

Issued November 29, 1911.

U. S. DEPARTMENT OF AGRICULTURE

BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF ROCKCASTLE COUNTY,
KENTUCKY.

BY

R. T. AVON BURKE, FRANK BENNETT,
AND CLARENCE LOUNSBURY.

[Advance Sheets—Field Operations of the Bureau of Soils, 1910.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1911.

[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., May 10, 1911.

SIR: One of the soil survey projects completed during the field season of 1910 was the survey of Rockcastle County, Ky. This survey was requested by leading citizens of the county, and its selection bore the indorsement of the Hon. Harvey Helm, Representative in Congress of the eighth congressional district, within which Rockcastle County is included.

I have the honor to transmit herewith the manuscript report and map covering this work, and to recommend their publication as advance sheets of the Field Operations of the Bureau of Soils for 1910, as authorized by law.

Very respectfully,

MILTON WHITNEY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
SOIL SURVEY OF ROCKCASTLE COUNTY, KENTUCKY. By R. T. AVON BURKE, FRANK BENNETT, and CLARENCE LOUNSBURY.....	5
Description of the area.....	5
Climate.....	7
Agriculture.....	9
Soils.....	15
Dekalb fine sandy loam.....	16
Dekalb shale loam.....	18
Dekalb sand.....	20
Dekalb silt loam.....	21
Huntington loam.....	23
Pennington clay.....	24
Lickdale shale loam.....	24
Colyer silt loam.....	26
Hagerstown silt loam.....	26
Clarksville silt loam.....	29
Holly silt loam.....	31
Elk silt loam.....	32
Guthrie silt loam.....	33
Rock outcrop.....	34
Rough stony land.....	34
Summary.....	35

ILLUSTRATIONS.

FIGURE.

	Page.
FIG. 1. Sketch map showing location of the Rockcastle County area, Kentucky .	5

MAP.

Soil map, Rockcastle County sheet, Kentucky.

East Fork, and Long Branch. It also receives the waters of Copper Creek, a stream of about the same size. This heads in Garrard County and receives the lateral drainage of the northwestern part of the county. The greater part of the drainage, however, is south and east into the Rockcastle River, which forms the east boundary line of the southern half of the county. The following streams in Rockcastle contribute to the waters of the Rockcastle River: Horselick, White Oak, Roundstone, Skegg, Buffalo, and Line Creeks, and Trace, Long, and Big Trace Branches, the most important of which are Roundstone and Skegg Creeks.

Rockcastle River flows through a narrow valley, and is bordered by bottom land, part of which is subject to overflow. The bottom is very narrow, rarely exceeding a width of one-eighth of a mile. As compared with the Dick River drainage system, there is little bottom land bordering the Rockcastle drainage system, and this is confined mainly to the larger streams, particularly Roundstone and its branches. The bottoms along Skegg Creek and the forks are of less importance.

Rockcastle County in its western portion includes a small part of the Central Plain of Kentucky. The surface features of this section vary from level to undulating, with an altitude about 1,000 feet. The approaches to the streams and stream bottoms are rather abrupt. This includes the country locally known as the "Glades."

The greater part of the county lies on the western edge of the Appalachian coal field, a hilly region which is separated from the Central Plain by a very irregular line. The limestone and shales have here been so cut and dissected that the escarpment and upland plain, which characterize the region in Tennessee, are lacking. In general the altitude of the coal fields section ranges from 1,150 to 1,300 feet, while the northeastern part of the county attains an altitude of 1,500 feet, and some knobs rise somewhat higher. The topography of the coal fields proper is characterized by narrow trailing ridges, the surface of which is level to gently rolling, separated by valleys which vary in depth from 150 to 500 feet. These have generally steep and smooth slopes, except where the ridges are supported by rock cliffs, as is common in the eastern part of the county, in which case the slopes are more rugged.

Intermediate between the coal fields proper and the Central Plain, as it occurs in Rockcastle in the north-central part of the county, is another plain, locally known as Brindle Ridge. This area, with an altitude of 1,200 feet above sea, is a level to gently rolling country, characterized by rather abrupt approaches to water courses. This plain owes its development to the resistance the underlying rock has offered the agencies of weathering. This is one of the most important sections of the county. It is said that three-fourths of the general farm products of the county are produced here.

The population of Rockcastle County is largely native born, very few people having come into the county since the days of early settlement. The present population as given by the Census of 1910 is 14,473. In addition to numerous small hamlets, the towns of Mount Vernon, Brodhead, and Livingston are within the borders of the county.

The industries of the county are agriculture, coal mining, lumbering, and the getting out of crossties, staves, and tan bark. There are also fine sandstone and limestone quarries in operation.

Rockcastle County is traversed by two divisions of the Louisville & Nashville Railroad. The Louisville, Knoxville & Atlanta division extends across the county in a northwest and southeast direction, passing through the stations of Gum Sulphur, Brodhead, Mount Vernon, and Livingston, and the Cincinnati, Knoxville & Atlanta division passes through the north-central part of the county and extends in a southeasterly direction, through Conway, Roundstone, Langford, Brush Creek, Mullins, Sinks, and Livingston. The junction point of these two divisions is at Sinks. In addition to these there is a freight line which extends from Brush Creek to the mines at Johnetta. The main lines afford rapid and convenient service, and have done much to develop the resources of the county.

The county is supplied with telephone service, but the free rural delivery of mail has not as yet been introduced. The character of the roads, which are only fairly good, has probably prevented the extension of this important service to Rockcastle County. Interest in road improvement is being awakened, and though little permanent construction has been done so far the presence of good stone for the purpose should make the problem easy of solution as the county develops.

The local markets of the area are the towns mentioned, and the more remote markets Cincinnati, Louisville, and Knoxville. Mount Vernon, the county seat, is 130 miles from Louisville, 160 miles from Cincinnati, and 147 miles from Knoxville.

CLIMATE.

The climate of Rockcastle County is comparatively mild and agreeable, extremes of heat and cold occurring at rare intervals. The winters are on the whole moderate, but are characterized by recurring cold spells, during which the temperature frequently falls below zero.

The climatic data given in the following table are compiled from the records kept at Eubank, in Pulaski County, and although they are not so desirable as the records from a local station would be, they give a general idea of weather conditions.

*Normal monthly, seasonal, and annual temperature and precipitation at Eubank,
Pulaski County.*

Months.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	<i>°F.</i>	<i>°F.</i>	<i>°F.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
December.....	35	68	-15	3.7	3.8	4.3	3.4
January.....	34	72	-14	4.1	2.0	6.2	5.0
February.....	36	74	-22	4.7	1.6	6.3	6.5
Winter.....	34			12.5	7.4	16.8	14.9
March.....	47	87	-2	5.7	3.4	11.5	3.3
April.....	55	94	20	4.1	5.4	4.2	0.4
May.....	65	99	29	3.8	3.1	6.0	0.0
Spring.....	56			13.6	11.9	21.7	3.7
June.....	72	99	35	3.7	4.7	1.4	0.0
July.....	75	103	48	4.2	0.3	4.5	0.0
August.....	74	102	48	4.0	6.9	1.3	0.0
Summer.....	74			11.9	11.9	7.2	0.0
September.....	68	101	30	3.3	6.2	2.2	0.0
October.....	58	89	19	1.9	1.3	3.0	0.0
November.....	44	77	7	3.6	1.3	1.7	0.8
Fall.....	57			8.8	8.8	6.9	0.8
Year.....	55	103	-22	46.8	40.0	52.5	19.4

It will be noticed that there is very little difference in the monthly mean temperature for December, January, and February, with the lowest mean in February. The absolute maximum and absolute minimum of the winter season occur in the same month. The snowfall in Rockcastle County is usually quite light. The total average snowfall at Eubank is 19.4 inches, while the total precipitation during the winter season varies from 7.4 to 10.8 inches. Thus it is seen that much of this comes as sleet and rain. The total precipitation in Rockcastle is quite sufficient for the need of crops, and is well distributed throughout the year. It probably approximates that at Eubank, which ranges from 40 to 52.6 inches, with a mean of 46.8 inches.

The summers are pleasant, and although there are some days that are hot and oppressive, the nights are always cool. The hottest month in the year at Eubank is July, with a monthly mean of 75° F.

The average date of the last killing frost in spring at Eubank is April 25 and the first in fall October 10, while the earliest frost recorded at the same station in fall occurred on September 14 and the

latest in spring on May 20. From these data it can be inferred that Rockcastle has a crop season of about 165 days, which is ample for the production of a great variety of crops.

With an altitude that varies from 900 to 1,500 feet above sea level local differences in climate may be expected, and it is regretted that there are no records to show any variation that may exist. Observation in the field would seem to indicate that the effects of late spring frosts were more pronounced in the lowlands than in the uplands.

Rockcastle County has exceptionally fine water, springs are numerous in all parts of the county, and the water is usually cold and free from taint, with the exception of those wells and springs in the black shales in the western part of the county, which are strongly impregnated with iron and sulphur.

AGRICULTURE.

Rockcastle County was formed from parts of Lincoln, Pulaski, Madison, and Knox Counties in the year 1809 and organized in 1810. Most of the early settlers came from Maryland and Virginia and were an agricultural class. Those that settled in Rockcastle chose the hill country and built their homes along the water courses. The western part of the county, although less rugged, was not so desirable on account of the water, while large areas of swamp led to the belief that this section was unhealthy.

The chief crops grown were corn, wheat, rye, and garden truck, at first only for home consumption. Even with the poor cultivation given corn produced yields of 50 to 80 bushels to the acre. The production of wheat was less than that of corn, the former requiring better preparation of the land. The resulting yields varied from 20 to 50 bushels to the acre. Rye yields ranged from 15 to 25 bushels.

Forest extended over all parts of the county when it was first settled and the early settlers allowed their live stock to range at will. The cattle were rounded up in fall and fed through the winter.

Lexington was an important market for early settlers. Such necessaries as could not be produced were brought from Philadelphia or Baltimore to Pittsburg and then by boat down the Ohio to Limestone (now Maysville) and then to Lexington by wagon.

The early markets were so remote that most of the farm products had only a nominal value. To offset this condition recourse was had to stock raising, and this industry attained considerable prominence. Horses, cattle, sheep, and hogs were raised. The early market for horses and sheep was Lexington, while great droves of cattle and hogs were driven to Georgia and Alabama. Stock raising flourished up to and some time after the opening of the Mississippi traffic and

the extension of the Louisville & Nashville Railroad from Lebanon to Corbin in the sixties.

The opening up of the railroads was followed by rapid development of the coal and timber interests, and to a great extent was detrimental to agricultural development, particularly in the eastern part of the county. At present comparatively little good timber is left. Crossties, staves, and tan bark are the chief forest products now, and the end of these is in sight. As a result attention is again being turned to agriculture, and considerable progress has been made in the last four years.

Some idea of the present state of agricultural development may be gained from the land classification published by the census of 1900. At that time a little over half the area of the county was in timber or brush. The remainder, 48.5 per cent, or 74,611 acres, was classed as improved lands, but of this area fully 60 per cent was used for pasture.

The authority above quoted gives the average size of the farms as 93.9 acres. Individual farms range from 30 or 40 to 2,000 acres or more. Something over 66 per cent of the farms are operated by the owners and the rest by tenants.

Various systems of leasing farm lands are followed, the usual plan being on a share basis, the tenant generally giving from one-third to one-half the produce of the land. The tenant usually furnishes everything needed to produce the crop, but where fertilizer is used the landlord may pay for half of it. The tenant is sometimes given the privilege of pasture land in addition to the area cultivated. The payment of cash rent is uncommon. Where exacted the rate ranges from 50 cents to \$5 an acre.

In some parts of the county the labor supply is adequate; in other sections great difficulty is experienced in securing efficient help. Most of the labor is employed by the day at a wage ranging from 50 cents to \$1. When labor is engaged by the month the wage ranges from \$12 to \$20.

Corn, wheat, oats, and hay constitute the main crops of the area at present, supplemented by millet, Irish potatoes, sweet potatoes, sorghum, tobacco, rye, and buckwheat, named in order of their importance. Garden vegetables are produced in small patches for home use, the combined acreage being considerable and lying between that devoted to millet and that of potatoes.

Corn is the most important crop, occupying three-fourths of the cultivated lands of the county. In 1899, according to the census of 1900, there were 20,661 acres under this crop and the production reached 364,680 bushels. In general, the climatic and soil conditions favor cultivation of this crop. It is produced most profitably in the more level parts of the county, where labor-saving machinery can be used.

In the section locally known as the "Glades" and upon the gently rolling limestone ridges the soil is usually plowed in the spring to a depth varying from 5 to 7 inches, followed by harrow and drag. The seed is planted with a drill, and when fertilizer is used it is commonly put in at the same time. The crop is usually planted in rows from 3 to 4 feet apart and planted 16 to 18 inches apart in the row. The cultivation is done with double shovel plows or two-horse cultivator and is usually frequent and shallow.

A less common method is to plant in checks $3\frac{1}{2}$ to 4 feet apart. The field can thus be worked both ways. This method can only be used to advantage when the surface of fields is level and its principal advantage is the elimination of hoeing by hand. The corn is cut by hand and shocked or left standing in the field.

In the rough or uneven sections of the county corn is grown in patches of 7 or 8 acres on the hillsides. When the slopes permit it, horses are used in preparing the fields and in cultivating the crop. But a great deal of the county is so rough that the crop is practically grown with hand labor. The corn is here rarely shocked, but allowed to remain in the field until gathering time, when it is hauled to the barn on sleds, as wagons can not be used on such steep surfaces.

These hillside patches are kept in corn for three or four years, when they are allowed to grow up in brush again and new patches cleared. The yields are usually heavy, but rarely compensate for the labor involved.

It is generally recognized that fall plowing and spring disking is the best method on the level land, though this is rarely practiced. Such a plan of course can not be followed in the rough country where surface wash and erosion is so severe. The impression that the tops of the ridges in the hill country are unproductive is not generally correct, for some very profitable crops of corn have been produced, especially on the heavier soils in such situations. But even if the yields were generally less than on the slopes, the fact that improved machinery can be utilized makes such areas better suited for the production of cultivated crops.

Oats is the crop of next importance in the county, but in 1899 it occupied only 2,585 acres, or about 9 per cent of the cultivated area. The acreage in oats reached a maximum in 1889, when there were 6,817 acres in this crop. The production from this acreage was 24,570 bushels. Some fields of oats are seen in the hills, but the greater part of the acreage is in the more level country. The difficulty of preparing land and harvesting the crop restricts its production in the rough country. Most of the crop is planted with a drill and harvested with a binder, but in the rougher country it is seeded broadcast and harvested with a cradle.

The acreage of wheat has declined since 1879, the 1899 area of 1,519 acres being about half as great as in the first-mentioned year.

According to the census of 1900 the wheat acreage represents only 5 per cent of the cultivated land of the county. Although the acreage of wheat is less than that of oats, the former is more generally distributed over the county. In the more level country it is planted with a drill and harvested with a reaper or binder, while in the hills, as in case of oats, the methods are necessarily more primitive. This adds considerably to the cost of production, and usually only enough is grown for home consumption. Not enough is produced on each farm in the hills to justify itinerant thrashing machines, even if they could be brought to the farm, and most of the grain is hauled to some central point to be thrashed. The usual charge is 3 cents a bushel for oats and 5 or 6 cents for wheat.

Most of the wheat is exchanged for flour or ground at local mills as need arises. In the last few years considerable areas in the hills have been planted to oats and wheat for forage, particularly when cattle are kept through the winter.

The acreage in hay in the year 1899 was less than in oats, but more than in wheat. But 1,799 acres, producing 1,422 tons, was reported by the census. The grasses consist of redtop, timothy, and clover. Sometimes clover is sown alone, but more often with timothy. The production of this mixed hay is largely confined to the limestone country. Seeding is occasionally done without but more often with a nurse crop of oats.

The production of redtop hay is more common than timothy and clover. The former grass does not appear to be restricted by damp or dry soil conditions, and although the largest yields are from stream bottom land good yields are reported from hillsides and ridges.

Millet, Irish and sweet potatoes, and sorghum are crops of minor importance, while nearly every home has its patch of garden products.

Tobacco, rye, buckwheat, and broom corn are practically experimental crops, but there is every indication that they will become important crops in the area. Under stimulation of present high prices of tobacco and broom corn these crops especially should receive more attention, and there is great necessity for rye as a cover crop and for buckwheat as a catch crop.

The tobacco grown is largely the White Burley, with some Red Burley. In 1909 the acreage planted to the crop was greater than at any time during the history of the county. At present it is confined largely to the limestone country, but there is no reason why it should not be extended to other soils. Some experimental crops of fine quality have been grown in the hills.

Rye is used largely as a cover crop, as a source of pasturage, and in some instances to supply green manure for tobacco crops. It is an excellent crop to protect sloping fields from winter erosion and it

affords good grazing early in the spring, at a time when there is little other pasturage.

The production of buckwheat, while at present insignificant, could be profitably increased. As a catch crop it is invaluable, as it requires only about six weeks to mature. In some fields two crops were grown during the current season. This of course is not good practice. The crop is more often used on lands that are inclined to be damp and where crops are usually late in starting or where stands of corn or other cultivated crops are unsatisfactory and the season is too far advanced for replanting.

Orchard products, which had a value of \$13,073 in 1899, consist chiefly of apples, peaches, and plums, named in order of their importance. There has probably been little change in the value of these products since 1899, but conditions are favorable for development of fruit growing, particularly in the production of apples. A great deal of the hill country could be profitably utilized for this purpose. The trees around the homesteads are generally in a thrifty condition.

Cognizance should also be taken of the rapid growth of young poplar and chestnut on some of the rougher portions of the Castle Cain country, oak, chestnut-oak, walnut, hickory, and pine in the country underlain by the Coal Measures, and pine on soils derived from the shale formations. These trees are growing very fast and if protected will ultimately be very valuable. Over the rougher part of the county, and a considerable portion of its area is rough, forestry and grazing are undoubtedly the wisest uses to which the soils can be put. It must be recognized that the hill country can not compete with more favored sections in the production of cultivated crops and recourse must necessarily be had to those industries suited to the conditions.

Mention has already been made of the early development of stock raising and its subsequent decline, owing in part to the growth of the coal and timber interests and the attraction of labor from the farm.

There has been some increase in the number and value of farm animals since 1879. In that year the total value was \$237,676, in 1889 it had risen to \$313,680, and 1899 to \$390,942. During this period the increase in mules, horses, and sheep has been much greater than that in cattle and hogs.

Many cattle are still raised in the county. They are mainly a mixture of beef and milk breeds, the latter blood predominating. In the western and more level part of the area the feeding of cattle is attaining some importance, and a considerable proportion of the small grain and corn is here converted into beef and pork. In the hill country most of the stock is pastured upon the partially cleared uplands. Very few animals are kept over winter, on account of the lack of forage, though much more forage could be produced if the

requisite effort were made. Some of the people in the hills have found the raising of stock, particularly cattle and sheep, profitable even under present conditions. A number of nutritious grasses and two varieties of vetch are common on most of the hillsides and uplands of the Coal Measure section. Even in cultivated fields it is a difficult matter to kill the grass. Advantage should be taken of this and strong permanent pastures developed. An additional natural pasturage is afforded by Japan clover, which flourishes on the limestone uplands and to a less extent on the hilly portion of the country underlain by the Waverly formation.

It is not expected that the hill country, even under changed conditions, will do any extensive feeding of cattle, as grain crops in general can not be economically produced here, but with lands that range in value from \$1 to \$8 an acre, the conditions are admirable for the ranging of grass-fed stock. To make this as profitable as may be, the recognized beef types should be introduced.

At the present time sheep raising is profitable, being particularly well adapted to the soil and the climatic conditions. There are two phases of the industry—the supplying of early spring lamb for market and the maintenance of flocks for their wool. The Dorset is a good type for the former purpose and the Dickerson Merino for the latter. Crossed with native stock with proper selection the Merino will give a flock bearing heavy fleeces of good quality.

No rotation of crops is practiced in the hill country. The requisite area of brush land is cleared and is kept in corn until the yields decline to a point of little profit, when a new area is cleared and the same process repeated. In a few instances the farmers in the hills alternate corn with wheat or oats grown for forage or grain.

In the more level country, corn used to be grown successfully year after year upon the same fields, but in late years some attention has been given to rotation. The rotations vary somewhat, but the most common successions are corn, oats, wheat, and hay; corn, oats, and hay; and corn, wheat, and hay. After the hay is removed the fields are used for pasturage from one to three years. Occasionally wheat or tobacco is grown on sod land.

Soil productiveness is usually maintained by the turning under of grass sod and grain stubble, by the use of clover in grass mixtures, and by commercial fertilizer, although the expenditure for fertilizers in the year 1899 was only \$2,730. It is believed that the use of fertilizers has greatly increased in the last few years.

The agricultural development of Rockcastle County is just begun, but with its healthful climate and varied soils it offers good inducement to prospective settlers.

SOILS.¹

As already stated, the greater part of Rockcastle County lies in the western edge of the Appalachian coal fields and a small part in the central plain of Kentucky. It is probable that the coal fields of the Appalachian and the coal fields in the western part of the State were at one time continuous. The uplift, known as the Cincinnati Arch, separated the two fields, and subsequent erosion removed the coal measures and reduced the county to its present condition. Some of the highest knobs west of the main belt of the coal fields in this county and separated by areas of limestone are capped with remnants of the Coal Measures, while one hill in particular, Brushy Mountain, has a small area of coal.

The rocks of the area belong to the Silurian, Devonian, and Carboniferous periods, and consist of sandstone, shale, limestone, and to a less extent of conglomerate. They are classed as sedimentary rocks; that is, they are composed of materials that were deposited ages ago in water. These rocks since their uplift have been weathering to form soil.

The soils of the area are divided into two general groups—residual and alluvial. The former group is derived from the disintegration and decomposition of the rocks in place, and the latter represents materials derived from the same source, but transported, sorted, and redeposited by rivers and streams.

The Silurian rocks occur in the northwestern part of the county, in the valleys of Copper Creek and Dick River, but do not contribute to soil formation, as they are covered with alluvial material. The Devonian is to a great extent covered with alluvial material, but the Chattanooga shale of that period outcrops to some extent south and northwest of Gum Sulphur. Here it gives rise to a well-developed soil type—the Colyer silt loam.

The Carboniferous strata are well developed, and the following important formation outcrops sufficiently to give rise to distinctly developed soil types. The Waverly shales, which occur just above the black shales of the Chattanooga formation of the Devonian, consist of grayish, pale blue, and dark-olive colored shales with siliceous layers at the top and to a less extent argillaceous sandstones of yellow or reddish-yellow color. The shales in this formation give rise to two types, one of which is known as the Colyer silt loam and the other the Lickdale shale loam.

The Newman limestone, which is superimposed on the Waverly shales, consists of grayish to bluish limestone, with some cherty layers at the base. The cherty layers at the top of the Waverly

¹ Statements in regard geology taken from Geology of the London Quadrangle, Kentucky, by M. R. Campbell.

shales and the basal part of the Newman limestone have given rise to the Clarksville silt loam, while the more typical limestone has given rise to the Hagerstown.

The Pennington shales, which occur above the Newman limestone, are very thin in this area and give rise more to soil conditions than to a type. The heavy clay which is characteristic of this formation is commonly obscured by slump from the Lee formation above. The Lee formation is made up of sandstone conglomerate, sandy shales, and shales. From these rocks is derived the Dekalb fine sandy loam, Dekalb sand, Dekalb shale loam, and Dekalb silt loam. The distribution of alluvial soils is confined to the valley floors of the larger streams, and these soils are not developed to any great extent. They are divided into three series, differentiated from one another on the basis of color and topographic position.

Fifteen soil types, including Rock outcrop and Rough stony land, are shown on the accompanying map. These soils are given the name of certain series, as determined by their origin, and classified into types within the series as variations in texture require.

The following table gives the name and extent of the soils found in this survey:

Areas of different soils.

Soils.	Acres.	Per cent.	Soils.	Acres.	Per cent.
Dekalb shale loam	71,680	38.0	Huntington loam.....	3,008	1.6
Clarksville silt loam.....	31,360	16.6	Elk silt loam.....	2,496	1.3
Hagerstown silt loam.....	2,880	12.9	Rough stony land.....	2,496	1.3
Steep shallow phase.....	21,440		Dekalb sand.....	1,280	.7
Lickdale shale loam.....	20,416	10.8	Colyer silt loam.....	768	.4
Dekalb silt loam.....	9,664	5.1	Guthrie silt loam.....	320	.2
Holly silt loam.....	9,088	4.8	Pennington clay.....	256	.1
Rock outcrop.....	8,064	4.3			
Dekalb fine sandy loam.....	3,584	1.9	Total.....	188,800

DEKALB FINE SANDY LOAM.

As typically developed the soil of the Dekalb fine sandy loam consists of gray and less commonly of yellowish-brown fine sandy loam, extending to a depth of about 8 inches, where it grades into heavy fine sandy loam of yellow or pale yellow color. In other places the soil may be 18 inches deep and the subsoil a fine sandy to silty clay. The subsoil is underlain by bedrock at variable depths, sometimes within 30 inches of the surface. As the rock is approached the material changes to a fine sandy or silty clay, which sometimes has a slightly reddish color.

This type of soil is derived from interbedded sandstone and fine sandy shale of the Lee formation. The color of the rock varies from gray to yellow. In places these rocks have been entirely decomposed,

and under such conditions the subsoil is here similar to that of the Dekalb shale loam. Small pebbles of sandstone and sandy shale are scattered over the surface and through the soil.

In addition to the typically developed Dekalb fine sandy loam three phases of the type are developed in Rockcastle County, the most important of which is derived from the flesh-colored sandstone of the Corbin conglomerate. This is generally coarser and has greater depth than the typical soil, but the main difference is the occurrence of thin layers of sticky brown-colored sand in the subsoil. These layers vary from one-fourth inch to about 6 inches in thickness, and are the result of the weathering of ferruginous layers, which occur without definite arrangement throughout this rock. The greatest thickness of these sticky layers was encountered on the ridge southwest of Robinet. The second phase is restricted to a small area on Chestnut Ridge southeast of Mount Vernon. It conforms to typical material with the exception that the subsoil grades into a red clay, which is underlain by a pinkish sandstone. This sandstone is unlike the other phase in that it is free from iron crusts and much finer grained. The third phase is developed on the ridge south of Climax and east and southeast of Johnetta. Here the soil and immediate subsoil is similar to typical areas, but the sandy clay layer common at the base of the section is missing. A fine-grained sandstone of yellow color usually occurs about 24 inches below the surface. This type is locally known as "puffy land."

The Dekalb fine sandy loam is only used to a limited extent for agricultural purposes. Most of it is covered with brush or thin forest. It usually occupies the tops of the winding ridges or knobs and less commonly in a "slump" on some of the more isolated hills. Chestnut, chestnut oak and other oaks, and hickory are the characteristic trees. Huckleberry and wild vetch seem to be indigenous undergrowth. Japan clover, so common on the limestone soils, was rarely encountered on this type. Even under virgin condition this type shows very little organic matter.

The crops grown on the Dekalb fine sandy loam are corn, oats, potatoes, and hay, of which the following yields are reported: Corn from 10 to 25, oats 10 to 15, sweet potatoes 75 to 100, and Irish potatoes 40 to 60 bushels per acre. The yield of hay is low, from one-half to 1 ton to the acre.

The grasses grown are orchard grass, redtop, and timothy. Some trouble is experienced in securing stands of red clover, as it has a tendency to winterkill. Wheat requires heavy fertilization and the yield rarely reaches 20 bushels to the acre.

All kinds of cane fruits, strawberries, and garden truck do well and mature early. Fruit trees, such as apples and peaches, are almost certain to fail on the phase of this type lacking the heavy layer at the

base of the subsoil. High winds and droughtiness of the soil are doubtless the principal causes of this. The influence of the wind on the trees set in the typical soil and that derived from the conglomerate is not so bad, but the growth is far from desirable from the same cause. In one instance the trouble with fruit trees was obviated by the use of stable manure, which had a tendency to firm the soil around the trees, and when seen these were in a very thrifty condition. The peach crop is quite uncertain on account of late spring frosts, but apples are a sure crop.

No systematic rotation of crops is practiced on this type. Corn, the chief crop, is grown year after year in the same fields and when the fields are "worn out" they are abandoned to brush and weeds and a new patch cleared. The incorporation of organic matter would do much to maintain the productiveness of the fields. It would also reduce the tendency to drought and diminish the injury to clover from freezing.

Organic matter can be added to the soil in the form of stable manure and by the more frequent use of grasses and legumes in crop systems. As the supply of stable manure is inadequate it is suggested that the following crops be used to build up the soil: Hairy vetch and rye sowed in fall, followed the next year with cowpeas and then in the fall with timothy and clover.

The crops would not only be profitable in themselves but would put the soil in good condition for a general rotation of crops, and it is recommended that after the second crop of hay is removed the land be kept in pasture for at least one year and the following rotation used: Corn, oats or wheat, and hay (timothy and clover), the field to be subsequently pastured as long as is desirable in case the grass flourishes.

Cultivated crops can be successfully produced on most of this type, as the surface is rarely too rough for the use of machinery.

It must not be expected, however, that this type will be as productive of the general farm crops as the limestone soils. It is naturally better adapted to potatoes and other truck crops. But until such industries can be developed the general crops will be best suited to the conditions. Should potatoes be desired, they could be substituted for corn in the rotation given above.

The value of land of this type ranges from \$1 to \$8 an acre.

DEKALB SHALE LOAM.

The soil of the Dekalb shale loam consists of a silt loam with a depth of about 10 to 12 inches. This is underlain by compact silty clay loam, which grades into silty clay. The depth of the subsoil is rarely less than 3 feet, and depths of 25 feet have been reported. The color of the soil is generally light brown, although it varies from a

yellow to a brown. The color, like the depth of surface soil, has a relation to the extent of erosion, being more nearly yellow where the yellow subsoil comes near the surface. The upper subsoil is usually yellow in color, while at depths varying from about 12 to 20 inches it frequently becomes a mixture of gray and yellow, with yellow predominating. This passes into a mottled silty clay with a greater proportion of gray color, but characterized by streaks of red. The deep substratum usually is a dull gray or blue-gray silty clay.

In places the surface soil is modified more or less by the presence of sand. Shale and sandstone fragments are quite common, particularly where the ridges are not bounded by cliffs. Upon the ridges bordered by cliffs the soil is usually more uniform, although conspicuous quantities of soft shale fragments are found upon the surface.

The Dekalb shale loam is derived from the weathering of the Lee shales of Carboniferous age. In road cuts or where exposed by local erosion the rock is frequently seen. It varies from blue to nearly black in color and is usually very fine in texture, though occasionally interbedded with sandy strata.

The Dekalb shale loam is the most extensive type in the county, occupying 38 per cent of the total area surveyed. It forms the roughly rolling country of the coal fields, and is generally developed on the slopes below the Lee sandstone and above the Pennington shale or Newman limestone.

In the eastern and southern parts of the county the limestone is rarely encountered, and the type occupies all the slopes below the cliff rock. The declivity of these slopes is quite variable, but in general they are very steep. Washing, although active, does not affect the soil as much as might be expected, and the conditions form a rather sharp contrast to those on the Hagerstown silt loam, steep shallow phase.

The Dekalb shale loam was originally covered with a heavy growth of poplar, oak, chestnut, walnut, ash, and hickory, but the greater part of this has now been removed and the slopes are covered with brush and a sparse growth of timber. Of the small plants, two varieties of wild vetch thrive on this type. In places the vines of these are so thick it is difficult to get through them. Much more of this type is under cultivation than in case of the ridge types, though only a small proportion of its total extent is farmed. It is generally looked upon as the most productive soil of the coal-field region, and now that the coal and timber interests are declining it is expected that more and more of it will be utilized for agriculture. It is used for the production of such crops as corn, wheat, oats, and hay, although the acreage of wheat, oats, and hay is insignificant as compared with corn. The following yields were reported for the type: Corn,

30 to 35 bushels; wheat, 15 to 20 bushels; oats, 20 to 30 bushels; and hay, 1 ton to 1½ tons per acre.

This type, because of surface conditions, is better adapted to hay and pasturage than to the production of cultivated crops. A number of grasses, including redtop, timothy, and the clovers, will do well, and there are several valuable native grasses that take possession of the land where cleared of the brush and scattering timber growth. The grazing of sheep and cattle is therefore one of the uses to which the type is suited.

Apple and peach trees seen upon the type were thrifty and of good size. Wild-plum trees are also seen. On the basis of the farm orchard some profit might be secured from the production of these fruits, but it can not be recommended for extensive commercial fruit growing, because of the impracticability of using machinery in spraying and cultivating the trees, which must be done in order to compete with the best modern orchards. The common varieties of apples are the "Horse" apple, some russets, and the "June." These do well and give crops of reasonable certainty. Peaches are more subject to damage by frost, though the danger is less than on some of the sandier ridge soils. Forestry is another means of making much of the steeper parts of the type a source of income. Chestnut and poplar, in particular, make very rapid growth.

DEKALB SAND.

The Dekalb sand consists of a rather loamy sand of a gray to pale yellow color, with an average depth of about 8 inches. The subsoil is a yellow loamy sand, ranging in texture from fine to medium, and is underlain, generally at depths varying from 20 to 30 inches, by gray or pink sandstone. As the rock is approached, the color of the subsoil changes to pink or reddish, the latter material being often quite sticky.

The type is of very small extent and is usually developed upon the tops of ridges. On the slopes erosion has generally kept pace with the weathering of the parent rock and the type is not developed.

The original timber growth on this type was pine, but at present it supports scrub oak, chestnut, and hickory. Spring vetch is very common on this type, as it is on most of the soils derived from the Lee formation.

Very little of this soil is under cultivation. It is used chiefly for the production of corn. A little spring wheat is grown on it, but the yields are very light and it is quite rare that more than 10 bushels an acre is secured. Corn will average about 15 bushels under the most favorable conditions.

The type is generally quite loose and incoherent and crops suffer in dry weather. It is usually quite deficient in organic matter, and even

under virgin conditions, the dark-colored soil, which is coextensive with the organic content, rarely exceeds 3 inches.

Great difficulty is experienced in securing stands of grass, clover, and wheat from fall planting, and generally, if successful, the crops succumb to winter freezes. This type is particularly well adapted to the production of early truck and cane fruits. All kinds of garden produce mature much earlier here than on any other type and are of good quality, though before the Dekalb sand could be profitably utilized for this purpose it would have to be made more productive than it now is. Moreover, the demand for garden truck is purely local.

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

Mechanical analyses of Dekalb sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24754.....	Soil.....	0.3	3.6	27.1	44.0	6.6	13.9	4.8
24755.....	Subsoil.....	.4	3.2	30.1	44.0	5.9	10.1	5.9

DEKALB SILT LOAM.

The Dekalb silt loam consists of a gray to light-brown floury silt loam, from 6 to 8 inches deep, grading into a subsoil of yellow silty clay loam, which becomes more intensely yellow and heavier in texture with increased depth. The upper subsoil is quite compact, but crumbles readily. In the deeper portion, as seen in road cuts, it breaks up into cubelike blocks.

This type is derived from the decay in place of shales and sandy shales of the Lee formation. The soil mantle varies generally from 18 to about 30 inches in depth, but is occasionally much deeper. The tracts are usually of a yellowish-brown color.

The distribution and area of this type are quite limited, and it only occurs on the tops of ridges and divides in the region underlain by the Coal Measures.

The surface features vary from level to slightly undulating. Crops mature early on it and it seems to withstand drought remarkably well, but it is not considered as productive as the Dekalb shale loam which lies on the slopes.

Very little of this type is under cultivation, as there exists a prejudice against it, which can only be accounted for on the ground that it is generally too remote from the homesteads, which are usually placed near the water courses. Most of the type now is in brush or a rather sparse growth of heavy timber. The original growth consisted largely of chestnut, white oak, chestnut-oak, hickory, and scrub oak. Of the

smaller plants wild vetch, huckleberry bushes, and, less commonly, Japan clover are characteristic.

The yields of the leading crops on this type are as follows: Corn from 20 to 50 bushels, wheat 20 to 35 bushels, oats 30 to 50 bushels, and hay from 1 ton to 1½ tons to the acre. In one instance a yield of 150 bushels of Irish potatoes has been obtained on a field of this type. Even if less productive as a type than the Dekalb shale loam the fact that the greater part of it lies so well that machinery can be used in cultivating the crops and that consequently a greater number of acres can be cared for, makes it relatively a more valuable soil for cultivated crops than the latter.

Such garden truck as lettuce, cabbage, beets, and turnips do well, but they do not mature so early as on the Dekalb fine sandy loam or the Dekalb sand. The apple trees on this type were in a particularly thrifty condition, as were also the peach and plum trees. The early harvest apple is said to do best. Very few orchards are found on this type. Peaches are uncertain on account of the late spring frosts, but plums do well.

The organic content of this type, although higher than in case of the sandy types of the series, is hardly adequate for highest yields, and more should be incorporated in the form of stable manure or green manuring crops, using preferably the legumes. It would, however, be more economical and equally as satisfactory to grow leguminous crops to supply grazing for live stock and turn under the droppings together with the stubble. After this is done the soil should be handled under some system of crop rotation, such, for instance, as corn, wheat or oats, mixed grasses (timothy and clover) for hay, using the land one or two years thereafter for pasture. The productiveness subsequently can be maintained by the turning under of grain stubble and the pasture sod, and the use of clover in rotation.

The soil ought to be plowed much deeper than is the common practice, while more care should be exercised in the care of the slopes to reduce surface washing.

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

Mechanical analyses of Dekalb silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24756.....	Soil.....	0.3	0.4	0.4	9.9	9.0	64.5	14.9
24757.....	Subsoil.....	.2	.6	.4	6.2	10.2	53.1	23.7

HUNTINGTON LOAM.

The Huntington loam consists of a surface soil of heavy fine sandy loam to light loam, with a depth of about 10 inches, grading into a light silty clay loam or fine sandy clay subsoil, which usually extends to depths greater than 3 feet. The color of the soil is commonly yellowish brown and that of the subsoil more often lighter and usually yellow. In places the areas are thickly strewn with rock fragments.

This type constitutes the bottoms which border the Rockcastle River and is developed to a very limited extent in the bottoms of some of the larger tributaries of the river, more particularly Skegg Creek. The areas are not continuous, but are often cut off as the river swings against the bluffs on one side or the other. They are usually level, but sometimes slope toward the bluffs. They are rarely over one-eighth mile wide and in places are slightly exaggerated in the map on account of their agricultural importance.

The Huntington loam is of alluvial origin derived from the weathering of material which was transported and deposited by the river. Some of this type is subject to occasional overflow, but the greater part of it is above any ordinary freshet. From the textural description of the soil it will be seen that it varies considerably. The lighter soil—the heavy sandy loam—is usually found close to the river, while the heavier phases are commonly located at the foot of the bluffs, where the river currents at times of overflow were less rapid, allowing the finer soil particles to settle.

Corn is the leading product on this type, but it is occasionally supplanted by oats and hay, and during the past year experimental crops of tobacco and broom corn were tried. Corn is commonly produced year after year on this land, and in one instance an average of over 40 bushels per acre for a period covering the last 11 years has been secured. The yields in general are: Corn 20 to 50 bushels, oats from 20 to 30 bushels, and hay from 1 ton to 2 tons to the acre.

The natural pastures are said to be good in spring and fall, but are very short during hot weather. The grass used for hay is chiefly redtop. Timothy and clover are rarely used on account of occasional overflows and the freezing out of clover.

No rotation of crops is practiced and corn is usually produced year after year on the same land, but remunerative yields can not be expected indefinitely under such a system. The provident method would be to adopt a system of soil management that would at least be certain to maintain present yields, if it did not improve the productive capacity of the type.

The type in places is deficient in organic matter and here the soil is in poor physical condition. This is probably responsible in a measure for the trouble experienced in securing stands of clover.

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

Mechanical analyses of Huntington loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24780.....	Soil.....	0.1	0.2	1.2	33.2	17.2	34.5	12.7
24781.....	Subsoil.....	.1	.1	.5	26.7	15.2	36.2	21.0

PENNINGTON CLAY.

The Pennington clay consists of a yellow or reddish-yellow clay, of variable depth, underlain by tough, yellowish clay mottled with light blue. This soil is derived from the Pennington shales, which consist of thin-bedded calcareous shales and impure limestone. In places the coloring of the parent rock is red and green, as near Mount Vernon, and also near Ward, but it is more commonly a dull gray or blue. These shales are usually found at the foot of the Lee formation and above the Newman limestone and are often covered by slides of Dekalb shale loam. The materials resulting from the weathering of the Pennington shales are not often exposed and the area of the soil type under discussion is limited.

The Pennington clay is usually characterized by a growth of water-loving grasses or sedges. It is almost impervious and water that percolates the Lee formation seeps out over the clay.

The type at present has no agricultural value, as it is too wet and cold for crops, but under proper management and drainage it should be made a strong productive soil.

A patch near Mount Vernon included with a field of Dekalb shale loam was found very difficult to work, but made a good growth of corn. Drainage and the application of lime and the incorporation of organic matter would greatly improve the physical properties of the type.

LICKDALE SHALE LOAM.

The soil of the Lickdale shale loam is a grayish-yellow to light-brown silt loam, with a depth of 4 to 6 inches. This grades into a light silty clay of yellow color, which in turn passes into mottled gray and yellow silty clay, resting on the parent shale rock. The depth to rock usually varies from 12 to about 24 inches, although in many places where erosion has been severe it is exposed on the surface.

The Lickdale shale loam is formed of materials derived through disintegration and decomposition from the Waverly shales, which are of Carboniferous age. The color of the rock ranges from gray and dull olive to grayish blue. Large quantities of this shale are scattered over the surface and through the soil and subsoil.

The Waverly formation is usually encountered just below the Newman limestone and above the black shales or Chattanooga shales of Devonian age and is exposed on the slopes of valleys which have been cut through the limestone formation. It also comes to the surface in the western and northwestern part of the county where the limestone has been almost entirely removed by erosion. The soil areas, of course, coincide with the shale exposures. In the lower part of the areas of this type bordering the streams the color of the soil and subsoil depart somewhat from the average of the type. Here the color of the soil is light brown or gray, while the subsoil has a dark or grayish color mottled with dull blue. The darker color here can be attributed to excessive hillside seepage, which is very common in the type in this position.

The forest growth of the Lickdale shale loam was originally chestnut, oak, some hickory, and pine. Most of the best timber has been removed and the pine is the most conspicuous growth at present. In the undergrowth in the higher positions vetch and Japan clover are encountered, while in the lower and wetter positions broom sedge and orchard grass are common.

Little of this type is under cultivation; the higher parts are too dry for crops, while the lower sections are too wet in early spring and too dry in summer. This type has too great an extent in the area to be entirely neglected and it should be put to some profitable use. Drought seems to be the chief drawback in its use. The bulk of the water that falls is carried away through the shale by gravitation. It is suggested that immediately after plowing the land be thoroughly rolled, so as to keep the moisture from passing at once to the underlying rock, and that all subsequent working be shallow, but often enough to maintain a mulch.

Orchard grass, redtop, and alsike clover should be tried on the lower slopes, and when the soil is thin and shale close to the surface recourse should be had to grasses that will bind the soil and prevent excessive erosion in such places. English meadow fescue and Bermuda grass have been suggested as suitable for such use. These suggestions as to grasses have only tentative value; they have not been tried in this section.

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

Mechanical analyses of Lickdale shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24750.....	Soil.....	2.2	4.0	1.2	1.0	0.5	75.1	16.0
24751.....	Subsoil.....	.0	1.2	.9	1.1	.4	63.3	33.0

COLYER SILT LOAM.

The soil of the Colyer silt loam is a light silt loam of gray to light-brown color, usually free from grit. It extends to a depth of about 8 inches, when it grades into a pale yellow silty clay loam, which is underlain by black shale at depths varying from 18 to 30 inches. The soil and subsoil are quite free from rock fragments.

This type is derived from the decay in place of the Chattanooga shales of Devonian age and is developed to only a very limited extent. It occurs on the tops of ridges and the surface features are usually level to gently rolling.

Areas of this soil are found in the vicinity of Gum Sulphur and west to the county line. The type is of limited extent. There is little difference as regards texture and color between this soil and the Dekalb silt loam, but the types are derived from rocks of decidedly different character. The prevailing forest growth is composed of species of oak, hickory, and chestnut. The best of the timber has been removed. Little of this type was found under cultivation. It is very well adapted to general farming.

HAGERSTOWN SILT LOAM.

The Hagerstown silt loam is usually a brown or dark-brown mellow silt loam to silty loam, with an average depth of about 15 inches, underlain by more compact material of lighter color, which becomes heavier in texture as the depth increases. The subsoil soon changes into a heavy silty clay of brownish-yellow color, which, at depths varying from 20 to 24 inches, rests upon a light-red or brownish-red friable clay, usually extending to depths greater than 3 feet.

The soil is particularly mellow, with a prominent crumblike structure; rock fragments are uncommon either on the surface or through the profile; and the soil contains a fair supply of organic matter.

This type occupies the valley floors or depressions in the limestone country. It is derived from the decomposition in place of the Newman limestone—a formation of Carboniferous age—and where developed in depressions its origin may be traced to such decomposition, supplemented by slight wash from the contiguous limestone uplands. The depressed areas are inclined to be wet, particularly if the rainfall is heavy, but when the rainfall is light they form the most productive part of this type.

Only a small extent of the Hagerstown silt loam occurs in Rockcastle County, and nearly all of it is under cultivation. The crops grown consist of corn, oats, wheat, and hay. Small patches of tobacco, millet, and buckwheat are grown here and there. The following yields are secured: Corn from 25 to 40 bushels, wheat 12 to 25 bushels, oats 20 to 30 bushels, and hay (mixed clover and timothy) 1 to 2 tons to the acre. Tobacco will range in yield from 1,000 pounds to 1,500

pounds per acre, and buckwheat 20 to 30 bushels to the acre. Much higher yields could be secured under better management.

No definite system of crop rotation is practiced on this soil. As on most of the soils of the area, corn is the chief crop and is commonly produced year after year on the same land. When the yields begin to decrease the field is put in small grain, in which timothy and clover are sown, cut for hay, and pastured indefinitely. Either oats or wheat follows corn, and either corn or tobacco is planted after turning under the pasture sod.

Buckwheat and millet are occasionally used as catch crops when the stand of some cultivated crop is impaired and it is desired to substitute some quick-maturing crop. The need of this is usually greater during wet seasons. In the depressed or poorly drained areas these catch crops are quite necessary. Small grain in these places is apt to lodge or rust. Thorough drainage should be established in these areas by the use of drain-tile. The outlay for this purpose would soon be repaid by the increase of yields of crops.

Tobacco has so far been grown locally in an experimental way, but if the present high price for the product continues it is destined to be an important industry on this type.

The Hagerstown silt loam is well adapted to the production of grass, grain, and tobacco. It is suggested that the type be handled under a definite system of crop rotation, and that the production of corn on the same field be limited to one crop every four or five years.

This type is valued at \$15 to \$35 an acre, depending upon location with respect to market.

Steep shallow phase.—A shallow phase of Hagerstown silt loam is developed in situations much steeper than those occupied by the typical soil. It occurs on moderately steep to steep slopes in a position below the shale and sandstone formation capping the hills and giving rise to the Dekalb soils and the lower and more gentle slopes and valley bottoms occupied by the typical Hagerstown silt loam. Some of this land also is confined to low, fingerlike ridges extending out from the higher elevations.

Over most of this phase of the Hagerstown silt loam the soil is variable in depth, owing to the effects of erosion, but in its average development the phase may be described as a brown silty loam to silt loam underlain at 8 to 12 inches by slightly plastic yellowish-brown to dull-red clay. The subsoil tends to become stiffer with depth, and below an average depth of about 20 inches is uniformly a dull-red clay, which persists to bedrock lying from 24 to 30 inches beneath the surface. In some patches, especially where the underlying rock comes near the surface, the subsoil has almost the brick-red color of the Decatur soils. Like the typical soil, this phase is derived from the Newman limestone. Some colluvial material from the higher-

lying Dekalb soils has accumulated in places, but not over sufficiently large areas or in large enough amounts to be recognized as a distinct phase.

Limestone ledges which are of frequent occurrence locally interfere with cultivation. Away from the comparatively narrow limestone ledges the soil is not sufficiently stony to be described as a stony loam, although there are local areas where stones are present in excessive amounts, usually as the result of the slumping of rock from the higher-lying sandstone formations. Excessive erosion on the steeper, cleared slopes has washed the soil away in some places, leaving the bedrock exposed or bringing it quite near the surface. Owing to this liability to severe washing the steeper areas either should be used for forestry and pasturage, or, if cleared, they should be seeded to grass or set to fruit or handled so as to hold the soil in place.

A considerable part of the phase, however, is sufficiently gentle in slope to admit of cultivation, and in view of the high productivity of the soil such areas constitute quite valuable agricultural lands. The soil works up well, making it a very easy matter to maintain an excellent tilth. Where the rock comes near the surface the drainage is somewhat excessive, causing crops to suffer in such spots during droughty seasons. At present only a small proportion of the soil is under cultivation. This is used for corn, wheat, and grass (timothy and clover). The commonly credited yields are 25 to 50 bushels of corn, 15 to 25 of wheat, 20 to 40 of oats, and 1 ton to 3 tons of hay to the acre. The quality of wheat and oats grown on this soil is said to be exceptionally good. Apples and plums do well. The Winesap and Ben Davis are common varieties. Peaches are liable to injury from late spring frosts. Bluegrass does well everywhere when given a fair chance; orchard grass, vetch, and Japan clover also thrive. Broom grass grows in common in old fields. It has been the general practice of many farmers on this land to cultivate to corn as long as the yields were satisfactory, then to turn the fields out to grow up in brush. Cultivation with 1-horse plows is probably the most practical method of handling most of those fields that would be classed as best suited to farming, while hand cultivation is the only safe plan in a considerable number of the steeper sloping fields. A comparatively small area has been included under this phase which is well suited to plows, cultivators, or disk harrows intended to cover a wide strip of ground. However, harvesting machinery and combination plows and cultivators can be used, and sometimes are used, over certain areas with gentler rolling surfaces.

The main timber growth is oak, chestnut, hickory, poplar, sugar maple, cedar, and walnut. Cedar is quite a conspicuous growth in abandoned fields. A large part of the merchantable timber has been removed.

CLARKSVILLE SILT LOAM.

The soil of the Clarksville silt loam consists of a gray or light-brown floury silt loam, with a depth of 10 to 20 inches. This material passes into a pale yellow silt loam or silty clay which persists to depths ranging from 20 to 30 inches. The deeper subsoil has always the heavier texture. This lower heavier material is at first yellow, but gradually changes to a yellowish-red and then to a dull-red color. Upon the surface and through the soil mass occurs a scattering of chert fragments. The proportion of rock fragments on the surface is greater where they accumulate in the upper parts of draws.

The type is derived largely from the weathering in place of the basal portion of the Newman limestone formation. This rock consists of a cherty limestone and is gray or dull blue in color and very hard.

The Clarksville silt loam occupies level to undulating uplands. The surface in general has the features of a plain, and this topography is attributed to the great resistance offered to erosion by the parent rock. The streams when they have cut through the rock are usually approached by rather abrupt slopes. The red clay referred to is usually seen in the deeper road cuts or where the type is shallow and in areas exposed by surface washing. It appears to be more extensively developed where the rock was more calcareous and less siliceous in composition.

The largest area of the Clarksville silt loam occurs on what is locally known as Brindle Ridge, but it is typically developed on the uplands south and east of Nigger Creek, and less so on the ridge south and north of Tarklin Branch, where it was difficult to establish boundary lines between it and the lower-lying areas derived from the Waverly shales. A part of the type, as in the vicinity of Bee Lick, known as the "Glades," might be considered as a phase, inasmuch as it is underlain by sandstone and shales of the Waverly formation. The soil here, except in places where the subsoil is pinkish, is identical in physical characteristics with the typical Clarksville silt loam and also has the same surface configuration and apparently the same agricultural value. It would seem that the soil of this phase is derived largely from the Newman limestone, which has completely weathered through to the underlying sandstone and shale. Some of the sandstone is pinkish or reddish in color, and a soil derived from these rocks would probably have a reddish subsoil and not the prevailing yellow subsoil of this phase of the type.

Throughout the Clarksville silt loam there occur local depressions too small to map in which the soil resembles the Guthrie silt loam. The most important of these occur 3 miles north of Hiatt. Here the immediate subsoil is mottled yellow and gray, and the areas need draining.

The crumbly structure so essential to good tilth is well developed in the Clarksville silt loam, particularly when the soil contains a fair supply of organic matter. The type is retentive of moisture and crops rarely suffer during seasons of drought. On the other hand, they are frequently injured by excessive rainfall where there is not enough slope to the surface. The type is easy to cultivate and responds readily to judicious treatment. About 25 years ago most of the type was considered so unproductive that the greater part of it was practically abandoned. It had been used for the continual production of corn, and as the yields declined the fields were thrown out of cultivation and were taken possession of by briars and sassafras thickets. At this time the ordinary yield of corn was 5 bushels and of oats 10 bushels, and it was practically impossible to get a stand of wheat or timothy. The clean culture which it had received up to this time had put the soil in such poor physical condition that when it was plowed it would not scour and appeared to have more clay in it than now. Later redtop grass was sown, and although the stand was light there was no difficulty afterwards in deep plowing or in securing stands of timothy and clover. It was largely the use of timothy and clover that built up the productiveness of the soil to a point where it is now considered the most important type in the county, although it does not have the extent of some of the soils. It is estimated that fully three-fourths of the county's output of general crops is produced on this soil.

Most of the Clarksville silt loam is now under cultivation. It is used for the production of wheat, oats, corn, hay (timothy and clover), and to a more limited extent for tobacco, potatoes, and garden truck. The ordinary yields are as follows: Corn, 40 to 60 bushels; oats, 20 to 35 bushels; wheat, 12 to 20 bushels; hay (timothy and clover), 1 ton to 2 tons; tobacco, 1,100 to 1,500 pounds; and potatoes, 50 to 100 bushels per acre.

In the last few years the practice of rotating crops has become more and more general, but there is much of this type that is still used year after year in the continuous production of corn. The rotation most generally used consists of corn, wheat, oats, and grass (timothy and clover), the last pastured from one to three years. The tobacco acreage is usually restricted to small patches, and there is no provision made for it in the rotation. On a great deal of this type, however, corn follows corn for three or four years, the land then being put in grain, in which timothy and clover is sowed. After the hay crop has been removed the fields are left in pasture for two or three years and again put in corn. Under systematic treatment the type responds wonderfully. The maximum yield of corn reported is 100 bushels, while mixed hay (timothy and sapling clover) has given as high as 5 tons to the acre. On the same land wheat was unsatisfac-

tory, being damaged by freezing. The organic content of the soil in this case was high and the trouble with wheat can be in part attributed to this, as the soil was open and inclined to be spongy and promoted heaving. Where there is no definite rotation practiced less trouble is experienced in growing wheat, but the yields of corn and hay are much less.

In cultivating this type the maintenance of yields is not alone placed in the use of clover and the turning under of grain and grass sod, as in addition considerable commercial fertilizer is used. The fertilizer commonly used, where the soil has a high organic content, gives a marked increase in yields, but the increase is not so satisfactory when the soil is deficient in humus or humus-forming material.

It is generally believed that as good results can be secured by the use of stable manure as with fertilizers, but the supply of the former is so inadequate that recourse must be had to commercial mixtures.

This type is well adapted to the production of general farm crops, but to develop and maintain the yields of crops it is suggested that the practice of rotating crops systematically be more generally adapted. Land of this type ranges in value from \$30 to \$100 an acre.

HOLLY SILT LOAM.

The Holly silt loam consists of a gray to light-brown, rather compact, silt loam, with an average depth of about 6 inches, although much greater depths are occasionally encountered. The surface soil passes into a grayish silt loam subsoil of the same texture as the soil, but more compact and generally mottled with yellow and brown colors. At depths ranging from 12 to 24 inches the subsoil sometimes passes into light silty or fine sandy clay, mottled yellow and gray, and as the depth increases the clay content becomes slightly greater and the color gray, drab, or dull blue.

The soil and immediate subsoil are usually quite uniform throughout the county, but the deeper subsoil is not generally so, as occasional layers of sand, sand and gravel, or coarse sandy clay are encountered.

The soil is usually cold and clammy, and the subsoil is frequently saturated with water. Shale fragments are quite conspicuous on the surface and through the soil mass, particularly where the areas are in contact with the Waverly shale formation, which is more commonly the case along the smaller streams.

The Holly silt loam occupies the first or overflow bottoms along the northern part of Roundstone Creek and its branches, and along Dick River and Copper Creek and their tributaries. It is an alluvial soil derived from material transported and redeposited by the streams. The type is poorly drained.

Under favorable conditions this soil is used for the production of hay. Redtop does very well, as it is adapted to moist soils. Where

the areas are well ditched and the season is dry, crops of corn and oats can be successfully produced. The following yields are secured: Corn 20 to 50 bushels, oats 15 to 50 bushels, and hay 2 tons to the acre.

The highest yields are obtained where fertilizers are used. Wheat, clover, and timothy are rarely planted on this type of soil and then only where it is well drained.

On a farm near Wildie the type was practically a swamp until main ditches were dug and tile drains led into these. The results have more than compensated for the outlay. Where formerly crops could not be depended upon, the land is producing corn, tobacco, wheat, oats, timothy, and clover, with the following yields: Corn 55 bushels, wheat 22 bushels, oats 40 bushels, tobacco 1,200 to 1,500 pounds, and hay (timothy and clover) 2 tons to the acre. This is a good indication of what this soil will do without fertilizer when properly reclaimed.

Mechanical analyses of Holly silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24772.....	Soil.....	0.0	0.1	0.2	0.6	2.6	83.1	13.3
24773.....	Subsoil.....	.0	.1	.3	1.5	5.3	78.1	14.3

ELK SILT LOAM.

The Elk silt loam consists of a grayish-yellow to light-brown silt loam, with a depth of 6 to 12 inches, underlain by more compact material of same texture, but of lighter color. This passes gradually into a pale yellow silty clay, which persists to depths of 4 feet or more, where it frequently rests upon a bed of gravel or sand and gravel. Well-rounded fragments of shale, limestone, and sandstone occur through the soil material and scattered upon the surface. This type occupies well-defined second-terrace areas between the Holly silt loam and the Lickdale shale loam, paralleling parts of Roundstone and Copper Creeks and Dick River. It is an alluvial soil formed of materials transported, sorted, and deposited upon earlier flood plains of these streams.

The surface of the Elk silt loam in general is flat and inclined slightly toward the streams. The slope in places is so slight that the type is inadequately drained.

The Elk silt loam is used largely for pasture or for the production of hay (redtop). Better areas are generally planted in corn and less commonly in wheat and oats. A few experimental crops of tobacco were grown during the present season (1910). The following yields are secured: Corn from 15 to 30, wheat 10 to 15, and oats 15 to 25 bushels, tobacco 600 to 800 pounds and hay 1 ton to 1½ tons to the acre.

As in case of most of the other types in this area, systematic

rotation is not practiced on this soil, and as locally described most of it has been "corned to death." The type is naturally well adapted to the general farm crops, and though much of it is in need of drainage, this can generally be supplied with very little expense by opening a few main ditches or by tiling. The well-drained areas have been used so long for the production of cultivated crops under lax methods of management that the tilth is impaired and there is a noticeable lack of organic matter. This type responds well to judicious treatment and ought to produce much better crops than it generally does at present.

After draining the depth of plowing should be gradually increased, organic matter in the form of stable manure should be generously supplied, or, if this is not available recourse should be had to green manuring crops.

Some difficulty is expected in securing stands of the legumes, and it is suggested that the fields intended for these crops be limed and inoculated. Once a success is made with any green manuring crop, the fields should be put in timothy and clover and after the hay is removed the land should be maintained as pasture for two years and thereafter cropped according to some systematic rotation.

This type ranges in price from \$15 to \$70 an acre, depending upon location and condition as to drainage and improvements. It is more valuable in the town of Brodhead than in other parts of the county.

Mechanical analyses of Elk silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24774.....	Soil.....	1.3	2.3	1.8	4.1	2.3	75.8	12.1
24775.....	Subsoil.....	1.0	1.2	1.1	2.4	2.5	74.7	17.0

GUTHRIE SILT LOAM.

The Guthrie silt loam consists of a floury light-gray to nearly white silt loam, from 4 to 10 inches deep, underlain by more compact material of same texture, but of a mottled gray, brown, and yellow color. This grades imperceptibly into mottled silty clay which extends to a depth of 8 feet or more. This type has a very limited distribution in this county, being confined to small areas in the western part. It is usually associated with the Clarksville silt loam.

The Guthrie silt loam in general occupies level or depressed areas and represents the material of surrounding soils changed by imperfect drainage. It is usually cold and clammy and it is not uncommon for the subsoil to be saturated with water. When this condition prevails the type is usually used for pasture and hay (redtop). Where

it is naturally better drained or artificial drainage is established it is used for the production of general farm crops, such as corn, oats, wheat, and grass (timothy and clover). The following yields without the use of fertilizer were reported: Corn 10 to 15 bushels, oats 8 to 10 bushels, wheat 2 to 5 bushels, mixed grasses (timothy and clover) 1½ tons, and straight timothy three-fourths ton to the acre. With the use of 200 pounds of fertilizer to the acre for corn, oats, and wheat and an additional 100 pounds of bone dust for wheat these yields are increased as follows: Corn 40 to 50 bushels, oats 30 to 40 bushels, and wheat 15 to 25 bushels per acre. When grass follows the small grain so treated, mixed hay gives a maximum yield of about 3 tons to the acre. The same or better results can be attained by the use of stable manure, but the available supply is wholly inadequate and dependence must be placed at present upon commercial mixtures.

Up to a few years ago this type was used for the continual production of corn, and when yields declined the fields were seeded to clover and timothy for hay and subsequently pastured for three or four years. This has given way to a better practice and the following rotation is in general use, with crop yields improving from year to year: Corn, wheat, and grass (timothy and clover); after hay has been removed the fields are kept in pasture for about two years and then put back in corn.

The value of this type ranges from \$10 to \$100 an acre, depending mainly upon the location.

ROCK OUTCROP.

The Rock outcrop consists of ledges and cliffs of sandstone, sandy shale, and conglomerate in the region occupied by the Coal Measures. These exposures vary from a few feet to as much as 60 feet in vertical extent and are indicated by symbols on the map. Under this head are also mapped outcropping areas of limestone and of the Rockcastle conglomerate, particularly in the vicinity of Sinks, Mullins, and Brush Creek. These rocky areas have no agricultural value.

ROUGH STONY LAND.

Rough stony land includes those rough stony areas in the Coal Measures region characterized by large fragments of sandstone and conglomerate. In the limestone area they are indicated by very thin soil and numerous outcropping limestone ledges.

Such areas are in general of no agricultural value. They afford some rather inferior pasturage, and should be used for forestry.

SUMMARY.

Rockcastle County, Ky., lies in the south-central part of the eastern half of the State, on the western border of the Appalachian coal field. The mean elevation is between 1,000 and 1,300 feet, with some hills rising from 200 to 300 feet higher.

Mount Vernon, the county seat, situated in the central part of the county, is by rail 130 miles from Louisville, 160 miles from Cincinnati, and 147 miles from Knoxville.

The greater part of the county is hilly or roughly rolling and there is comparatively little level country within its limits.

The greater part of the watershed belongs to the Cumberland system, the main stream being the Rockcastle River; the remainder drains to the Kentucky River through Dick River.

The county is rather sparsely settled in the Coal Measures and more thickly settled in the limestone region.

The climate of the county is temperate. The growing season varies from five and one-half to six months. Lumbering and coal mining have been the dominant interests until recently, but attention is again being given to agricultural pursuits and considerable progress has been made. Corn, wheat, oats, and hay are the leading crops. These are supplemented by millet, Irish potatoes, sweet potatoes, sorghum, tobacco, rye, buckwheat, and broom corn, in order of their respective importance.

Fifteen types of soil, including the miscellaneous types, Rock outcrop and Rough stony land, occur in Rockcastle County. All but three are residual types—that is, derived from the weathering in place of the underlying rocks. The remaining soils are stream-bottom, or alluvial, types.

The Dekalb shale loam has the most extensive distribution of any soil in the area. It occupies hilly uplands and erosion makes it poorly adapted to the production of intertilled crops. It is better suited to the production of forage crops and pasturage. Some areas can be used for fruit culture.

The Dekalb silt loam is an inextensive type. It has better surface features than the preceding soil and can be profitably utilized for the production of corn, oats, and wheat in addition to grass and apples.

The Dekalb fine sandy loam and Dekalb sand occupy the tops of ridges underlain by the Coal Measures. They are adapted to light farming or the production of truck and fruit.

The Pennington clay is a type of small extent and very little of it is under cultivation. Where drained it produces good crops of corn and grass.

Little of the Colyer silt loam was found under cultivation. It is well adapted to general farming.

The Hagerstown silt loam is developed to considerable extent throughout the county. It produces good crops of tobacco, corn, wheat, oats, and hay.

Very little of the Lickdale shale loam is under cultivation. It occupies the valley slopes in the Waverly formation. It is subject to severe surface washing and crops planted on it suffer in spring from seepage and in dry weather from lack of moisture.

The Clarksville silt loam is the most important type in the area. At present fully three-fourths of the agricultural output is produced upon it. It is used for tobacco, wheat, oats, and grass, for which it is well adapted.

The Guthrie silt loam is derived largely in the same manner as the Clarksville silt loam, but has been modified by imperfect drainage. Where well drained it is used for grass and grain.

The Huntington loam is an alluvial soil used largely for the production of grass. In favorable seasons good corn crops are grown on it.

The Holly silt loam occupies the first or overflow bottom of Dick River and its tributaries and the north part of the Rockcastle River system. It is used for pasture and the production of hay. When well drained it is a strong soil for corn, wheat, oats, grass, and tobacco.

The Elk silt loam is an alluvial soil occupying second terraces above the Holly silt loam. This type at present is run down as a result of continual cropping to corn. With careful treatment it can be built up to a good state of productiveness. Part of the type is imperfectly drained.

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