of the Weather Bureau station at Franklin, located in the adjoining county of Simpson, gives the normal monthly, seasonal, and annual temperature and precipitation, the absolute maximum and minimum temperatures, and the total precipitation in the driest and wettest years on record:

Normal monthly, seasonal, and annual temperature and precipitation at Franklin, Simpson County.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1901).	Total amount for the wettest year (1892).
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	40.0	70	0	4.28	2.90	7.62
January	37.6	73	−14	3.60	4.06	2.78
February	38.6	76	−2	4.89	1.56	3.28
Winter	38.7	76	−14	12.77	8.52	13.68
March	50.1	89	16	4.75	3.00	3.94
April	59.1	90	25	4.61	3.10	11.78
May	67.0	98	33	4.05	2.79	6.38
Spring	58.7	98	16	13.41	8.89	22.10
June	74.9	103	42	3.97	.72	4.12
July	77.5	101	51	4.11	.60	4.54
August	77.2	101	48	3.30	7.22	3.95
Summer	76.5	103	42	11.38	8.54	12.61
September	72.0	102	38	3.36	3.25	5.11
October	59.3	95	24	2.10	.55	.25
November	48.5	82	7	3.53	.10	5.76
Fall	59.9	102	7	8.99	3.90	11.12
Year	58.5	103	−14	46.55	29.85	59.51

AGRICULTURE.

The early agriculture in Logan County dates back to about 1790, when the first settlements were made in the hilly country to the north of Russellville. The pioneers established homes near springs in the forested section. Corn, wheat, and tobacco were the first crops grown in the county. Stock raising was carried on, the cattle, hogs, and sheep running at large.

Later on the more nearly level country to the south, which had been considered undesirable on account of the scarcity of timber and water, was found to be well suited to the production of tobacco and the grain crops, and settlers from the hill country as well as newcomers occupied this section and engaged in farming.

Tobacco was at that time, as it is to-day, the principal cash crop. It was hauled to Nashville, Tenn., and to Bowling Green, Ky., from which points it was shipped by water to the larger markets.

After the building of the Louisville & Nashville Railroad, transportation to outside markets greatly stimulated agricultural pursuits.

The early methods of farming were crude and wasteful. Fields were poorly cultivated and often planted to the same crop year after year. No thought was given to improving the productiveness of the soil or to maintaining its natural productivity, and as a result the yields decreased. Farming methods were gradually improved, and at the present time a large number of farmers follow a system of crop rotation and recognize the importance of returning organic matter to the soil in the form of barnyard manure or green crops Commercial fertilizers are more extensively used, and the growing of leguminous crops has greatly increased.

Some idea of agricultural conditions in the county may be gained from the census reports of the last few decades. In 1880 there were 2,521 farms, with an average size of 125 acres. Of the land in farms, 59 per cent, or 74 acres per farm, was improved. In 1890 there were 2,724 farms of an average size of 116 acres. Of the area in farms, 64 per cent was improved, or about 74 acres to the farm. In 1900 there were 3,779 farms of an average size of about 84 acres. Seventy per cent of the land in farms, or about 59 acres to the farm, was improved. In 1910, 79.8 per cent of the county was in farms, and 71.2 per cent of the land in farms, or 62 acres to the farm, was improved. There were 3,772 farms of an average size of 87 acres. In 1920, 79.7 per cent of the county was in farms, and 72.2 per cent of the land in farms was classed as improved land. There were 3,819 farms in the county of an average size of 85.9 acres, of which 62.1 acres were improved. Since each tenancy is classed as a farm, the average size of holdings throughout the county is considerably larger. The average size of the holdings in the northern part of the county is probably about 60 acres, but the average size is undoubtedly much greater in the southern part. There are many farms of 200 to 400 acres or more. Land values have steadily increased during the last few years, while within the last year the advance has been rapid.

Corn leads the cereals in point of acreage. In 1919 it was grown on 54,207 acres, the production being 1,068,487 bushels. Corn is the most widely grown crop in the county. It is produced on all the tillable soils, the fields ranging in size from a few acres to 50 acres or more, the small fields prevailing in the hilly section.

As a rule the land, usually in sod, is broken in the spring, although considerable fall plowing is practiced. Corn is planted with a planter, the greater part of the crop being check-rowed, the re-

mainder being drilled in. The corn is cultivated largely with double-shovel plows and riding and walking cultivators. Cultivation is frequent and shallow in order to keep down weeds and grass and also to conserve moisture by keeping the surface well mulched.

Usually there is enough corn grown to supply the local demand. In favorable seasons some farmers have an excess to sell, but corn is seldom shipped out. Boone County White is the favorite variety. Only a small acreage of corn is cut for silage. The practice of shredding fodder and storing it in barns is increasing. The general practice, however, is to allow the stover to stand in the shocks in the field and haul it as needed. A small acreage is harvested by pulling the ears, the husks being removed when the grain is fed to stock.

Wheat ranks next to corn in acreage. According to the 1920 census, wheat was grown on 23,436 acres, yielding 274,070 bushels. It was grown on 24,514 acres in 1909, the yield being 321,353 bushels. In 1899 the total acreage in wheat is given as 40,977, with a yield of 418,850 bushels. In 1889, 26,343 acres produced 312,313 bushels, and in 1879, 340,202 bushels were grown on 36,893 acres.

Wheat is sown in the fall, either on corn or tobacco land. The ground is prepared for wheat by disking the surface from one to three times. The quantity of seed per acre ranges from 1½ to 2 bushels. In the smoother limestone country wheat is usually sowed with drills and cut with a binder, and it is practically all thrashed from the shock. A small part of the straw is baled and sold. Wheat is almost wholly a cash crop, practically all of it being sold to the several flouring mills located within the county. Flour is shipped to outside markets.

The Decatur silt loam and clay loam are the most important wheat soils with respect to both acreage and yield. From 20 to 40 bushels per acre are produced, 20 bushels being more nearly the average yield. Wheat is usually sowed in October, although when conditions are unfavorable at this time fairly good yields are secured from wheat sowed as late as the middle of November. Land planted to wheat is usually fertilized with 150 to 250 pounds of acid phosphate per acre. Some farmers use in addition 2 tons of ground limestone and a liberal application of barnyard manure.

In 1919 oats occupied 1,459 acres, producing 24,204 bushels. There has been a steady decrease in the oat acreage since 1880, when 8,932 acres produced 130,659 bushels. The yield for oats ranges from 15 to 50 bushels per acre. This crop is sown in the fall and thrashed in the same manner as wheat. Practically all is fed on the farm.

Tobacco, although classed as a special crop, is one of the most important of the crops grown in Logan County. In 1919 there were planted 18,791 acres, which yielded 15,243,546 pounds of tobacco.

This is the largest acreage ever occupied by tobacco, the greatest area previously reported by the census occurring in 1899, when tobacco occupied 13,122 acres. The heavy planting was due to the high prices prevailing during the war period. The yield of tobacco ranges ordinarily from 700 to 1,000 pounds per acre on the Tilsit and Hanceville soils, and from 800 to 1,200 pounds or more per acre on the Decatur soils.

The general practice is to select the best land on the farm for the growing of tobacco. The seed bed, prepared in late March to late April, is usually located on a southern slope and is first sterilized by burning with logs or brush. Some beds are steamed for this purpose. The soil is harrowed, and a large tablespoonful of tobacco seed is mixed with wood ashes and sown broadcast. The bed, which is usually 10 yards square, is then rolled and covered with canvas or cheese cloth. Transplanting, which in most cases is done by hand, is begun when the plants reach a height of about 4½ inches. It usually requires about two months' time to produce a plant of this size. Plants are set on the check-row system at intervals 3½ feet in rows 3½ feet apart. It requires approximately 3,500 plants to set an acre of dark tobacco. Burley tobacco plants are set about one-half as far apart in the row.

Fertilizers used are either acid phosphate or bone meal applied at the rate of 100 to 250 pounds per acre. A ready-mixed fertilizer analyzing 10–3–1 is used to some extent. It is applied at the rate of 100 pounds per acre. Prior to the scarcity of potash, 8–3–3 and 10–3–3 preparations were used, the usual application being about 100 pounds per acre. Fertilizers are either broadcasted when the land is being prepared for planting or a small amount is placed in the hills when the plants are set out. More tobacco is fertilized in the northern than in the southern part of the county.

The tobacco crop is cultivated in very much the same manner as corn, except that the hoe is used to remove grass and weeds nearest the plants. After the last cultivation with the plow some farmers advise hilling up the plant. This is not the general custom, however. When the blossoms appear, the plants are topped. Sprouts or suckers are removed from time to time, so that the strength of the plant supports only the main-stem leaves, which make the best grade of tobacco.

It requires from 90 to 100 days for the tobacco plant to mature. Tobacco should be planted by the middle of June, and therefore cutting commences about the first of September. The stalks are cut close to the ground, placed on sticks, and hauled to the barns, where the tobacco is either air cured or fire cured, the method depending upon the kind of tobacco. Blue Pryor, Madole, Orange, and other varieties of tobacco are grown. The One Sucker, a dark tobacco, is most extensively grown and is air cured. Burley, a light or bright

air-cured tobacco, is grown only to a limited extent, and is produced almost exclusively east and southeast of Auburn. It commands the best price and is used for the manufacture of cigarette, smoking, and chewing tobacco. Broad leaf, a dark tobacco, is fire cured. It is grown throughout the county, but more extensively in the southern part. It is claimed that a better grade of export tobacco is produced in the vicinity of Adairville and a few other localities in the southern part of the county than around Auburn or elsewhere in the northern part. The bulk of the tobacco crop is sold to buyers who represent Louisville and Nashville firms. There are no tobacco factories located in Logan County.

The hay crop of the county is relatively important. Timothy and clover, redtop, and alfalfa are grown for hay. The 1920 census reports 15,738 acres in tame or cultivated grasses, 3,830 acres being in timothy and clover mixed, 1,528 acres in timothy alone, and 2,288 acres in clover alone. Timothy and redtop are grown almost exclusively in the northern hill section; clover is an important hay crop throughout the southern part of the county. There is considerable difficulty in obtaining a stand of clover, but a stand of timothy is more certain.

Within the last few years the acreage of alfalfa has been substantially increased, especially in the vicinity of Auburn. No alfalfa was reported for 1909, and the present acreage is small, but its importance and possibilities are recognized. The 1920 census reports 554 acres of alfalfa yielding 1,044 tons. This legume is most successful on the Decatur silt loam and clay loam. The Huntington silt loam and Elk silt loam are also well adapted to it, although there is some danger of the crop being damaged by overflow waters, especially on the Huntington soil. A few farmers produce alfalfa on a commercial scale. Three or four cuttings from alfalfa fields are obtained each year, the total yield ranging from 3 to 5 tons per acre.

Alfalfa contains a high percentage of protein and has a feeding value nearly equal to wheat bran. Besides its value in hay production, alfalfa is especially valuable for pastures where live stock is kept.

For the production of alfalfa the soil should be well drained, liberally manured, limed, and in good physical condition. Inoculation is not always necessary, but a stand is more certain when soil from an old alfalfa field is used or nitroculture is applied to the seed.

In 1919 there were 2,682 acres of grains cut green, and 1,308 acres of coarse forage, the latter consisting of cowpeas, soy beans, and sorghum cut for hay. In addition 12,283 acres of corn were cut for forage.

Crops of minor importance consist of soy beans, cowpeas, sorghum for sirup, sweet potatoes, and Irish potatoes. Sorghum for sirup occupied 441 acres in 1919, producing 1,079 tons of cane and 19,748

gallons of sirup. Sorghum is grown in small patches by many farmers and is either used for forage or for the manufacture of sirup for home use and the local markets. Sweet potatoes and Irish potatoes are grown mainly for home use, although some are sold locally. The 1920 census reports 202 acres of Irish potatoes, yielding 9,358 bushels, and 230 acres of sweet potatoes, yielding 15.858 bushels. Other vegetables are grown chiefly to supply home needs.

There were 39,954 apple trees and 25,588 peach trees in the county, according to the census of 1920. Orchards of varying size are found throughout the county, and there are some trees on nearly every farm. The few orchards of commercial size are given very little care and attention. Some of these are located north of Russellville on the Tilsit silt loam, and if properly pruned and sprayed should prove profitable. The Hanceville and Christian soils are well suited to peaches. Grapes are grown for home use only.

The production of strawberries on a commercial scale is practiced to some extent, mainly in the vicinity of Auburn. The berries are handled through the Warren County Strawberry Association, with headquarters in Bowling Green. The strawberry business was a very profitable one in 1918, some growers realizing over $200 per acre. The 1920 census reports 30 acres in strawberries, with a production of 24,544 quarts. Blackberries do well and in 1919 were grown on 28 acres, producing 29,971 quarts.

Hog raising is an important industry in Logan County. There were 22,723 hogs in the county in 1919, according to the census. Hogs are raised principally to supply pork products for home use, although a considerable number are shipped to outside markets. A number of farmers raise thoroughbred Duroc-Jersey hogs, though a large proportion of the stock is of mixed breeds.

The 1920 census reports 12,856 cattle of all ages in the county in 1919, and their value is stated as $628,848. A few farmers make the raising of cattle for beef a special industry, while others raise a few head each year for the market. A number of registered Shorthorn cattle are sold for breeding purposes.

Conditions in Logan County are very favorable for dairying, and this branch of animal husbandry is rapidly increasing. Dairying is a supplementary source of income on many farms, while on a number it has become the chief source. Many prefer to sell the cream rather than make butter for the local markets. The average farmer keeps from 1 to 5 milk cows, though there are a few farms making a specialty of dairying and keeping a much larger number of cows. Cream stations are situated at Adairville, Russellville, and Auburn, from which points cream is shipped to Louisville and Nashville. There are no creameries in the county. The cream separator is not in general use at the present time, and there are only a few

silos in the county. In 1919 the value of dairy products, excluding home use of milk and cream, was $317,231.

The value of poultry and eggs produced in 1919 was $376,568. Poultry provides food for family use as well as furnishing a small income from the sale of the excess products.

The value of farm lands in the county depends upon the character of the soil, topography, location, and improvements. The lowest in value consists of the stony and hilly types, which in general occupy the northern half, prices for which range from $10 to $50 an acre. On the Decatur silt loam, clay loam, and gravelly clay loam types which are more highly developed, land values range from $50 to $200 or more an acre. According to the 1920 census the average assessed value of farm land was $44.85 an acre.

The southern part of the county is more generally farmed than the northern part, as it includes more unbroken country and the soils are more productive.

Farm buildings are, as a rule, indicative of the productiveness of the soil. In the northern part of the county the dwellings are small to medium-sized frame buildings and the barns are correspondingly small. In the southern part the houses and farm buildings are larger, and there is in general more evidence of thrift and prosperity.

Throughout the county where the surface features will admit the use of improved farm machinery there is an increasing tendency to utilize labor-saving devices. There are a number of tractors in use, as well as other gasoline engines used for grinding feed, pumping water, sawing wood, and similar power purposes. There are a few privately owned rock-crushing machines.

There is considerable variation with respect to crop rotation, but the one most common consists of tobacco, wheat, clover, and corn. A rotation not including tobacco consists of clover two years, followed by corn, wheat, and clover. When alfalfa is raised it is usually allowed to remain three years, followed by corn two years, and the land again seeded to alfalfa. Soy beans and cowpeas are also employed in some of the rotations in maintaining productiveness.

According to the 1920 census the expenditure for fertilizers on 2,692 farms, or 70.5 per cent of the total number, was $95,628, or an average of $35.52 on the farms reporting. This amount represents a slight increase over that reported in 1910.

Sixteen per cent acid phosphate is commonly used, usually in conjunction with ground limestone and stable manure, on the Decatur soils. Bone meal is used to some extent instead of acid phosphate.

Until recently mixtures varying in the percentage of phosphoric acid, nitrogen, and potash were in general use. Mixtures analyzing

8–3–3 or 10–3–3 were the most common. More recently a 10–3–1 preparation has proved satisfactory and is quite extensively used for fertilizing tobacco. For the Tilsit soils a high-grade complete commercial fertilizer appears to be the most satisfactory. Best results are obtained from commercial fertilizers when the soil contains a relatively high percentage of organic matter. The use of ground limestone is increasing. There is an ample supply of lime rock at hand, and in some cases this is either gathered from the fields or quarried and crushed on the farm. This practice should be extended.

The labor problem is one which concerns the farmer at the present time (1919). In some parts of the county difficulty is experienced in obtaining help when most needed. Most of the laborers are employed by the day. The usual wage is $2 a day, except during the hay and wheat harvest and tobacco-cutting season, when $3 is frequently paid.

According to the census of 1920, 61.3 per cent of the farms in Logan County are operated by owners, 38.5 per cent by tenants, and 0.2 per cent by managers. The share system prevails in renting. When the tenant furnishes everything, one-third of the crop is given as rent. When land is rented on halves, each pays for one-half of everything and gets one-half of the crops. Under the "cropper" system the tenant gets the use of a house, pasture for one cow, garden, and fuel, and receives one-third of the corn and one-half of the tobacco crops. The landowner furnishes tools, stock, barn, and all equipment for handling tobacco. The acreage rented to a tenant consists on an average of 4 acres of tobacco and 15 acres of other crops. Comparatively little land is rented for cash.

SOILS.[1]

The soils of Logan County may be classed in two general groups—the upland and the lowland or alluvial soils.

[1] Logan County, Ky., does not join up very well everywhere along the boundary of Robertson County, Tenn., mainly for the reason that more detail is shown on the map of Logan County than on that of Robertson County, and for the reason that the Decatur gravelly clay loam as mapped in Logan County was called Decatur clay loam at the time the Robertson County survey was made.

From the Red River eastward Decatur clay loam in Robertson County joins with Decatur gravelly clay loam in Logan County for about 3 miles; thence eastward to a point about 1 mile east of Adairville Decatur silt loam in Robertson County joins with Decatur silt loam and Decatur gravelly clay loam in Logan County, because more detailed mapping was carried on in the latter area. East of this point the two maps join up for about 3 miles, and thence eastward they fail to join for a distance of nearly 2 miles because two fairly large areas of Clarksville silt loam mapped along the boundary in Robertson County were not mapped in Logan County and because about a mile of a rolling phase of Decatur clay loam was mapped in Robertson County, whereas this phase is not recognized in Logan County. West of Red River a mile or more of Decatur clay loam in Robertson County joins with Decatur gravelly clay loam in Logan County, but from this point westward the soils in the two counties agree very well.

The upland soils are residual from St. Louis limestone, which is quite cherty in places; from interbedded limestone, sandstone, and shale; and from sandstone and shale.

Sandstone and shale are widely distributed over the northern part of the county, occurring abundantly in the more rolling country, capping the hills and ridges, and to a considerable extent over some of the flatter areas bordering the ridges and hills. Shale fragments are more numerous in the extreme northern part. Remnants of decomposed conglomerate rock occur in small areas capping the ridge which extends north from Sand Spring Church. The elevation of this ridge is between 600 and 700 feet above sea level.

The St. Louis limestone occurs as the exclusive soil-forming rock over the greater part of the southern portion of the county. It is also found in the valleys and low areas, and along the lower slopes of hills in the northern part. In this section occurs a thin-bedded limestone probably belonging to the Chester group. It occupies a higher position than the St. Louis limestone and is more grayish or yellowish in color.

Some important differences exist in the soils derived from the same or similar rock, which are due, apparently, to differences in degree of oxidation as a result of accident of position. The better drained soils of the higher and more rolling positions, as a rule, have more reddish subsoils, while the poorer drained flats and depressions frequently have yellow, gray, or mottled subsoils or lower subsoils. Some types, however, have distinct color and structural features that appear to be due directly to the lithologic character of the parent rock. This is particularly true in the case of the Shelbyville soils.

The soils of Logan County are grouped into series on the basis of color, origin, and structural characteristics. Twelve series are represented. The series are divided into types on the basis of texture, or the proportion of sand, silt, and clay particles. Twenty-two soil types, including Rough stony land, were mapped in this area. The upland or residual soils are classed with the Decatur, Clarksville, Guthrie, Shelbyville, Christian, Tilsit, and Hanceville series.

The Decatur series includes types which have a brown or reddish-brown surface soil and a deep-red or blood-red subsoil. The surface features range from undulating to hilly, the latter topography applying only to the stony clay. The soil types of this series are residual from the St. Louis limestone. The drainage is adequate. The series is represented by the silt loam, gravelly clay loam, stony clay, and the clay loam with a stony and eroded phase.

The Clarksville series is represented by a single member, the silt loam, which is characterized by its gray surface soil and yellow subsoil. This soil is derived from both chert-bearing and chert-free

limestone. In places chert fragments occur in the soil and subsoil, and to some degree in the substratum. Drainage is fairly adequate.

The types of the Shelbyville series are limestone soils with a yellowish, heavy clay subsoil which is extremely plastic and sticky when wet, and very tough when dry. Consequently the underdrainage is very slow. These soils are found on slopes in positions which should give them equally as good drainage as the red limestone soils of the Decatur series. The limestone giving rise to the Shelbyville may be more argillaceous than that giving rise to the Decatur. The Shelbyville series is represented by the stony clay type.

The Guthrie series is also of limestone origin. It is represented by the silt loam, a low-lying type having poor drainage. The surface soil is light grayish to whitish, and the subsoil is mottled gray and yellow.

The Tilsit series has gray to grayish-brown surface soils and a reddish-yellow to yellow subsoil, with grayish and yellowish mottlings. Two types of this series, the silt loam and silty clay loam, were mapped. These soils are derived from fine-grained sandstone and shale. The drainage is fairly well established.

The Hanceville soils have light-brown to grayish surface soils and a reddish subsoil. These soils occupy slopes and rolling country. Drainage is free to excessive. The soil material is derived from the weathering of sandstone and shale. Three types, the Hanceville silt loam, very fine sandy loam, and stony loam were recognized.

The soils of the Christian series are of mixed origin, being derived from both limestone and sandstone. In places these rocks are interbedded.

Much of the soil material of the series, especially of the stony loam type, is derived from limestone material which has been influenced by overlying strata of sandstone. The silt loam, very fine sandy loan, and stony loam were recognized in Logan County. These types have grayish-brown to reddish-brown surface soils overlying a reddish-yellow to yellowish-red or red subsoil.

The alluvial soils of the county occupy first bottoms subject to overflow and second bottoms or terraces which stand above normal overflow. These soils are classed with the Elk, Huntington, Pope, Dunning, and Abernathy series.

The soil types of the Elk series are characterized by light-brown to brown surface soils and a yellowish-brown subsoil. The silt loam is the only member mapped in this survey. It occupies second bottoms or terraces. The drainage is good. The material is alluvium from upland limestone, sandstone, and shale soils, deposited at a time when the present streams were flowing at higher levels.

The Huntington series has brown, friable surface soils and a lighter brown to yellow subsoil of heavier texture. The surface is level to gently undulating, and the drainage is good except during periods of overflow. The material is composed of sediments washed from limestone soils and mixed wash from limestone, sandstone, and shale soils. Two types in this series were mapped, the silt loam and silty clay loam.

The Pope series has light-brown surface soils and a yellowish-brown or yellow subsoil. The Pope soils represent wash from the sandstone and shale soils, with little or no limestone sediments. The silt loam is mapped.

The Dunning soils differ from the Huntington in that the surface material is darker and the bluish-gray and yellowish-brown subsoil is more plastic. They are derived from limestone wash. Only one type, the silt loam, was mapped.

The Abernathy series has reddish surface soils and a mottled reddish, brown and gray, and grayish subsoil. The one type recognized in this survey the silty clay loam is to some extent colluvial in origin, part of the material having been washed down from the surrounding Decatur soils. The drainage is poor.

Rough stony land constitutes broken, uncultivable land, composed mainly of rock outcrop and bowlders, with a thin, uneven soil covering. Both limestone and sandstone rocks are included in this classification.

The following table gives the names and the actual and relative extent of the soil types mapped in Logan County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Decatur silt loam	89,088	24.9	Decatur stony clay	4,672	1.3
Tilsit silt loam	57,856	16.2	Christian stony loam	4,224	1.2
Decatur clay loam	42,176	14.1	Shelbyville stony clay	3,584	1.0
Stony and eroded phase	8,128		Guthrie silt loam	3,328	.9
Hanceville stony loam	32,192	9.0	Pope silt loam	3,264	.9
Christian silt loam	24,192	6.8	Christian very fine sandy loam	3,200	.9
Decatur gravelly clay loam	19,392	5.4	Hanceville very fine sandy loam	3,072	.9
Huntington silt loam	14,016	3.9	Elk silt loam	2,304	.6
Clarksville silt loam	11,200	3.1	Dunning silt loam	960	.3
Hanceville silt loam	8,256	2.3	Abernathy silty clay loam	832	.2
Huntington silty clay loam	8,000	2.2			
Rough stony land	7,552	2.1	Total	357,760	
Tilsit silty clay loam	6,272	1.8			

DECATUR STONY CLAY.

The Decatur stony clay consists of reddish-brown clay loam 3 to 4 inches deep, or reddish or deep-red heavy clay, depending upon the

position and degree to which it has been weathered and eroded. The subsoil, which is frequently exposed at the surface, begins as a reddish-brown silty clay which soon passes into stiff, heavy clay of the same color with rock frequently coming in at shallow depths. The lower subsoil in places is a stiff, heavy yellow clay, mottled with reddish brown and stained with black iron stains, and carrying small crumbly iron concretions several inches above the underlying limestone. Some patches have a shallow covering of gray silt loam. There are abundant outcrops of flattish limestone and some loose fragments.

The Decatur stony clay is found principally in the central part of the county to the north and east of Russellville. A few scattered areas are found west and northwest of this point. It does not occur in the southern or extreme northern part of the county. The type occupies hills, knolls, and slopes.

This land is so stony and broken that it is seldom cultivated. It is used to some extent for pasture, but is mainly forested with cedar, white oak, red oak, hickory, and locust. Sassafras and sumac are present in places, while some areas support cedar almost exclusively.

The value of this land is based almost entirely upon the character of its timber growth. It is seldom sold separately, as it does not occupy large continuous areas.

DECATUR GRAVELLY CLAY LOAM.

The dominant soil of the Decatur gravelly clay loam, which is a mixed soil, consists of brownish to red clay loam ranging from 1 to 5 inches in depth, over red clay. There is an abundance of yellowish and grayish angular chert fragments of small size to 4 or 5 inches in diameter scattered over the surface and disseminated through the soil and substratum. This type represents a condition rather than a distinct soil type. The areas mapped as Decatur gravelly clay loam have a strongly undulating to billowy surface configuration due to the characteristically numerous sink holes. The soil material described above occurs on the slopes of the depressions and to some extent on the intervening situations.

There are many narrow bands on the irregularly winding intervening rises which consist of yellowish-brown to grayish silt loam, passing at 5 or 6 inches into yellowish or reddish silty clay loam, which in turn passes into red clay containing considerable chert fragments, especially in the lower subsoil. The latter soil really represents an inclusion of Baxter silt loam. The Baxter soils are important in many parts of the limestone region. Another inclusion consisting of Decatur gravelly silt loam occurs on some of the flattish areas.

The depressions contain colluvial wash. This material consists of a brown or reddish silt loam to silty clay loam, passing down into brown silty clay loam with some grayish or drab mottlings. These mottlings increase with depth until at 24 inches the subsoil becomes a mottled brown and rusty-brown silty clay. Some yellow mottling and black iron stains appear in places in the lower subsoil. This part of the Decatur gravelly clay loam resembles very closely the Abernathy silty clay loam. In some of the depressions is found a brown silty clay loam, 3 feet in depth. Some of the depressions are well drained and cultivated and some are partially filled with water the year round or for much of the year. Many of the slopes are badly eroded, with clay galls in places.

Practically all of the Decatur gravelly clay loam lies within 7 miles of the southern boundary of the county. The largest areas occur in the vicinity of Adairville and east and northeast of Keysburg.

The forest growth consists of red oak, white oak, hickory, and black walnut. This type is cultivated to some extent, but usually in a rotation which allows a long time in hay and pasture. There are some areas devoted to permanent pasture and a number to timber. Fair returns are obtained from tobacco, which yields 500 to 600 pounds per acre. Corn yields 20 to 30 bushels and wheat 6 to 10 bushels per acre. Cowpeas make a good yield of hay. The vines are frequently plowed under to enrich the soil. When sown in spring, cowpeas are usually followed by wheat. It is difficult to secure a good stand of clover on this soil.

Commercial fertilizers and manures are used mainly with tobacco and to a less extent for other crops. When broadcasted, 150 to 200 pounds per acre are used, together with 50 to 75 pounds in the hill. Another plan is to use 150 to 200 pounds per acre in the hill alone. Land of this type is valued at $50 to $75 an acre.

DECATUR SILT LOAM.

The Decatur silt loam in Logan County differs somewhat from the type as developed in Alabama and Georgia in that the subsoil is not as deep red in color as it is farther south. It has some resemblance to the Hagerstown silt loam, which also is derived from limestone, usually in areas farther north. The Decatur silt loam in this area consists of a brown, mellow silt loam, passing at about 6 or 8 inches into light-brown or reddish-brown silt loam or silty clay loam; at 10 or 12 inches, this grades into reddish-brown or brownish-red friable clay, which becomes stiffer, more brittle, and deeper red with increasing depth, the lower subsoil being a clay, deep red when moist, brittle and molderately stiff when dry, and moderately plastic when

wet. In places the surface soil is reddish brown and the subsoil is more red and slightly heavier.

In the southern part of the county, and especially in the vicinity of Adairville, there is a considerable quantity of chert fragments present in the subsoil and substratum. In this section there is also found a light-brown silt loam, passing at 4 or 5 inches into yellowish-brown silty clay loam, below which is reddish-brown clay passing into dull-red clay. This material more closely resembles the Hagerstown silt loam. Typical Hagerstown silt loam is found in small spots, the soil consisting of a brown silt loam passing into fairly friable reddish-brown to dull-red moderately friable clay. Small patches of the Decatur clay loam or clay also occur on slopes where erosion has removed the surface soil.

This type is a residual soil, derived from the St. Louis limestone, a hard blue or gray rock, through processes of weathering.

The Decatur silt loam is the predominating soil in the southern part of the county, several of the areas being of considerable size. It is also found in the east-central part and is nearly always associated with the Decatur clay loam and gravelly clay loam.

In general the surface is undulating to very gently rolling, affording sufficient slope to insure good surface drainage. The internal drainage is good, and much of the surface run-off escapes through underground channels in the limestone bedrock. Sink holes are common, and when their slopes are not already occupied by the clay loam type, care must be exercised in cultivating in order to prevent the removal of the surface soil by erosion. Small areas of forest here and there include white oak, red oak, hickory, maple, walnut, tulip poplar, ash, and some black gum, cedar, and dogwood.

The Decatur silt loam is a very high-grade agricultural soil. The type gives good yields of all grain and hay crops and is well adapted to those fruits which are suited to this climate.

Corn yields from 30 to 50 bushels per acre, wheat 15 to 25 bushels, oats 25 to 40 bushels, tobacco 750 to 1,200 pounds, clover hay 1½ to 2 tons, redtop and timothy 1 to 1½ tons, cowpea hay three-fourths to 1½ tons, soy beans 1 to 1½ tons per acre. Variations in yields result from differences in the cropping system, cultural methods, and seasonal conditions, and slight variations in the soil. Clover does well and makes up a large part of the hay crop. It is not always easy to get a stand. Sorghum is grown for feed and is frequently planted on spots where wheat winterkills. It is not an extensively grown crop, however. Soy beans are gaining in favor as a hay crop, and the acreage is increasing. Soy beans are sown about the middle of May and harvested the latter part of August at a time well suited for curing the hay. Rye is grown for winter pasture and as a cover crop.

Alfalfa is grown successfully on this type. At present the largest areas are located in the vicinity of Auburn. It is coming into favor in the crop rotation because of its large yields, high feeding value, ready market, and beneficial effects on the soil. Good results are secured by perfecting a pulverulent seed bed after the land has been plowed to a depth of 6 to 8 inches, fertilizing with 200 to 250 pounds of acid phosphate (usually 16 per cent), 2 tons of ground limestone, and 6 tons of stable manure per acre. The seed is sown usually from August 20 to September 1 by means of the drill with disk seeder at the rate of 12 pounds per acre. Four cuttings are secured, the average yield for each of the first two cuttings is 1¼ tons per acre, for the third and fourth cuttings 1 ton. The first cutting is made about May 20 and the last one early in September. Grass and weeds are not troublesome until the second year, when the fields begin to become infested. Alfalfa is said to "run out" frequently, after four or five years, when it is turned under and the land planted to corn. Some few farmers make a specialty of growing alfalfa, one farmer near Auburn having shipped 20 carloads during 1918.

For grain crops and tobacco the same amount of acid phosphate is used. Potash does not appear to be so necessary on the Decatur soils. By feeding the greater part of the crops at home, much plant food is returned to the soil in the form of manure. Clover, alfalfa, soy beans, and cowpeas are grown for soil improvement.

The rotation most generally practiced on the Decatur silt loam is tobacco, followed by wheat and clover, then corn. When tobacco does not enter the rotation, which is the exception rather than the rule, clover runs for two years, then corn, then wheat, then clover. When alfalfa enters the rotation it remains three years, then corn for two years, then alfalfa. The land for wheat is generally disked, and the wheat sown in the fall.

The Decatur silt loam is the most efficiently farmed type in the county. Up-to-date labor-saving farm machinery can be easily used on account of favorable surface features.

Farms on this type are usually larger than the average for the county, and a considerable acreage is being handled by tenants. Tobacco is the chief crop produced by tenants.

Apples, peaches, and pears do well, but the trees require care and attention in order to keep them free from disease and to insure good yields of marketable fruit. Blackberries and raspberries grow wild on unused land. Strawberries do particularly well. Vegetables, including watermelons, cantaloupes, sweet potatoes, and Irish potatoes, are grown for home use and to some extent for sale in local markets.

The farm income is derived from the cash crops of wheat and tobacco and from the sale of hogs, beef cattle, and mules. Some

farmers raise thoroughbred Duroc hogs and registered Shorthorn cattle.

The adaptation of this soil to pasturage, hay, and forage crops should favor the development of the live-stock industry. Apparently the extension of dairy farming and live-stock raising would be profitable, especially in view of the high prices being obtained for dairy products, beef, pork, and mules. The application of ground limestone and phosphate fertilizers is recommended, and much of the type would be greatly benefited by the addition of organic matter by means of heavier applications of manure or the plowing under of green manuring crops.

Farms on this type command the highest prices in the county, ranging from $75 to $200 or more an acre, depending upon the location and improvements.

DECATUR CLAY LOAM.

The Decatur clay loam consists of a brown, reddish-brown, or dark-red clay loam or silty clay loam, underlain at 5 or 6 inches by moderately friable red clay, which grades below into deep-red, heavy, compact clay, which is brittle (not tough) when dry. The entire type is subject to erosion; in fact it has resulted from erosion occurring on areas of Decatur silt loam, and over numerous small areas, ranging from mere patches to 3 or 5 acres in extent, the surface soil is very shallow or entirely washed away, exposing the clay subsoil. This clay subsoil, although quite stiff, is not of the extremely stiff nature of the subsoil of the Shelbyville soils.

The shallow soil and clay spots are rather unproductive unless manured heavily. East of Russellville and elsewhere the type is somewhat different from the typical material both in texture and color. The surface is a grayish-brown or brown silt loam, usually 4 to 6 inches deep. The subsoil begins as a reddish-brown silty clay, which passes within a few inches into a reddish-brown, stiff, heavy clay. The subsoil often contains small, black, crumbly iron concretions and black iron stains or concretionary material in the lower portion. Bedrock is encountered in places at less than 3 feet, and in these cases the subsoil for a few inches above the rock is usually mottled reddish brown, yellow, and gray.

The surface is generally free from rock fragments, though in some places they are present and in others the underlying rock outcrops at the surface. The type as mapped includes patches of Decatur clay, silty clay loam, silt loam, and stony clay, too small to separate on the map.

The largest areas of the Decatur clay loam lie north of South Union, north and south of Auburn, and in the vicinity of Rus-

sellville. Other areas are scattered throughout the limestone region in the southern part of the county.

The surface of this type varies from undulating to rolling. Sink holes are numerous in places and the drainage is largely through subterranean channels. As a whole, the areas are well to excessively drained.

The Decatur clay loam is a residual soil derived from St. Louis limestone. This type is one of the heaviest soils of the county and is very sticky and plastic when wet. It is more difficult to handle than the Decatur silt loam. If plowed when wet it is sticky and forms clods on drying, and when very dry it is hard and tough. Owing to the relatively low organic matter content this soil is among the first of the limestone soils to show effects of drought.

The forest growth consists mainly of white oak, red oak, hickory, and some cedar. The Decatur clay loam is used for the same crops as the Decatur silt loam, with which it is very closely associated. The clay loam appears best suited to early maturing and drought-resistant crops, such as wheat, oats, tobacco, or sorghum. These crops do well when the soil is plowed to a good depth, and lime is applied and organic matter incorporated. The yields of corn range from 15 to 30 bushels, oats 30 to 50 bushels, hay 1 to 1½ tons, wheat 10 to 15 bushels, and tobacco from 500 to 800 pounds per acre. Grasses and alfalfa do well, but only small patches of alfalfa are grown. The average farmer recognizes the importance of growing legumes and cover crops, but more attention should be given to crop rotation on this type. Land of this type sells for $75 to $150 an acre.

Decatur clay loam, stony and eroded phase.—This phase includes undifferentiated Decatur stony clay and clay loam, along with Christian silt loam and stony loam. Where mapped in the extreme northern development the phase includes also small areas of Shelbyville soils. The subsoil in these areas is more yellow than the Decatur subsoil, and farther north the phase gives way to the Shelbyville stony clay and Christian stony loam.

The phase occurs on rather abrupt slopes near streams and drainageways and on hills. In seeking their level numerous small streams have cut ravines and gullies through the standstone and shales, exposing the underlying limestone. The material of this soil is thus derived from both sandstone and limestone. In places it is entirely from limestone and represents a gradation from the typical clay loam toward the Decatur stony clay. Outcrops of shelving bluish or bluish-gray limestone are common, and stones and bowlders are strewn on the surface to a considerable extent. Sandstone fragments are found where the phase occupies a position on slopes below the Hanceville stony loam.

The phase occurs north of an east-and-west line drawn through Russellville.

The stony and eroded and phase is adapted to the same general crops as the typical Decatur clay loam, where topography and absence of stony material permit. The proportion of cultivable soil, however, is small. The yields are on an average somewhat lower than on the typical soil. A large part of the phase has been cleared of timber, and that not cultivated is used for pasture. Pastures consist largely of fields which were cultivated until they became so badly eroded that cultivation was both difficult and unprofitable.

Cover crops and a reduction in the number of cultivated crops are recommended for the control of erosion. Contour cultivation should be practiced where possible. Land values are much lower than for the typical soil. The land is usually sold with adjoining types.

CLARKSVILLE SILT LOAM.

The Clarksville silt loam consists of a grayish-brown or brownish-gray to yellowish-brown silt loam of a floury and friable structure, which grades at 3 to 5 inches into yellow or pale-yellow silt loam. This quickly passes into yellow silty clay loam or silty clay mottled slightly in the lower subsoil with gray. In low, less well drained situations the lower subsoil is a bluish-gray or mottled yellowish and bluish-gray plastic clay. In places the upper subsoil is reddish yellow. The mottled lower subsoil is rather more compact than the upper subsoil in places. The surface soil on drying out presents a decidedly grayish cast.

The surface is characteristically level to gently sloping or undulating, and the drainage is rather imperfect, though better than in the Guthrie silt loam. The type occupies a position intermediate between the Guthrie silt loam and the Decatur silt loam. In the vicinity of Corinth the surface soil consists of 10 to 12 inches of light-brown silt loam which dries out to a brownish gray. This soil grades into a subsoil which begins as yellow or yellowish-brown silty clay loam, and becomes a paler yellow color with depth, changing slowly to a yellow silty clay mottled with gray and carrying iron stains below 30 inches. In this locality it is surrounded at higher elevations by brown silt loam over reddish-brown silty clay loam or silty clay (Decatur material). Near Union Church the surface soil, in spots too small to map, contains more very fine sand to fine sand than usual. Such patches are really Clarksville very fine sandy loam. Southwest of Gordonsville, at Stevensons Chapel, and in many other smaller areas, the type occupies more rolling country. It is here well drained and occupies positions above Decatur material. The soil on these higher undulating areas is a brownish-

gray, mellow silt loam, grading at 6 to 10 inches into a somewhat compact yellow silt loam or silty clay loam, which passes at 18 to 20 inches into a motted yellow and gray, compact silty clay loam or silty clay. This soil is underlain by the material from which the Decatur soils are derived, and the subsoil passes at a depth greater than 36 inches into mottled yellow, gray and reddish silty clay and this into reddish clay below. Such areas are more productive than the typical Clarksville silt loam, largely because of better drainage. Corn, tobacco, wheat, hay, and sorghum are grown, the yields being somewhat smaller than on the Decatur silt loam. The methods used, however, are the same on both types. A moderate yield of a high grade of dark tobacco is produced.

The Clarksville silt loam occurs chiefly in the southern part of the county. It is particularly well developed southeast of Gordonsville, east of Cave Spring, and northwest and south of Ferguson.

On the better drained areas the forest growth consists of red oak, post oak, white oak, hickory, poplar, and dogwood.

The typical Clarksville silt loam, which occupies flats not having the best surface drainage, produces fairly good yields of corn, wheat, oats, tobacco, and hay during seasons of normal rainfall. A part of the type is in pasture, in which lespedeza flourishes. Hay is usually timothy and redtop. Oaks are the principal trees.

The Clarksville silt loam is deficient in organic matter. Liming, the use of phosphatic fertilizers, and increasing the organic matter will increase the productiveness of this soil. This type sells for $50 to $100 an acre, depending upon location and improvements.

SHELBYVILLE STONY CLAY.

The Shelbyville stony clay consists of a brown, greenish-brown, dark-brown or yellow clay, which passes quickly into yellowish or greenish-yellow heavy plastic clay which is very sticky when moist. Outcrops and large and small loose fragments of limestone are plentiful throughout the type.

In places, notably on the lower slopes on the north side of Wolf Lick Creek north of Wolf Lick station, a colluvial development was mapped. The surface soil consists of a very dark brown to black clay, passing into dark-brown to black plastic clay, and this into yellow or grayish-yellow, sticky plastic clay. The surface soil in these places crumbles when dry.

Areas of Shelbyville stony clay occur on knolls, ridge tops, abrupt slopes, and about the heads of drainage ways in the northern part of the county. The type has a low agricultural value on account of its stoniness and is of limited extent. It is forested with cedar, hickory, and dogwood. Only small patches are cultivated, and these are usually in corn and wheat. It is best suited to pasture grasses.

Land of this type is valued mainly for its timber and pasturage. It is usually sold in connection with associated types.

On account of their small extent areas of Shelbyville clay have been included with the Shelbyville stony clay in mapping. The Shelbyville clay is a brownish clay grading into yellow to greenish-yellow clay, which is tough and impervious. The lower subsoil contains some black and brown ferruginous concretions. In places the clay has a reddish cast in the upper subsoil, but is a very plastic clay unlike the subsoil of the Decatur or Clarksville in structure. Limestone outcrops are not uncommon. Some patches of Shelbyville silt loam are included with the stony clay type. The silt loam has a slightly higher agricultural value and is more easily cultivated. The Shelbyville clay occurs only in small unimportant bodies occupying ridge crests, knolls, and slopes. The largest continuous areas occur along the base or lower slope of Iron Mountain. Small areas of this soil have been cleared, and when not in grass are used for growing corn and sorghum. This type is very susceptible to drought and it is not considered a good farming soil. Cedar is the dominant tree growth.

Land of this type seldom sells for more than $25 an acre, it being valued mainly for its pasturage and timber.

GUTHRIE SILT LOAM.

The Guthrie silt loam is a light-gray or pale-yellow floury silt loam, underlain at 6 to 8 inches by a whitish or pale-yellow, or mottled yellow and gray, heavy silt loam or silty clay loam, which grades into heavy silty clay loam or clay of a mottled bluish-gray and pale-yellow color. In places the lower subsoil is a straight bluish-gray clay. Iron concretions are of common occurrence in the subsoil.

This type occupies flat or depressed upland areas from which the drainage waters are removed but slowly, or flat areas about the heads of drainage ways. It occurs only in the southern part of the county, and is locally known as "swamp." The surface and internal drainage are very poor, and crops are frequently injured by too much rainfall. On the other hand, crops show the effects of drought early.

Corn, tobacco, and sorghum make rather low yields. Lespedeza and redtop do well. Considerable of the type is forested with oak, elm, sweet gum, black gum, maple, and ash.

The greatest need of the Guthrie silt loam is artificial drainage. It also probably needs, for best results, lime, phosphate fertilizers, and in addition deep and thorough tillage and the incorporation of organic matter. Land of this type is generally sold in conjunction with other types.

TILSIT SILT LOAM.

The Tilsit silt loam consists of a gray to grayish-yellow silt loam, grading at about 8 inches into a reddish-yellow to yellow silt loam, and underlain at about 12 inches by reddish-yellow to yellowish-red friable silty clay or fine sandy clay, which usually becomes yellowish below, passing at depths ranging from 20 to over 30 inches into a somewhat compact layer of fine sandy clay to rather stiff clay mottled yellowish and gray. There is usually enough sand in the mottled lower subsoil to make the material friable, although in places there is some tendency to compactness. In depressions and on some of the level areas the mottled yellow and gray layer comes nearer the surface, there being no red in the subsoil of some areas.

The surface soil of the low, flat, poorly drained areas consists of a light-gray or pale-yellow, floury silt loam, grading into a gray or yellow silt loam, underlain at about 20 inches by a mottled gray and yellow silty clay loam. These small areas are really Lickdale silt loam, but are too small to be shown on the soil map.

Black concretions or soft concretionary material are found in the mottled lower subsoil in places, while on some slopes disintegrated sandstone and arenaceous shale occur near the surface and outcrop in places. Fragments of this stony material frequently are scattered over the surface.

There are some small included areas of very fine sandy loam, which really differ but slightly in quality and crop value from the silt loam.

The soil material is derived from interbedded fine-grained sandstone and arenaceous shales of the Chester group overlying the St. Louis limestone. This formation occurs only in the northern half or hilly section of the county.

The Tilsit silt loam is the principal agricultural soil of the uplands in the northern part of Logan County. The largest and most typically developed areas occur north of Gordonsville, and to the north of Cavetts Store, and in the northeastern corner of the county.

The type occupies very gently rolling to undulating to flattish ridge tops and divides. In the vicinity of Gasper and south of Richelieu the surface is rolling to hilly. On the average it is deeper to the mottled layer on the crests of these hills and ridges, the depth ranging from about 26 to 32 inches. As a whole the surface features of the type are favorable for farming. The natural drainage is adequate except over the flatter situations, where the compact lower subsoil does not permit free internal drainage.

The forest growth consists of red oak, post oak, hickory, poplar, gum, and persimmon.

Corn, tobacco, and hay are the chief crops. Wheat is grown to a moderate extent, but unless well fertilized or grown on land planted

to tobacco the previous season the yield is rather low. Hay consists of timothy, redtop, and clover. Cowpeas and sorghum are forage crops of some importance. Sorghum is frequently converted into a cash crop by being made into sirup. Corn yields 20 to 30 bushels per acre, tobacco 800 pounds, wheat 10 to 15 bushels, oats 20 to 40 bushels, and hay 1 to 1½ tons. Tobacco is fertilized with about four loads of barnyard manure per acre, together with about 75 pounds of acid phosphate. For wheat 100 pounds of acid phosphate are used.

A rotation used by a number of farmers handling this type consists of sod land planted to corn, followed by wheat seeded to grass (timothy, redtop, or clover), which stands for two to three years.

Lespedeza and broom sedge do well and appear in all old fields and pastures.

Sweet potatoes, Irish potatoes, melons, truck crops, and small fruits do well where surface drainage is adequate. Strawberries are grown commercially on this soil, notably north of Auburn.

Peaches, pears, and plums do well when not injured by cold weather. A few apple orchards of considerable size are located on this type, and from a soil standpoint have proved successful. Lack of proper care and attention, however, has resulted in diseased trees and consequent decreased yields and inferior fruit. It is believed that successful orcharding on this type can be accomplished through systematic and thorough spraying, pruning, drainage, and cultivation. Stayman Winesap, Gano, and Ben Davis are considered more certain than Arkansas Black, Grimes Golden, and Jonathan for this climate.

The farm income on the Tilsit silt loam is derived largely from tobacco, and to a lesser extent from the sale of the other crops, such as grain, or their products in the form of mules, beef, pork, poultry, eggs, and sorghum sirup.

The farms in general average smaller, or at least have less land under cultivation, than those located on the Decatur and other limestone soils. Farms located mostly on the Tilsit silt loam include as a rule some broken land not well suited to cultivation, such as the Hanceville stony loam, which is used for pasturage. A small acreage of stream-bottom land is also frequently included and is used mainly for corn and hay.

The Tilsit silt loam needs organic matter, lime, and phosphatic fertilizers. Better drainage of the depressed areas should be provided by means of shallow ditches or tile. Land of this type ranges in value from $25 to $50 an acre.

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

Mechanical analyses of Tilsit silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391116	Soil	0.5	1.4	0.5	4.4	10.5	74.0	8.6
391117	Subsoil	.0	1.8	.4	2.4	7.7	64.9	22.8
391118	Lower subsoil	.0	.0	1.2	3.3	10.3	63.3	21.8

TILSIT SILTY CLAY LOAM.

The Tilsit silty clay loam consists of yellowish to reddish silty clay loam, grading at about 6 inches into reddish-yellow or yellowish-red silty clay, with gray mottlings at about 2 feet. The lower subsoil is rather stiff. Over much of the type more or less of the surface soil has been removed, resulting in the exposure of the yellow or reddish clay in patches. Small fragments of shale and sandstone, from which this soil is derived, are usually present in both soil and subsoil.

This type occurs around the heads of small streams and drainage ways, principally in the northwestern part of the county. The surface is sloping and drainage is thorough to excessive.

The Tilsit silty clay loam represents eroded slopes. It occupies a position between the Tilsit silt loam and the Hanceville stony loam and represents a transition between these two soils.

When cultivated, this type is used for the same crops as the Tilsit silt loam. It is a heavier soil, however, and slightly better yields are obtained under similar conditions and treatment. It is best suited to pasture on account of its tendency to wash when placed under cultivation.

This type is sold in conjunction with other upland soils.

Below are given the results of mechanical analyses of samples of the soil and subsoil of the Tilsit silty clay loam:

Mechanical analyses of Tilsit silty clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391144	Soil	0.0	1.4	0.5	2.0	5.9	69.7	20.5
391145	Subsoil	.0	.0	.9	1.5	7.3	48.9	41.5

HANCEVILLE STONY LOAM.

The Hanceville stony loam consists of a grayish-brown or light-brown, mellow loam to fine sandy loam, 8 to 10 inches deep, underlain by yellowish-red to red clay loam or fine sandy clay of friable structure. The surface is everywhere thickly strewn with fragments of fine-grained yellowish, brownish, and reddish sandstone. This material also occurs abundantly throughout the 3-foot section. The stones range in size from gravel and thin pieces of shale to stones several feet in diameter. In places the underlying sandstone rock outcrops as shelves and ledges, often with cliffs as high as 50 feet.

The Hanceville stony loam has quite an extensive development in the northern part of the county. It occurs on abrupt slopes to stream bottoms and drainage ways, usually as narrow bands either extending down to the bottom lands or separated from the bottoms by strips of Christian stony loam and silt loam or the stony and eroded phase of the Decatur clay loam. It is also closely associated with Rough stony land in places. The most extensive areas occur northwest of Spa.

The surface features are rough to broken. The type as a whole is freely to excessively drained, and some erosion occurs on cultivated areas. Much of this type is in forest consisting of oak, hickory, chesnut, poplar, beech, dogwood, maple, and walnut.

The more moderate slopes are used for corn, tobacco, and hay. Lespedeza and other grasses furnish pasturage on the more sparsely forested areas. Because of its susceptibility to erosion its stony character and rough topography, this land should be allowed to remain in forest.

Land of this type is not highly prized and is valued principally for the timber growth. Prices range from $10 to $25 an acre.

HANCEVILLE VERY FINE SANDY LOAM.

The Hanceville very fine sandy loam consists of a gray very fine sandy loam, passing at about 3 or 4 inches into yellowish very fine sandy loam, underlain at 8 to 12 inches by red or yellowish-red friable fine sandy clay loam or fine sandy clay. The sandstone from which this soil is derived outcrops in places, especially on the narrow ridges. In the northern part of county, extending north from Sand Spring Church toward Harreldsville, in Butler County, the type occupies the highest elevations in the county. The soil in this locality contains an abundance of small waterworn gravel and is really a gravelly fine sandy loam. The presence of the gravel is due to the disintegrated capping of conglomerate sandstone. Quartzite pebbles are present in both soil and subsoil in varying amounts, and in places

the soil consists of almost pure gravel to a depth of 3 feet or more. This gravelly material is used to some extent for surfacing roads.

This gravelly variation of the Hanceville very fine sandy loam is shown on the soil map by means of the gravel symbol. On account of its physiographic position and open structure, it is excessively drained and has a very low agricultural value. Most all of this gravelly land is in forest consisting of oak, hickory, and dogwood.

The Hanceville very fine sandy loam is not extensive, being limited to a few small areas scattered over the central and northern parts of the county. The largest areas are found northwest of Auburn. They occupy ridge crests, hills, and narrow divides. The topography is undulating to gently rolling and hilly. Drainage is good to excessive.

This type is the lightest textured soil in Logan County. It warms up early in the spring, is easily cultivated, and admirably suited for the growing of melons, sweet potatoes, vegetables of all kinds, and small fruits. At present corn and tobacco are the main crops grown, and these produce well where heavily fertilized. Better results are obtained during seasons of moderate to heavy rainfall. Organic manures are of much benefit. The type is usually sold along with surrounding soils.

HANCEVILLE SILT LOAM.

The Hanceville silt loam consists of a grayish or grayish-brown silt loam 5 or 6 inches deep, overlying yellowish to reddish silt loam or silty clay loam, which passes at about 8 or 10 inches into reddish-yellow to yellowish-red, friable silty clay. The lower subsoil frequently contains considerable very fine sand, and in places the underlying sandstone is encountered within the 3-foot section. Some patches have a yellowish and grayish mottled lower subsoil. The surface soil is compact when dry, especially in uncultivated cleared areas where little organic matter has been added to the soil. The type is naturally deficient in organic matter.

The Hanceville silt loam is a residual soil derived from interbedded sandstone and arenaceous shales of the Chester group overlying the St. Louis limestone.

The type is found only in the hill section in the northern part of the county. The largest and most typical areas occur in and around Gasper, Homer, Anderson, and to the east of Pauline and Sycamore School.

The Hanceville silt loam mainly occupies slopes, knolls, and ridges on the higher elevations, and most all of it is naturally well drained. Sink holes and depressions are prominent topographic features.

In agricultural value this type is similar to the Tilsit silt loam, except that crop yields are slightly higher during seasons of scanty

rainfall. The soil is handled in much the same manner as the Tilsit silt loam. Corn yields on an average 20 bushels, tobacco 600 to 800 pounds, wheat 10 to 15 bushels, and hay 1 ton per acre.

Much of this type is located at a considerable distance from shipping points. Farms sell for $20 to $35 an acre.

CHRISTIAN STONY LOAM.

The Christian stony loam consists of a grayish-brown or brown to yellowish-brown silt loam or silty clay loam, underlain at about 5 to 10 inches by a reddish-yellow or yellowish-red to red brittle silty clay or heavy clay. Areas having red subsoil similar to that of the Decatur soils are of limited extent. The type as mapped includes considerable Shelbyville material, the silt loam, silty clay loam, and stony clay being represented, but these occur in areas too small to be shown separately on the soil map. Areas of Christian silt loam occupying steep slopes within the stony loam type have been included with the Christian stony loam. Outcrops of limestone and sandstone are common. Fragments of these rocks are abundant on the surface and are frequently distributed throughout both the soil and subsoil.

The Christian stony loam occurs in strips in the northern part of the county, mainly near the Logan-Butler County line. The principal areas lie along the slopes of Mud River and Wolf Lick Creek. The type chiefly occupies lower slopes above which occurs the Hanceville stony loam.

In places the land is dissected by numerous small streams and drainage ways, giving it a broken and rough surface. Natural surface drainage as a whole is excessive.

Owing to its topographic position and stony character, practically none of this type is cultivated.

The forest growth consists principally of white oak, red oak, hickory, cedar, and dogwood. The type affords some pasturage where thinly wooded.

The Christian stony loam has been derived from interbedded sandstone and limestone, the latter apparently having been the more influential.

Fruits, including apples, peaches, and berries, should do well.

This type can be bought for $10 to $25 an acre, the value depending largely on the forest growth.

CHRISTIAN VERY FINE SANDY LOAM.

The Christian very fine sandy loam consists of grayish-brown very fine sandy loam passing into pale-yellow very fine sandy loam, and underlain at 8 to 10 inches by reddish to reddish-yellow, heavy very

fine sandy loam or sandy clay loam, which in turn is underlain at 12 to 15 inches by yellowish-red to red friable clay much like the subsoil of the Decatur soils. In places the lower subsoil is a red sandy clay loam.

Areas of this soil are scattered over the central part of the county, but there are no extensive developments and its total extent is not large. It is typically developed in the largest areas which occur southeast of Russellville, west of Rogers School, and at Sandbanks School.

The surface is gently rolling to rolling and the surface drainage is very good. Numerous sink holes occur throughout the greater part of the type. This is especially true of the Rogers School area.

The Christian very fine sandy loam is closely associated with soils of strictly sandstone or limestone derivation, and owes its origin to the combined weathered products of these rocks. Fragments of sandstone and limestone are usually present on the surface, but these are not numerous. The subsoil as a rule is derived chiefly from limestone.

The common tree growth consists of oak, hickory, dogwood, and cedar.

Corn, tobacco, oats, sorghum, and cowpeas give good yields. Tobacco is of exceptionally good quality. The use of legumes in rotation with the staple crops will tend to supply deficiency in organic matter. Sweet potatoes, other vegetables, and strawberries produce well. Considerable of this soil is used for pasture land. Land of this type is generally sold in conjunction with adjoining soils.

CHRISTIAN SILT LOAM.

The Christian silt loam consists of a grayish-brown or yellowish-brown silt loam underlain at about 8 to 10 inches by reddish-yellow to red or yellowish-brown friable silty clay loam, which quickly passes into yellowish-red to red clay. The lower subsoil in places resembles that of the Decatur soils.

There is considerable variation in the color and texture of this type, especially in those areas lying in the extreme northern part of the county. In this section there are also some included spots of Shelbyville stony loam, silt loam, and clay, and Christian stony loam, too small to be shown satisfactorily on the soil map. Limestone outcrops and fragments of sandstone and limestone are of frequent occurrence in practically all the areas of this type, but these interfere with cultivation only in limited areas. On the slopes bedrock is frequently exposed at depths of less than 3 feet.

The Christian silt loam is derived partly from limestone and partly from sandstone and shales.

The type occurs throughout the central and northern parts of the county and is associated with both limestone and sandstone soils. It occupies slopes, ridges, and nearly level crests of divides. The surface features vary from gently undulating to rolling and hilly. The most rolling areas occur mainly in the northern part of the county as narrow strips or bands on the steeper slopes. Drainage is good to excessive.

The forest growth consists chiefly of white oak, red oak, beech, hickory, dogwood, and cedar. The type has been largely cleared and is either under cultivation or in abandoned fields or pasture. It is adapted to the production of corn, wheat, grasses, and a dark grade of tobacco. Corn yields from 15 to 30 bushels per acre, wheat from 12 to 25 bushels, oats from 20 to 30 bushels, tobacco from 700 to 1,000 pounds, and hay from 1 to 2 tons.

No systematic crop rotation is extensively practiced, although many farmers realize the advantages of rotation. A common practice is to follow tobacco by winter wheat, which is seeded to clover in the spring and followed by corn.

Thorough plowing and the application of ground limestone and organic matter will increase crop yields.

The more desirable areas near shipping points sell for $50 to $90 an acre, while the more broken and eroded areas bring $20 to $30 an acre.

ELK SILT LOAM.

The Elk silt loam is a brown, mellow silt loam, underlain usually at 8 to 12 inches by a lighter brown or yellowish-brown silty clay loam, and generally grading into a yellowish-brown silty clay. Where the type occurs only a few feet above the first bottoms, the soil does not differ materially from the Huntington silt loam. Along the outer margin toward the uplands the surface soil is frequently a brown silt loam, colluvial in origin, and closely resembles the Decatur silt loam.

The Elk silt loam occurs on the second bottoms of streams occupying a position above normal overflow. Practically all of the type is found along the North and South Forks of Red River.

The surface is nearly level to undulating, and the drainage is good. This type is all under cultivation and is used for corn, tobacco, wheat, hay, and pasture. The yields are more certain and nearly as large as those obtained on the Huntington silt loam. Land of this type is usually sold in conjunction with the adjoining soils. When sold separately it usually commands the same prices as the Decatur silt loam.

HUNTINGTON SILT LOAM.

The Huntington silt loam is a brown to dark-brown mellow silt loam, grading at an average depth of about 12 inches into a slightly

lighter brown silt loam, which becomes lighter in color and more compact with increasing depth. At about 24 inches, a yellowish-brown silty clay loam is frequently reached, which in places grades at about 30 to 36 inches into mottled brownish, yellowish, and grayish silty clay. Small brownish-black concretions are common below a depth of 24 inches.

This is a first-bottom soil which is found along many of the streams throughout the county. The best developments occur along the Mud, Red, and Gasper Rivers and their tributaries, and Black Lick and Wiggington Creeks. The type consists of alluvium washed from limestone soils or from limestone and sandstone and shale soils. Although subject to overflows, this soil is usually well drained between overflows, and crop yields are very good. A large proportion of the type is used for corn each year. Corn is frequently grown on the same field for a number of years in succession, owing to repeated alluvial depositions which keep up the fertility. The yields range from 30 to 60 bushels per acre, with an average of about 40 bushels. Hay is the crop next in importance. The yields range from 1 to 1½ tons per acre of timothy, clover, and redtop.

The parts of the type less liable to overflow are sometimes used for wheat, tobacco, peas, soy beans, and alfalfa. The yields of all these crops are very good. When the land is used for pasturage the grazing is good all through the growing season.

The forested areas support a growth of sycamore, sweet gum, ash, locust, and hackberry. When this type is sold it is usually included with other types.

HUNTINGTON SILTY CLAY LOAM.

The Huntington silty clay loam is a brown or mottled brown and drab, heavy silt loam to silty clay loam 6 to 10 inches deep, underlain by mottled gray or bluish-gray and rusty-brown silty clay loam, which grades at about 24 inches into mottled bluish-gray and yellow or yellowish-brown, somewhat plastic silty clay. In places gray is predominant in the subsoil. It is composed of material washed from upland soils derived from limestone, sandstone, and shale.

This type occurs along Mud River, and Wolf Lick, Clifty, Rawhide, and Alum Lick Creeks in the northern part of the county. One other area of limited extent is found along Pleasant Run Creek, northwest of Schochoh. The topography varies from flat to hummocky. The type is subject to overflow, and crops are damaged about one year out of three. This fall (1919) serious damage resulted to corn from heavy rains in October and November.

The Huntington silty clay loam is recognized as a strong corn and grass soil. Corn averages from 40 to 60 bushels per acre, and in favorable seasons as much as 100 bushels per acre is not an un-

common yield. Hay, consisting principally of timothy, redtop, and sapling clover, yields from 2 to 3 tons per acre.

The prevailing timber is oak, beech, birch, hickory, sweet gum, black gum, elm, sycamore, ironwood, and maple.

This type is a heavier soil and less well drained than the silt loam. It is also more difficult to cultivate and clods badly when plowed either too wet or too dry. Early planting of corn is frequently delayed on account of poor drainage.

Ditches and dikes should be installed to provide better drainage and protection from overflow. This type sells for $40 to $60 an acre.

POPE SILT LOAM.

The Pope silt loam consists of a light-brown, mellow silt loam, underlain at about 12 to 16 inches by a yellowish-brown to slightly reddish silt loam. The lower subsoil contains considerable very fine sand in places. Often the subsoil is a very fine sandy loam or fine sandy loam. Lenses of brown clay loam a few inches thick occasionally are found in the subsoil. There are included areas of Pope very fine sandy loam and fine sandy loam.

This soil is typically developed in the first bottoms of streams and is subject to frequent overflow. Unlike the Huntington silt loam, it has been washed from upland soils derived from sandstone and shale, rather than limestone, or limestone, sandstone and shale. It occurs only in the northern part of the county.

The type is of small extent, the largest and most representative bodies occurring along Duncan, Rocky Clifty, and Rock House Creeks, and Gasper River after its union with Rock House Creek.

The Pope silt loam is used principally in the production of corn and hay. Corn yields from 40 to 60 bushels and hay from 1½ to 2 tons per acre.

The forest growth consists of beech, oak, elm, sycamore, and maple. This type is sold in connection with adjoining soils.

DUNNING SILT LOAM.

The Dunning silt loam is a dark-brown to black silt loam underlain at 6 to 12 inches by either yellowish clay mottled bluish gray and yellowish brown below and plastic in structure, or bluish-gray plastic clay containing some yellowish-brown and black concretions in places.

This type is not extensively developed and occurs in rather widely separated areas in the first bottoms of streams. The most important as well as the most typically developed areas occur east of Corinth, northeast of Auburn along Black Lick Creek, and east of Stevensons Chapel. A few other areas of limited extent constitute all of the type mapped in Logan County.

The surface is nearly flat, and both surface and infernal drainage are slow. This soil is used for corn, wheat, hay, and pasture. Timothy, lespedeza, and redtop do well. Alfalfa has been successfully grown on some of the better drained portions. Broom sedge grows abundantly in pastures. Corn yields an average of 40 to 60 bushels, and wheat 20 to 25 bushels per acre in favorable seasons. Wheat frequently lodges on account of heavy growth of straw.

When plowed too wet or too dry the Dunning silt loam clods badly. Its productiveness can be increased by improving the drainage, and by applying ground limestone and phosphate fertilizers.

The selling price of this type is the same as that of the closely associated Decatur silt loam and clay loam.

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

Mechanical analyses of Dunning silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
391140	Soil	0.0	1.0	0.9	21.5	7.8	52.6	16.2
391141	Subsoil	.0	1.3	1.1	21.5	8.5	49.5	18.1

ABERNATHY SILTY CLAY LOAM.

The Abernathy silty clay loam consists of reddish-brown to brown silty clay loam underlain at an average depth of about 10 inches by reddish-brown or yellow, rather stiff clay frequently mottled with brown, gray, drab or yellow at about 30 inches. The lower subsoil carries a noticeable amount of small black iron concretions, soft and crumbly.

The type is not extensive and for this reason is not agriculturally important. It occurs in small bodies and patches throughout the southern part of the county. It occupies flats, sink-hole depressions, and solution basins within the Decatur soils. The soil material consists of material washed from the surrounding soils. Water stands for some time after rains on these areas, whose drainage is effected by underground channels. In many places this natural method of disposing of the runoff from the surrounding higher land is not sufficient and artificial drainage is necessary for the successful production of crops.

This type is used mainly for corn, sorghum, hay, and pasture. Yields are good, except in excessively wet seasons. This soil is usually sold in connection with surrounding types.

ROUGH STONY LAND.

Rough stony land comprises areas too rough and stony to be classed with any of the recognized soil types. It occupies isolated hills and knolls and steep slopes with limestone outcropping along the lower slopes and sandstone above. In places it consists almost entirely of rock outcrop. Rough stony land occurs throughout the central part of the county, being most extensively developed immediately north, northeast, and east of Russellville. The forest growth consists principally of oak, hickory, cedar, chestnut, and dogwood. It affords some pasturage.

CHEMICAL ANALYSES OF SOILS AND THE MAINTENANCE OF FERTILITY.[2]

INTRODUCTION.

The following discussion deals largely with the chemical analyses of the soils and subsoils representing the different types mapped in the county; certain other matters should be briefly discussed, however, if the report is to meet the needs of the agricultural public.

The St. Louis and Chester areas, embracing more than a fifth of the agricultural land in the State (8,000 square miles), are typically represented in Logan County, and practically every type of soil to be found in those areas has been mapped in this county; consequently this report is of more than local interest.

The incorporation of fertilizers, limestone, and organic matter with the soil is limited by the depth of plowing, which is ordinarily about 7 inches, and the feeding roots of most crops function mainly within this depth.

To facilitate calculation and for purposes of discussion, it is assumed that the dry soil on an acre, to the depth of 7 inches, weighs 2,000,000 pounds, and that the subsoil from 7 to 20 inches over the same area weighs 4,000,000 pounds. These assumptions are very close approximations to the true weight of the soil and serve all practical purposes in this discussion. It follows that to convert parts per million to pounds per acre, multiply by 2 for the first 7 inches, or surface soil, and by 4 for the next foot, or subsoil. It must be remembered that the analyses reported herein are of the sifted soil, exclusive of whatever material has been removed by the 2-mm. sieve (about $\frac{1}{12}$ inch). If the amount removed was large, it should be considered in computing the pounds per acre of the substances determined. For example, 26.6 per cent, consisting of cherty fragments, was removed from the sample of top soil representing the Decatur gravelly clay loam; therefore only 73.4 per cent of the sample is to be

[2] This chapter prepared by S. D. Averitt and A. M. Peter, of the Kentucky Agricultural Experiment Station.

reckoned as soil, the rest being inactive material. Accordingly, the number of pounds of phosphorus per acre, computed from the analysis, would be $595 \times 0.734 \times 2$, or 873 pounds.

The following table shows the plant food contained in the main crops grown in the State, calculated for yields which may be considered profitable:

Average amounts of nitrogen, phosphorus, and potassium contained in various crops.

Crop.	Nitrogen.	Phosphorus.	Potassium.
	Pounds.	*Pounds.*	*Pounds.*
Corn, 50 bushels per acre, contains	50	9	10
Stalks of same, 1½ tons	25	3	26
Total	75	12	36
Wheat, 25 bushels per acre, contains	36	6	6
Straw of same, 1¼ tons	12	2	23
Total	48	8	29
Oats, 40 bushels per acre, contains	28	5	6.5
Straw of same, 1 ton	13	3	21
Total	1	8	27.5
Tobacco, 1,000 pounds of leaf, contains	40	2.2	50
Stalks from same, 300 pounds	10	.8	10
Total	50	3	60
Red clover hay, 1 ton per acre, contains	40	5	30

Nitrogen, phosphorus, and potassium are the three elements commonly supplied in commercial fertilizers. All are necessary to plant growth, and a deficiency of any one of them may limit crop production to such an extent as to make farming unprofitable.

In the analyses of soils in this report the figures for nitrogen represent the total amount present. What proportion of the total is available to growing plants is not known. It is safe to assert that in the long-cultivated soils of the State nitrogen is one of the limiting factors in the production of profitable crops. In many cases it is doubtless the first limiting factor. The supply of organic matter in the plowed soil is determined by crop rotation, cultivation, disposition of crop residues and manure, green manure crops, and other factors more or less under the farmer's control, and since plants get their nitrogen mainly from the organic matter in the soil, this element will be further considered under the head of "Maintaining fertility."

METHODS OF SAMPLING AND OF ANALYSIS.

The sampling was done uniformly as follows: On a representative area of the type or phase, selected after mapping, composite samples of surface soil, 0 to 6 inches, and of subsoil, 7 to 18 inches, were taken by means of a soil auger such as is used by the Bureau of Soils. In the case of the surface soil, the sample usually consisted of the earth from 12 borings. The subsoil was taken from about half of the holes made for the surface soil. After these samples had been air-dried they were rubbed up in a wedgewood mortar, being careful not to crush the gravel, and sifted in a 2-mm. sieve. If gravel or stones were obtained, the amount was determined as percentage of the air-dry sample. The earth which passed the sieve, after thorough mixing, constituted the sample for analysis. A part was ground finer for determination of total K, P, and N, but the portion used for digestion in N/5 HNO_3 was not ground. Portions were weighed out equivalent to the desired amount of moisture-free soil, so the findings are expressed on the moisture-free basis.

The methods of analysis used are as follows: Total N, plain Kjeldahl, 5 hours' digestion; total P, magnesium-nitrate method (Journal of A. O. A. C., vol. 1, No. 4, p. 25); total K, the modified J. L. Smith method, as adopted by the A. O. A. C. in 1909 (see Bureau of Chemistry Bulletin No. 132 and Bulletin No. 122, p. 116, for method); N/5 HNO_3 digestion for easily soluble K, P, and Ca. A weight equivalent to 150 grams of water-free soil was digested in 1,500 c. c. of N/5 NO_3 for five hours at room temperature and filtered through a dry paper filter; 1,000 c. c. of the clear filtrate was evaporated to dryness and treated twice with HCl to get rid of HNO_3, taken up with HCl and water, and the silica filtered out and washed and the filtrate made to 100 c. c.. Aliquots of 10, 50, and 32.2 c. c. were taken for Ca, P, and K, respectively; CaO to neutralize. The method is essentially that given in the Journal of the A. O. A. C. (vol. 1, No. 4, p. 25). One cubic centimeter St. KOH=0.004 gram $CaCO_3$ or 0.01 per cent, instead of 0.001 per cent, as stated in the text.

In tabulating the analyses, a reference number has been assigned to each, the odd numbers representing top soils and the even numbers subsoils. The next even number consecutive with any odd number represents the coresponding subsoil, and its absence shows that the corresponding subsoil was not sampled. The locations of the samples are given at the end of this chapter.

CHEMICAL ANALYSES.

Decatur silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
1	1,320	530	8	12,900	214	980	25
3	1,120	425	6	12,300	92	1,390	20
5	1,080	400	9	13,400	86	820	35
7	1,380	520	9	14,600	166	1,060	30
9	1,220	425	6	15,900	172	1,050	25
11	1,380	585	10	13,100	138	1,070	5
13	820	520	9	14,600	136	660	60
15	1,260	655	8	14,900	163	950	20
17	1,440	460	8	13,500	176	1,400	10
Average	1,220	500	8	13,900	149	1,040	26
Maximum	1,440	655	10	15,900	214	1,400	60
Minimum	820	400	6	12,300	86	660	5
6 to 18 inches:							
2	680	285	4	12,400	114	1,190	40
4	1,040	285	8	12,600	86	1,580	15
6	560	275	6	14,300	92	1,000	30
8	740	510	6	15,400	175	1,180	30
10	840	420	5	16,200	151	990	30
12	800	525	6	14,000	134	730	160
14	660	440	5	14,900	112	1,010	20
18	680	320	8	13,400	158	770	300
Average	750	382	6	14,200	128	1,060	78
Maximum	1,040	525	8	16,200	175	1,580	300
Minimum	560	275	4	12,400	86	730	15

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 1, 0.3; Nos. 2, 3, 4, and 5, 0.1 each; No. 13, 0.8; No. 14, 0.2.

Silicate analyses.

[Per cent of the moisture-free fine earth.]

	Top soil, 0 to 6 inches.		Subsoil, 6 to 18 inches.	
	No. 1.	No. 5.	No. 2.	No. 6.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Ignition	4.67	3.88	4.71	3.46
Silica, SiO_2	83.76	84.74	76.36	81.77
Alumina, Al_2O_3	5.29	7.55	10.92	9.92
Ferric oxid, Fe_2O_3	2.36	1.29	3.26	2.43
Titanium dioxid, TiO_2	1.25	1.13	1.60	1.36
Phosphorus pentoxid, P_2O_5	.12	.09	.07	.02
Calcium oxid, CaO	.88	.59	.72	.53
Magnesium oxid, MgO	.59	.50	.59	.53
Potassium oxid, K_2O	1.59	1.62	1.52	1.74
Total	100.51	101.39	99.75	101.76
Moisture in the air-dry sample	1.60	.78	2.22	1.26

The Decatur silt loam, as mapped and described in this report, is the most important type in the county. It is bedded, for the most part, on the St. Louis limestone. Some of it, in the northern part of the county, however, is derived from the limestones of the Chester.

The analyses show an average of 1,000 pounds of total phosphorus to the acre in the surface soil, with a range of 800 to 1,310 pounds. The average for easily soluble phosphorus is only 16 pounds, with a range of 12 to 20 pounds. The analyses show a marked deficiency in phosphorus in these soils, indicating that they will respond to the application of phosphatic fertilizers. This conclusion is confirmed by the crop yields obtained on the Russellville experiment field of the Kentucky Agricultural Experiment Station,[3] the soil of which is of this type. In a crop rotation of corn, soy beans, wheat, and clover, the value of the crops for four years was increased $21.47 and $24.86 by the use of acid phosphate and rock phosphate, respectively, with manure, as compared with manure alone. Where limestone also was applied, the gain ascribable to acid phosphate was $21.96, and to rock phosphate $13.11.

The analyses show an abundance of total potassium in the soils of this type and the quantity of easily soluble potassium is large, the average being 298 pounds to the acre in the surface soil, with a range of from 172 to 428 pounds. In the subsoil the average is 512 pounds, ranging from 344 to 700 pounds. As indicated in all the soils of the county, nitrogen and phosphorus are the limiting elements in the production of profitable crops and in the long-cultivated soils calcium is becoming deficient, so that the use of ground limestone is becoming more and more necessary to grow clover and other legumes. Successful growing of legumes is one of the fundamental factors in permanent fertility and it is fortunate that practically inexhaustible supplies of excellent limestone exist at many places in the county. In any management of the soils of this type which is conducive to permanent fertility the well-drained soils will always contain a good supply of easily soluble potassium. The liberation of potassium from the ample store in the soil is the problem here.

Acidity in the surface soil of this type is not great; the subsoil, however, shows more acidity, and the use of ground limestone for growing legumes in the rotation can not be too strongly recommended.

[3] Bulletin 228, Ky. Agr. Expt. Sta., p. 112, Lexington, July 1, 1920.

Tilsit silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
19	920	320	6	10,400	186	1,050	5
21	800	395	6	9,100	54	380	300
23	820	575	13	12,300	126	500	180
25	1,120	445	15	12,100	106	620	420
27	1,180	515	14	8,800	164	1,040	10
29	800	365	5	11,100	78	420	90
Average	940	436	10	10,600	119	670	168
Maximum	1,180	575	15	12,300	186	1,050	420
Minimum	800	320	5	8,800	54	380	5
6 to 18 inches:							
20	420	305	6	15,300	123	450	520
22	440	290	5	9,700	56	300	1,660
24	440	375	6	11,500	90	350	1,620
26	540	645	6	13,500	57	330	1,280
30	640	260	4	12,100	70	380	670
Average	500	355	5	12,400	79	360	1,150
Maximum	640	645	6	15,300	123	450	1,660
Minimum	420	260	4	9,700	56	300	520

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 21, 1.1; No. 22, 0.4; No. 23, 1.2; No. 24, 0.7; No. 25, 4.2; No. 26, 4.0.

Silicate analyses.

[Per cent of the moisture free fine earth.]

	No. 23, topsoil, 0 to 6 inches.	No. 24, subsoil, 6 to 18 inches.		No. 23, topsoil, 0 to 6 inches.	No. 24, subsoil, 6 to 18 inches.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Ignition	3.54	3.64	Calcium oxid, CaO	0.36	0.34
Silica, SiO_2	83.98	80.89	Magnesium oxid, MgO	.52	.63
Alumina, Al_2O_3	6.56	10.16	Potassium oxid, K_2O	1.50	1.41
Ferric oxid, Fe_2O_3	2.02	3.02			
Titanium dioxid, TiO_2	1.07	1.02	Total	99.68	101.20
Phosphorus pentoxid, P_2O_5	.13	.09	Moisture in the air-dry sample	1.03	2.09

The Tilsit silt loam stands next to the Decatur silt loam both in extent and in agricultural importance. It is derived from the shales and limestones of the Chester and is a thinner soil than the Decatur silt loam and less productive.

The analyses show that the supply of total phosphorus is not quite as large as in the Decatur, averaging 872 pounds in the surface soil, with a range of from 640 to 1,150 pounds; the easily soluble phosphorus, however, is somewhat larger, averaging 20 pounds in the surface soil, with a range of 10 to 30 pounds.

The supply of nitrogen is much less than in the Decatur silt loam. The calcium content is low and there is a considerable tendency to acidity in the surface soil, with stronger acidity in the subsoil. The supply of total and easily soluble potassium is distinctly less than in the Decatur silt loam but is sufficient for crop needs. This soil is deficient in organic matter and, partly for this reason, is more compact than the Decatur silt loam.

The fertility of these soils may be greatly increased by growing clover and other legumes with the aid of limestone and phosphatic fertilizers. The great abundance of the former near them is fortunate.

Decatur clay loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
31	680	325	4	8,900	76	800	110
33	760	310	10	14,400	124	1,260	10
35	740	260	8	9,800	115	750	240
37	1,100	345	7	14,000	95	1,270	5
Average	820	310	7	11,800	102	1,020	70
Maximum	1,100	345	10	14,400	124	1,270	240
Minimum	680	260	4	8,900	76	750	5
6 to 18 inches:							
32	480	215	4	8,600	73	1,150	165
34	640	255	7	12,800	103	1,090	160
36	520	235	4	9,500	85	480	1,000
38	680	260	7	15,200	89	1,400	85
Average	580	241	5	11,500	88	1,030	350
Maximum	680	260	7	15,200	103	1,400	1,000
Minimum	480	215	4	8,600	73	480	85

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 33 and No. 35, 0.1 each.

Silicate analyses.

[Per cent of the moisture-free fine earth.]

	No. 33, topsoil, 0 to 6 inches.	No. 34, subsoil, 6 to 18 inches.		No. 33, topsoil, 0 to 6 inches.	No. 34, subsoil, 6 to 18 inches.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Ignition	3.91	4.32	Calcium oxid, CaO	0.39	0.38
Silica, SiO_2	78.32	76.04	Magnesium oxid, MgO	.63	.71
Alumina, Al_2O_3	9.84	12.16	Potassium oxid, K_2O	1.75	1.57
Ferric oxid, Fe_2O_3	3.57	3.83			
Titanium dioxid, TiO_2	1.27	1.06	Total	99.75	100.18
Phosphorus pentoxid, P_2O_5	.07	.06	Moisture in the air-dry sample	1.40	1.84

The Decatur clay loam is intimately associated with the Decatur silt loam. It is of the same origin and represents those areas of Decatur silt loam on which erosion has removed a large part of the surface soil.

The analyses show that the soil of this type is low in nitrogen, total and easily soluble phosphorus, and calcium, with more tendency to acidity than in the Decatur silt loam. The supply of total and easily soluble potassium, though less than in the latter, is ample, and with the increase of organic matter in the manner recommended for the other types need cause no concern.

Dunning silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
39	1,880	490	6	8,500	72	3,480	5
41	2,020	625	22	11,800	118	2,940	5
Average	1,950	559	14	10,150	95	3,210	5
6 to 18 inches:							
40	1,160	320	5	8,000	65	3,370	15
42	1,780	500	10	11,300	64	3,620	5
Average	1,470	410	8	9,650	65	3,500	10

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 39, 0.5; No. 40, 0.1; No. 41, 5.5.

Huntington silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
43	1,300	505	6	13,000	78	1,490	20
45	1,500	695	25	12,500	83	2,020	10
Average	1,400	600	15	12,750	81	1,760	15
6 to 18 inches:							
44	800	435	5	12,600	57	1,920	10
46	980	515	8	12,300	51	1,650	.....
Average	890	475	7	12,450	54	1,790	.....

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 44, 0.1.

These are bottom soils, the Huntington silt loam being subject to overflow. They consist largely of material transported from the surrounding upland Decatur soils. The analyses show that they contain approximately twice as much nitrogen and easily soluble phosphorus and three times as much easily soluble calcium as the Decatur soils. The supply of total phosphorus is about the same as in the Decatur silt loam, and that of total and easily soluble potassium somewhat less.

Maintaining fertility in these soils is relatively simple. It may be stated, however, that the use of phosphoric acid would doubtless result in an increased production in grain crops. Both types are of limited extent in the county. The Dunning silt loam is found only along the sluggish streams.

Clarksville silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
47	1,100	410	7	8,600	55	1,120	20
49	1,020	330	7	11,800	86	480	120
Average	1,060	370	7	10,200	71	800	70
6 to 18 inches:							
48	490	275	6	7,200	46	840	210
50	660	345	6	12,300	57	480	360
Average	570	310	6	9,750	52	660	290

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 47, 0.7; No. 48, 0.9; No. 50, 0.8.

Guthrie silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
51	580	300	6	6,600	35	660	40
53	1,080	280	6	6,600	74	690	30
Average	830	290	6	6,600	55	680	35
6 to 18 inches:							
52	380	200	3	7,100	36	460	1,500
54	660	195	6	8,000	39	650	980
Average	520	197	4	7,550	37	550	1,240

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 51, 0.2; No. 52, 0.5; No. 53, 1.2; No. 54, 0.7.

These types, like the two just discussed, are so limited in extent that they will be considered together. Both are surrounded by Decatur silt loam, the Clarksville silt loam occupying knolls and elevated positions and the Guthrie silt loam occupying somewhat depressed, badly drained areas.

The analyses show that the Guthrie silt loam is distinctly poorer than the Clarksville silt loam, as measured by content of nitrogen, phosphorus, potassium, and calcium. The total and easily soluble potassium are only about half that shown in the Decatur silt loam; however, with the increase of organic-matter content and proper cultivation and rotation, potassium probably will not limit the production of crops. Clover grown with the aid of limestone and phosphorus will greatly increase the fertility of these soils, especially of the Clarksville silt loam. Acidity is greater in the surface soil of the Clarksville than in that of the Guthrie; the subsoil of the latter, however, shows considerable acidity, which is to be expected from the position of this type in depressed areas.

Hanceville silt loam.

[Parts per million of the moisture-free fine earth.]

Depth and reference number.	Total nitrogen (N).	Total phosphorus (P).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
0 to 6 inches:							
55	780	510	7	12,700	60	760	5
57	1,000	220	11	8,300	75	960	.....
59	640	225	6	11,700	99	540	50
61	620	195	6	9,300	61	400	55
Average	760	287	7	10,500	74	670	36
Maximum	1,000	510	11	12,700	99	960	55
Minimum	620	195	6	8,300	60	400	.....
6 to 18 inches:							
56	560	465	6	15,100	70	1,050	5
58	440	235	4	7,800	62	350	180
62	480	200	6	9,700	141	950	265
Average	470	300	5	10,900	93	780	150

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample No. 55, 1.4; No. 58, 0.1.

The Hanceville silt loam lies on ridges and slopes. It is derived from the shales, sandstones, and thin limestones of the Chester. Soil of this type is found mostly in the upper part of the Chester.

The analyses show that this soil is quite deficient in nitrogen, calcium, and phosphorus. This indicates that the procedure to be followed in increasing and maintaining fertility in this type is the same as for all the other types studied in the county.

OTHER TYPES.

Seven other types have been mapped in the county, several of which are of very small extent. Only one sample of surface soil and one of the corresponding subsoil from each was analyzed, but the results in connection with the descriptions given elsewhere in this report make it apparent that the general methods appropriate for increasing and maintaining fertility in each of these types will be the same as for the more important types described.

Other types or phases of types.

[Parts per million of the moisture-free fine earth.]

Type reference number.	Total nitrogen (N).	Total phosphorus (K).	Phosphorus (P) dissolved by N/5 HNO_3.	Total potassium (K).	Potassium (K) dissolved by N/5 HNO_3.	Calcium (Ca) dissolved by N/5 HNO_3.	Acidity as lime (CaO) to neutralize.
Christian silt loam:							
63	740	260	5	13,100	72	900	10
64	400	210	4	14,400	59	1,350	220
Christian very fine sandy loam:							
65	340	305	5	4,300	38	420	30
66	360	170	5	6,700	99	550	1,480
Christian silt loam:							
67	1,280	645	5	14,800	129	1,560	5
68	740	645	4	15,500	86	1,530	5
Huntington silty clay loam:							
69	1,640	520	12	14,800	112	3,750	5
70	460	580	9	15,000	80	2,810	10
Abernathy silty clay loam:							
71	1,140	480	7	14,900	167	1,040	40
72	1,060	530	6	15,100	169	1,130	30
Elk silt loam:							
73	1,020	800	60	11,600	82	900	15
74	680	775	56	13,100	70	920	20
Decatur gravelly clay loam:							
75	840	595	7	10,000	91	850	150
76	600	630	6	8,000	83	1,140	335
Pope silt loam:							
77	1,120	330	9	10,300	112	930	15
78	700	315	7	10,800	83	800	10

Gravel removed by the 2-mm. sieve, as per cent of the air-dry sample: No. 63, 0.2; No. 65, 1.1; No. 66, 3.2; No. 67, 0.1; No. 68, 0.2; No. 69, 0.2; No. 71, 0.1; No. 72, 0.3; No. 73, 0.6; No. 74, 0.9; No. 75, 26.6; No. 76, 8.9. The two latter are chert.

It should be stated that the Christian silt loam is derived from the sandstones and limestones at the base of the Chester, and it is not always possible to determine whether limestone or sandstone has

predominated in furnishing the material. Undoubtedly the limestone has in some places.

Except for the large amount of gravel and small stones which it contains and the topography in some places, the Decatur gravelly clay loam is almost identical with the Decatur clay loam. It probably would be better to call it a phase of the latter, though the analyses show distinctly more phosphorus and less acidity than in the Decatur clay loam.

MAINTAINING FERTILITY.

The thing of first importance in good farming is the maintenance of the soil in a state of profitable productiveness, and there are agricultural practices which are distinctly conducive to this condition. The first essential to permanent fertility is keeping up and increasing the supply of organic matter in the soil, which, in the process of decay, furnishes nitrogen, renders available phosphorus, potassium, and other elements locked up in insoluble compounds, and improves the physical condition of the soil.

From the table on a preceding page it will be seen that a 2-ton crop of clover, if plowed under, would add to the soil 80 pounds of nitrogen, a large part of which has come from the atmosphere through the action of root-nodule bacteria. This shows the importance in grain growing of giving legumes a prominent place in the rotation in order to maintain the supply of organic matter and nitrogen.

Another important fact shown in the table is that in grain farming a large part of the plant food removed by the crops may be returned to the soil in the stalks and straw. This is notably true of potassium.

Nitrogen-gathering crops (legumes) grown in the rotation will not maintain, much less increase, the supply of organic matter. The crop residues (stalks and straw) must be returned either directly or by carefully conserving and returning them in the form of manure. Catch crops and cover crops should be turned under and the second crop of clover, where it is grown in rotation, should be left on the ground.

In growing the nitrogen-gathering crops (clover, soy beans, cowpeas, vetch, etc.) the application of ground limestones is important and often necessary on the long-cultivated soils.

In soils low in phosphorus (as are all those of the St. Louis and Chester) this element should be supplied. In the case of soils well supplied with organic matter this may be done with ground rock phosphate. On the average soil, however, a more available form of phosphorus, such as acid phosphate should be used. If manure is

available, 50 to 100 pounds of acid phosphate per ton of manure makes a very effective fertilizer.

The analyses of the surface soils and subsoils of the various types show that the supply of potassium is ample and, under good agricultural practice, as outlined above, will remain ample on all well-drained soils, under proper cultivation.

To maintain and increase fertility it is only necessary to maintain and increase the supply of organic matter by growing the nitrogen-gathering crops, with the use of ground limestone and phosphorus, supplying additional phosphorus, where needed, elsewhere in the rotation, turning under catch and cover crops, and returning all crop residues and manure to the soil.

LOCATIONS AND DESCRIPTIONS OF THE SAMPLES ANALYZED.

DECATUR SILT LOAM.

Ref. No.	Lab. No.	
1	51798	2½ miles northwest of Schochoh. Brown, mellow silt loam. Grayish brown when dry.
2	51799	Subsoil of preceding. Yellowish-brown to reddish-brown silty clay loam. Rather compact.
3	51808	6 miles west of Russellville on Hopkinsville road. Mellow, brown silt loam.
4	51809	Subsoil of preceding. Reddish-brown, somewhat more compact silt loam or silty clay loam.
5	51810	One-fourth mile a little north of west of Olmstead. Brown, mellow silt loam. Grayish brown when dry.
6	51811	Subsoil of preceding. Brownish-red to red, compact, friable, silty clay.
7	43623	Russellville experiment field of the Agricultural Experiment Station, one-fourth mile west of the Louisville & Nashville station at Russellville. Red-brown loam. Collected by S. C. Jones, April 14, 1914.
8	43624	Subsoil of preceding. Red clay.
9	43625	8 Miles south of Russellville, 4 miles west of Oakville on farm of Prentice Bailey. "Limestone land." Collected by W. H. Rogers, county agricultural agent, May 20, 1914.
10	43626	Subsoil of preceding. Red clay.
11	56186	One-half mile south, 1 mile east of Schochoh. Brown, mellow silt loam. Grayish brown when dry.
12	56187	Subsoil of preceding. Brownish-red to red, compact, silty clay.
13	56190	2⅔ miles southeast of Adairville. Brown, mellow silt loam. Grayish brown when dry.
14	56191	Subsoil of preceding. Yellowish to reddish-brown silty clay loam. Rather compact.
15	56197	1 mile north of Adairville on Russellville road. Farm of J. S. Gilbert. "Limestone soil." Light-colored soil, red clay subsoil.
17	56776	1¼ miles north of Auburn on right of road to Bucksville.
18	56777	Subsoil of preceding.

TILSIT SILT LOAM.

Ref. No.	Lab. No.	
19	51804	4 miles northeast of Russellville, on Morgantown road (Duncan Hill). Gray, floury silt loam.
20	51805	Subsoil of preceding. Yellow to slightly reddish yellow silty clay loam.
21	51806	2 miles north of Gordonsville, on Rush Mill road. Gray to pale-yellow floury silt loam.
22	51807	Subsoil of preceding. Pale-yellow and yellow silt loam. Slighty compact.
23	56178	On Rush Mill road, 1½ miles north of Page's store, 1¾ miles southeast of Spa. Grayish-brown silt loam, becoming pale gray when dry.
24	56179	Subsoil of preceding. Yellow silty clay.
25	56182	1¼ mile northwest of Lewisburg and one-eighth mile north of Jericho road.
26	56183	Subsoil of preceding.
27	56196	One-half mile south of Stewart & Williams store. George Page's farm.
29	56782	1⅛ miles a little west of north of Cavett's store. Grayish, floury silt loam.
30	56783	Subsoil of preceding. Yellow or slightly reddish yellow silty clay loam.

DECATUR CLAY LOAM.

31	51794	5¼ miles south of Russellville on Adairville road. Brown or reddish-brown, silt loam to silty clay loam.
32	51795	Subsoil of preceding. Deep red clay, stiff and compact.
33	51812	One-fourth mile a little north of west of Olmstead. Brown to reddish-brown silt loam to silty clay loam.
34	51813	Subsoil of preceding. Deep red and very compact. Brittle when dry.
35	56780	Near Auburn (southwest), 75 yards to right of railroad, one-third mile from School Street crossing. Soil typical of this type.
36	56781	Subsoil of preceding.
37	56788	One-half mile northwest of Woodward school on right of road to Cavett's store. Reddish-brown silt loam to silty clay loam.
38	56789	Subsoil of preceding. Red, compact clay or silty clay.

DUNNING SILT LOAM.

39	51802	1¾ miles northwest of Cave Spring. Black, dark-gray, or dark brownish gray silty clay loam.
40	51803	Subsoil of preceding. Heavy, plastic, impervious clay, mottled drab, yellowish and bluish.
41	56774	1⅛ miles a little south of west of Logan (col.) school. on Black Lick Creek.
42	56775	Subsoil of preceding.

HUNTINGTON SILT LOAM.

43	51792	One-fourth mile southwest of the Louisville & Nashville depot, Russellville. Mellow, brown silt loam.

Ref. No.	Lab. No.	
44	51793	Subsoil of preceding. Slightly lighter brown, more compact silt loam, becoming lighter in color with increasing depth.
45	56784	Near Auburn (northeast) on Black Lick Creek to right of railroad, between railroad and Dixie Highway. Brown silt loam.
46	56785	Subsoil of preceding. Lighter brown, silty clay loam.
		CLARKSVILLE SILT LOAM.
47	51814	1¼ miles east of Corinth on Franklin Road. Grayish-brown to yellowish-brown silt loam.
48	51815	Subsoil of preceding. Pale-yellow silt loam.
49	56192	3 miles southwest of Adairville, 280 yards east of Smith's Grove. Brownish-gray silt loam.
50	56193	Subsoil of preceding. Somewhat compact, yellow silt loam.
		GUTHRIE SILT LOAM.
51	51800	3 miles south of Russellville. Light-gray, floury silt loam.
52	51801	Subsoil of preceding. Mottled yellow and gray silty clay loam, underlain by heavy, tenacious, impervious clay.
53	56772	1¼ miles southwest of Friendship Church and School. Light-gray, floury silt loam.
54	56773	Subsoil of preceding. Heavy, tenacious, deep-yellow and yellow-brown clay, quite impervious.
		HANCEVILLE SILT LOAM.
55	56176	1¾ miles northeast of Page's store, on the west side of Elk Lick Creek, 2⅛ miles southeast of Spa. Brown, mellow loam.
56	56177	Subsoil of preceding. Light-brown, compact loam to sandy clay loam.
57	56786	1½ to 1¾ miles northwest of Auburn on right of road. Light grayish brown to gray silt or very fine sandy loam.
58	56787	Subsoil of preceding. Reddish-yellow, fine sandy clay loam.
59	56790	Near forks of road east of Bucksville, on right, approaching Bucksville. Grayish silt loam.
61	56814	1 mile east of Pauline. Grayish to reddish silt loam containing some fine sand in places.
62	56815	Subsoil of preceding. Red, compact, silty clay.
		CHRISTIAN SILT LOAM.
63	51788	1¾ miles northwest of the public square, Russellville. Gray to brownish-gray silt loam.
64	51789	Subsoil of preceding. Light-brown silty clay.
		CHRISTIAN VERY FINE SANDY LOAM.
65	51790	1¾ miles northwest of the public square, Russellville. Yellowish-gray to brownish-gray, very fine sandy loam.
66	51791	Subsoil of preceding. Reddish, compact, brittle clay.
		CHRISTIAN SILT LOAM.
67	56184	One-half mile north of Lewisburg, on the west side of the railroad track. Mellow, brown silt loam. Grayish brown when dry.
68	56185	Subsoil of preceding. Lighter brown, compact, silty clay loam.

HUNTINGTON SILTY CLAY LOAM.

Ref. No.	Lab. No.	
69	56180	2 miles northwest of Lewisburg, in bottom, on Wolf Lick Creek, on Deer Lick Road. Brown or mottled brown and drab, heavy silt loam to silty clay loam. Brownish gray when dry but brown when moist. Crawfishy land in overflow bottom of Wolf Lick Creek and other large streams.
70	56181	Subsoil of preceding. Mottled drab and brown silty clay loam.

ABERNATHY SILTY CLAY LOAM.

71	51796	5½ miles south of Russellville on Adairville road. Reddish-brown, brown or brown mottled with yellowish and grayish silty clay loam.
72	51797	Subsoil of preceding. More compact, silty clay loam, mottled brown, yellow and gray or drab.

ELK SILT LOAM.

73	56188	2 miles northeast of Adairville, south of creek, east of road. Brown silt loam.
74	56189	Subsoil of preceding. Lighter brown, silty clay loam becoming lighter in color and heavier in texture with increasing depth.

DECATUR GRAVELLY CLAY LOAM.

75	56194	3⅜ miles southwest of Adairville, one-half mile north of state line. Light-brown silt loam.
76	56195	Subsoil of preceding. Red clay.

POPE SILT LOAM.

77	56778	1¼ miles southeast of Richelieu in Shaker Bend of Gasper River. Light-brown silt loam.
78	56779	Subsoil of preceding. Yellowish silt loam to silty clay loam.

SUMMARY.

Logan County, situated in the southwestern part of Kentucky, has a total area of 559 square miles, or 357,760 acres.

The surface features vary from hilly in the northern and northwestern parts to gently rolling to level in other parts of the county. Drainage is well established. The northern two-thirds is drained northward through tributaries of Green River. The southern third of the county is drained in a southwestern direction through Red River and its tributaries.

The climate is temperate. The rainfall is ample and is quite evenly distributed throughout the year. The mean annual precipitation is 46.55 inches. There is a normal growing season of 169 practically sure days and 179 to 203 probable days.

Nearly 80 per cent of the land is in farms and over 70 per cent is improved. Practically all of the southern half of the county is favorable for agriculture and is in a high state of cultivation. In the vicinity of Auburn the same conditions prevail.

Logan County is predominantly agricultural. The crops grown are corn, wheat, tobacco, hay, and other forage crops, and oats, supplemented by sorghum, Irish potatoes, sweet potatoes, strawberries, apples, peaches, grapes, and other fruits. Tobacco and wheat are the most important cash crops.

There is a distinct tendency toward further development of dairying and other branches of the live-stock industry.

The population of the county is reported by the census of 1920 as 23,633, averaging 36.8 persons to the square mile. The population of Russellville, the county seat, is given as 3,124.

Twenty-two soil types, including Rough stony land, are mapped in Logan County. The soils are largely residual, and are derived from limestone, sandstone, and shale. The alluvial or bottom soils occur along the streams as first and second bottoms.

The upland soils of strictly limestone derivation are classed in the Decatur, Clarksville, Shelbyville, and Guthrie series.

The Decatur soils are the most extensively developed and the most important agriculturally. The Decatur silt loam is considered the strongest and most productive soil in the county. It produces good yields of tobacco, corn, wheat, grass, clover, alfalfa, and sorghum. Its nearly level to gently rolling topography permits the practical use of all types of farm machinery. The clay loam and gravelly clay loam members are productive soils, but require more careful handling. The stony and eroded phase of the clay loam type, as well as the stony clay, are best suited to forestry and pasturage.

The Clarksville silt loam is developed mainly in the southern part of the county. It has an undulating to gently rolling topography and is well adapted to farming.

The Shelbyville stony clay is an inextensive type. Most of it is undesirable on account of its stony character.

The Guthrie silt loam is inextensively developed. It occupies low, basinlike depressions within areas of the Decatur soils. It is poorly drained and is locally known as "swamp."

From the sandstones and shales are derived soils of the Tilsit and Hanceville series.

The Tilsit soils include the silt loam and silty clay loam types. These occur in the hill section of the county. The silt loam is the most extensive of these types and is typically developed in the north-central part. The surface is undulating to rolling, and the drainage is fairly good. Corn, tobacco, wheat, oats, grasses, and sorghum are the principal crops. The silty clay loam occupies slopes usually around the heads of small drainageways. It is an inextensive type found mostly in the northwestern part of the county. Drainage is good to excessive. The type produces less uniform yields than the Tilsit silt loam.

The Hanceville silt loam is developed in the northern part of the county. The topography is gently rolling to rolling. It is probably slightly stronger than the Tilsit silt loam. It produces good yields of the general farm crops.

The Hanceville very fine sandy loam is not extensively developed. It is the lightest textured soil in Logan County. Crops do best during seasons of moderate to heavy rainfall. It is well suited to trucking and to all crops requiring a light-textured soil.

The Hanceville stony loam is extensively developed in the northern part of the county. It occupies slopes generally too steep and stony for farming. Drainage is excessive. The larger part of the type is forested.

A combination of material from limestone, sandstone, and shale gives rise to the Christian series. The Christian silt loam and very fine sandy loam are productive soils. The stony loam occupies positions unfavorable for agriculture. It is too stony and broken for farming and is better suited to grazing and forestry.

The lowland, or alluvial, soils are classed with the Elk, Huntington, Pope, Dunning, and Abernathy series.

The Elk silt loam occupies second bottoms or terraces along the larger streams and is rarely overflowed. It is most extensively developed in the southern part of the county. The surface is level and the soil is easily and economically cultivated through the use of improved farm machinery. This is a good soil for the production of the general farm crops and practically all the type is cultivated.

The Huntington silt loam and silty clay loam are productive first bottom soils and are subject to overflow. They are composed of sediments washed from the residual upland soils derived from limestone and limestone, sandstone, and shale. The Huntington soils are particularly adapted to corn.

The Pope silt loam occurs in the overflowed bottoms of the larger creeks and along Gasper River just above where it leaves the county. This soil represents material washed from soils derived from sandstone and shale, with practically no limestone sediments. The type is best suited to corn and grasses.

The Dunning silt loam is encountered principally along Black Lick Creek. It is subject to occasional overflow. It is devoted mainly to corn, of which good yields are secured.

The Abernathy silty clay loam is a very inextensive type. It is confined to the first bottoms of streams and upland "sinks." It is best suited to corn and grasses.

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