

larger streams the bottom land attains a width of one-half mile to 1 mile or more and in such cases much of it is composed of terrace or second-bottom areas. Where streams have cut their way through massive sandstone strata the first bottom is usually lacking and the second bottom is found surmounting the rock strata. Viewed from the highest peaks the tops of the ridges conform to a general line, and show very plainly that they are a remnant of a plateau that has been dissected by erosion. In general the western half of the area is not so rough as the eastern half, the ridges are broader, the hill-sides more gently sloping, and the valleys contain more bottom land. Along the tributaries of the larger streams and along the "Break" and east of the "Break" the country is very broken, and abrupt rock cliffs are common along the streams.

The lowest point—the water level of the Little Kanawha River where it leaves the area—is about 600 feet above sea level, and the highest point in the area, Mule Knob, in the southern part of Calhoun County, is 1,550 feet above sea level. Several high knobs occur over the area, such as Weedy Knob, 1,450; Desert Knob, 1,400; Nichols Knob, 1,250; and Kite Knob, 1,269. The most of these knobs are found in the southeastern part of the area. The general level of the hilltops of the area is about 900 to 1,100 feet above sea level, and the difference between the hills and valleys ranges from 100 to 400 feet.

All the drainage waters of the area find their way into the Ohio River through the Little and Great Kanawha rivers. The divide between the drainage systems of these two streams passes through Roane County in a general east-and-west direction just south of Clarence and Speed; turning in a southeast direction north of Roxalana it strikes the Roane-Calhoun county line south of Tariff and follows that line to the Kanawha County line. The Little Kanawha and its tributaries drain the greater portion of the area. This river flows in a northwesterly direction through the northern part of the area. The West Fork of the Little Kanawha River forms part of the line between Roane and Calhoun counties, Henry Fork of the West Fork drains the southern end of Calhoun County, and Beech Fork receives drainage from both Roane and Calhoun counties. The northern part of Roane County is drained into the Little Kanawha through Reedy and Spring creeks. The most of Wirt County and the northern part of Calhoun is drained through small streams directly into the Little Kanawha River. The southern part of Roane County is drained by Pocatalico River and Big Sandy Creek, which empty into the Great Kanawha River.

Most of the early settlers came from Virginia, with a few from North Carolina, Maryland, and Pennsylvania. The first settlements in the area were made along Reedy Creek and the Little Kanawha River, between 1775 and 1790. The other parts of the area were

settled gradually in the ensuing thirty years. The town of Elizabeth was founded in 1806. The first settlement in Roane County was made where Spencer now stands, in 1812; and the first in Calhoun County was made on West Fork in 1811. The early settlers were mostly hunters, trappers, and woodsmen, and only cleared small patches to grow a few necessaries for home consumption. The western part of the area developed more rapidly than the eastern part, as the conditions in the former section were more favorable to agricultural development. The grazing of cattle became the chief source of income in the western part, while lumbering became the chief occupation of the eastern part.

The discovery of oil in paying quantities near Burning Springs, in Wirt County, in the early sixties attracted large numbers of people from Pennsylvania and Ohio. Since the discovery of oil on Flat Fork, Roane County, in 1897, and the subsequent opening of other fields many have come into the area from adjoining counties and exhausted oil fields.

Nearly all the rural population are descended from the original settlers, and only a few negroes are found in the area. The inhabitants of the eastern part of the area are confined largely to the stream valleys, and the hills are pretty well covered with timber; the western part is largely cleared and in pasture.

The following table shows the growth in population of the counties comprised in the Spencer area, according to the returns of the federal census:

Counties.	1850.	1860.	1870.	1880.	1890.	1900.
Calhoun.....		2,502	2,939	6,072	8,155	10,266
Roane.....		5,381	7,232	12,184	15,303	19,852
Wirt.....	3,353	3,751	4,804	7,104	9,411	10,284
Total.....	3,353	11,634	14,975	25,360	32,869	40,402

Spencer, the county seat of Roane County, has a population of about 3,000, and is the most important town in the area. It is the terminus of the Ravenswood and Spencer branch of the Baltimore and Ohio Railroad, a distributing point for the oil fields in Roane County, and an important cattle-shipping point. Reedy is a small but important town in Roane County. It has about 600 population and is situated upon the Baltimore and Ohio Railroad about 10 miles north of Spencer, in the heart of a good farming country. Newtown and Walton are other small towns in Roane County. The latter is the center for the Rock Creek oil field. Elizabeth, the county seat of Wirt County, has a population of about 1,000 and is situated on the Little Kanawha River and Little Kanawha Railroad. Newark, Creston, and Burning Springs are small towns in Wirt County, all situated upon the Little Kanawha River. The latter place is at the head of navigation of that stream. Grantsville, the county seat of

Calhoun County, has a population of about 500, and is situated on the Little Kanawha River. Arnoldsburg is the next town of importance in Calhoun County.

The oil and gas business and allied industries represent the most important interests in the area. The oil industry is confined largely to the region of the "Break." The Rock Creek and Triplet fields are producing large quantities of oil and are among the largest producing fields in the country. The development of the new oil fields in the southern part of Roane County is being pushed very rapidly and is giving employment to thousands. There are a great many small oil fields in Wirt County, but the most of them have decreased in production or failed entirely. Large quantities of gas are produced in Wirt and Calhoun counties, and carbon black is an important manufactured product.

Coal occurs in small quantities in nearly all parts of the area and is mined on a small scale for local use. In the southern part of Roane County considerable coal is mined, though the output does not supply the local demand. Sandstone suitable for building purposes occurs in nearly all parts of the area, and is quarried in many places. Along the tributaries of the Little Kanawha in Calhoun County lumbering is quite an industry.

The area is not very well supplied with transportation facilities, only two spur lines of railroad entering it. The Spencer and Ravenswood branch of the Baltimore and Ohio Railroad connects with the main line at Ravenswood, and the Little Kanawha River Railroad runs from Palestine, in Wirt County, to Parkersburg. This gives direct connection with Pittsburg and the large cattle markets of the East. In addition, the Little Kanawha River is navigable up as far as Creston, and small boats ply between Creston and Parkersburg, where they connect with boats on the Ohio River.

The public-road system of the area is very good, except for the main roads that lead from the distributing points to the oil fields. These have been deeply cut and worn by the continued heavy hauling, especially where the roads traverse red clay soils. During dry weather in summer and fall the roads are usually in good condition. Most of them follow the valleys or ridge tops.

Nearly all small towns are connected with telephone lines and most of the farm houses have telephones. The same cooperative system that is found in eastern Ohio and the part of West Virginia bordering the Ohio River is found in this area, and is very cheap and efficient. The lines are usually owned by the patrons.

CLIMATE.

The climate of the Spencer area is ideal for general farming. A few cold spells occur during winter, when the temperature may fall to zero or below, but they are of short duration. The mean for the

two coldest months, January and February, is about 32° F., while the absolute minimum recorded at the Glenville station in eighteen years is -29° F. The summers are warm, but not excessively hot. The mercury never rises above 100° F. The annual average temperature is 52.5° F. The annual rainfall, about 40 inches, is well distributed for agriculture, the heaviest precipitation occurring during the growing season, June and July, and the least during September, October, and November, during the harvest season. Cattle can be pastured during eight months of the year, and it is not necessary to keep them closely housed during the winter, as the snowfall is not heavy and melts very quickly, remaining on the ground only a few days.

The alternate freezing and thawing common to this section is a great benefit to the soil, improving its physical condition and putting it in splendid tilth for crops the following spring, especially if the subsoil has been exposed by plowing during January and February.

The following tables give the normal monthly, seasonal, and annual temperature and precipitation as recorded by the U. S. Weather Bureau stations at Spencer, Creston, Ryan, and Glenville,^a and the average dates of first and last killing frost:

Normal monthly, seasonal, and annual temperature and precipitation.

Month.	Spencer.		Creston.		Ryan.		Glenville.	
	Tem- perature.	Precipi- tation.	Tem- perature.	Precipi- tation.	Tem- perature.	Precipi- tation.	Tem- perature.	Precipi- tation.
	° F.	Inches.						
December.....	35	2.8	35	2.6	36	3.4	35	4.0
January.....	34	3.9	32	3.2	33	3.5	31	3.8
February.....	30	2.9	30	2.1	31	2.7	31	4.0
Winter.....	33	9.6	32	7.9	33	9.6	32	11.8
March.....	47	5.6	50	4.9	47	5.4	42	4.2
April.....	50	2.9	53	3.0	52	3.4	52	3.7
May.....	60	4.1	62	4.0	63	3.8	62	4.0
Spring.....	52	12.6	53	11.9	54	12.6	52	11.9
June.....	68	4.8	70	4.4	69	4.6	69	5.0
July.....	73	6.2	74	4.3	73	4.8	76	5.4
August.....	72	3.1	72	3.7	71	4.4	73	3.6
Summer.....	71	14.1	72	12.4	71	13.8	73	14.0
September.....	63	2.8	67	2.4	67	2.2	67	3.1
October.....	51	2.2	53	2.7	53	3.1	54	2.5
November.....	42	1.7	42	1.6	42	1.8	42	3.6
Fall.....	52	6.7	54	6.7	54	7.1	54	9.2
Annual.....	52	43.0	53	38.9	53	33.1	52	46.9

^a The data for the Glenville station is based on records for eighteen years and the other stations for five years.

Average dates of last killing frost in spring and the first in fall.

	Spencer.		Creston.		Ryan.		Glenville.	
	Last in spring.	First in fall.						
Average.....	May 5	Oct. 9	Apr. 30	Oct. 15	May 8	Oct. 10	Apr. 25	Oct. 18

AGRICULTURE.

The early settlers were not agriculturally inclined, and lived mostly by hunting, trapping, and lumbering. They cultivated small patches and kept a few cattle. Agriculture developed more rapidly along the lower part of the Little Kanawha River in Wirt County and Reedy Creek and adjoining country in Roane County than in the interior and rougher sections of the area. The settlers were attracted to this section by the rich bottom land and the red limestone land that is so well suited for grazing. The first crops grown were wheat and corn for home consumption. Later on wheat was grown for local markets, but with the building of railroads and the opening of the West wheat production decreased, as the farmers of the area could not meet the competition of the western wheat growers. Corn is still grown to a considerable extent, mostly upon the bottom land, and is the most important crop of the area. Oats have increased in about the same proportion that wheat has decreased.

The opening of the Staunton and Parkersburg turnpike, in 1850, was a great impetus to agriculture, especially to cattle raising, in Wirt County. The Glenville, Ripley, and Ohio turnpike, completed in 1855, and the Ravenswood and Spencer turnpike, in 1860, were instrumental in opening Calhoun and Roane counties. The completion of the Ravenswood and Spencer branch of the Baltimore and Ohio Railroad, in 1891, and the Little Kanawha Railroad, in 1898, were both important factors in the industrial and agricultural development of the region. The oil and gas industry has diverted attention from agriculture and taken labor from the farm, but has compensated somewhat by enhancing the value of farms and farm products.

From the early fifties until a few years after the civil war tobacco was an important crop, but its culture was discontinued when the war tax was placed upon tobacco in the sixties. About 1880 tobacco began to be grown again to a considerable extent, but the production was lowered by the low prices that prevailed from 1890 to 1900, and only in the last few years has this crop been produced to any appreciable extent, and the output has never been as great as it was before the civil war. The growing of tobacco has been con-

fined mostly to the limestone ridges in the northwestern part of the area. White and Yellow Burley are the varieties grown.

Oats are grown to a limited extent, and rye and barley are grown very little. Extensive areas are in bluegrass pastures, and large quantities of timothy hay are produced and fed to stock, generally upon the field where it is cut. Peavine and timothy hay is grown to a limited extent. Very little buckwheat or millet is grown. Sweet potatoes are produced to a considerable extent on the sandy terrace soils in the southern part of the area.

The following table gives the acreage and production of the principal crops grown in the Spencer area, according to the census of 1900:

Acreage and yield of principal crops.

County.	Wheat.		Corn.		Oats.		Clover.	
	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Tons.</i>
Calhoun.....	5,722	41,070	13,537	348,970	733	9,220	128	94
Roane.....	12,539	88,720	24,787	546,790	1,140	13,430	463	365
Wirt.....	7,577	61,510	12,327	274,670	915	11,850	537	434
Total.....	25,838	191,300	50,651	1,170,430	2,788	34,500	1,128	893

County.	Cultivated grasses.		Tobacco.		Potatoes.		Miscellaneous vegetables.	
	<i>Acres.</i>	<i>Tons.</i>	<i>Acres.</i>	<i>Pounds.</i>	<i>Acres.</i>	<i>Bushels.</i>	<i>Acres.</i>	<i>Value.</i>
Calhoun.....	8,118	5,809	52	29,270	397	28,360	513	\$27,649
Roane.....	13,257	8,979	30	9,940	609	40,683	536	28,769
Wirt.....	6,942	5,297	250	160,940	506	30,516	490	21,632
Total.....	28,317	20,085	332	200,150	1,512	99,559	1,539	78,050

Small orchards are found on nearly every farm, but there is no commercial fruit growing in the area. Apples and peaches are the principal fruits. Rome Beauty, Ben Davis, Black Ben Davis, Grimes Golden, Baldwin, Northern Spy, and Russets are the leading varieties of apples. Peaches do best upon the limestone ridges. Elberta and Crawford (late and early) are the principal sorts. The former is the best shipper. Plums do well and are found in every orchard. Bartlett and Kieffer pears are grown, the former giving the best satisfaction, as it is resistant to blight. Niagara and Concord are the principal varieties of grapes. The orchards are usually situated convenient to the houses and with little regard to soil and exposure. They receive little care, are not properly pruned or sprayed, and usually are in bad condition. The most serious troubles so far encountered in growing fruit are frost, which injures the young fruit, and winterkilling of the trees.

Stock raising became an important industry as early as 1840, but it was not until the passage of the stock law, in 1885, that any

progress was made in the way of purebred cattle. Before the days of railroads the cattle were driven overland to Baltimore and other eastern markets. The first pure breed of cattle to be introduced in the area was the Shorthorn, about 1880. Next was the Hereford, about 1895, and next the Polled Angus, about 1899. The Herefords seem to be giving the best results, but the purebred cattle are about equally divided between the three breeds. The Hereford and Polled Angus are strictly beef cattle, and the Shorthorn is a dual-purpose breed. There are no large dairy herds in the area, and no cattle are bred for that purpose. The growing of cattle for beef is the most important industry in the area, and many blooded herds are found. All the purebred cattle were introduced near Spencer, and that place is now the center of the cattle business. Large numbers of cattle are shipped from the area each year. The most of them go to Ohio dealers, who finish them on corn and later sell them mostly in the Pittsburg and Baltimore markets.

The raising of sheep became an important industry some time between 1860 and 1870, and continued important until about 1890, when the low price of wool caused a marked decline in the flocks. Sheep do not pay as well as cattle, and, moreover, they injure bluegrass sod by close cropping and cause it to deteriorate rapidly. In the rougher portions of the area a great many sheep are raised. The first pure strain of sheep introduced into the area was the Merino, about 1890, near Garfield, Wirt County, followed by the Southdown, introduced near Spencer, in 1895. Merinos are not raised much now, as they do not thrive under the local climatic conditions. The Southdown is a hardier breed, gives good wool, and is the principal sheep raised in the area. Shropshires are used for both wool and mutton.

Hogs are raised in all parts of the area for home consumption and for local markets, but none are shipped from the area. A few horses are raised, though not enough to supply the local demand. Goats are raised in small numbers in the rougher portions of the area. They are used by many farmers to keep down the weeds and brush in pastures. Chickens and turkeys are raised in large numbers, and a great many of the latter are shipped to outside markets.

The value of the red land for grazing purposes is recognized, and upon this soil stock raising has been largely developed. Wheat is usually grown upon the red ridges, corn upon the bottom land, and tobacco on the limestone ridges. Alfalfa is grown to a small extent on the limestone land. In general, the soils are too shallow and the subsoils too impervious for the successful growing of alfalfa.

Rotation of crops is practiced to a certain extent upon the upland. Corn is rarely planted in the same fields two years in succession, except upon bottom land. A popular and good rotation for the upland in general is corn, followed by wheat or oats and then by tim-

othy or red clover and bluegrass. The wheat is sown on the corn stubble, and the timothy and bluegrass are sown after harvest. The timothy is cut until it begins to fail. It usually lasts four to six years, and the land is then used as pasture. Red clover is sown instead of timothy when pasture is wanted sooner, as the red clover will all disappear before the third year. A rotation used on bottom land where mowing land is desired is corn, oats, and timothy. Timothy and cowpeas are often sown at the last working of corn and make splendid hay. Cowpeas, soy beans, and vetch should be used more freely in rotations, especially the latter, which makes an excellent winter cover crop. A rotation used in bringing newly cleared woodland into pasture is: Corn, two years; wheat, bluegrass, and red clover, sowing the grass seed, usually red clover, with wheat to protect the bluegrass until it becomes established. The agricultural methods used by the more advanced and successful farmers are admirably suited to the conditions of the country. Stock is usually fed upon the ground where the hay is cut, thus returning practically all the plant food to the soil. The hillsides are kept in woodland, where not in sod. Very little attempt is made to cultivate these steep areas except in reclaiming them for pasture. The country is well suited to the growing of apples, but very little attention is paid the orchards. The area is best adapted to stock raising, and the best farmers have reduced the production of cattle to a science.

The rapid development of the oil fields has taken much efficient labor from the farm. Farm labor is paid \$20 to \$25 a month with board, 75 cents a day with board, or \$1 a day without board. The same class of labor in the oil fields receives \$2 a day. According to the census of 1900, 69.7 per cent of the farms are operated by owners and a large part of the field work is done by the family of the operator, very little outside help being used on the farms. In renting hill land, where the owner furnishes teams, tools, and land, the renter the work and seed, each receives one-half the crops. In bottom land the owner furnishes land only and receives one-half the field crops.

The following table gives the average size of farms, acres in farms, and value of farms and equipment, according to the Twelfth Census:

County.	Average size of farms (acres).	Acres in farms improved.	Total acres in farms.	Value of farm lands and improvements except buildings.	Value of farm buildings.	Value of implements and machinery.	Value of live stock.
Calhoun.....	92.6	70,321	155,046	\$1,277,400	\$407,360	\$57,270	\$369,164
Roane.....	100.6	166,074	284,269	2,706,030	697,060	107,880	855,337
Wirt.....	80.7	72,185	123,295	1,292,880	377,720	63,080	357,787
Total.....		308,580	562,610	5,276,310	1,482,140	228,230	1,582,288

In a country where the chief interest is the grazing of live stock the maintenance of good bluegrass sod is very important. The average life of a bluegrass sod in this section usually ranges from ten to forty years, depending upon the soil and the treatment it has received. Sods should be watched very closely and all dead spots reseeded before erosion begins. The application of lime (slaked or agricultural), floats (ground phosphate rock), ground limestone, or ground bone, in small quantities, will rejuvenate a sod and keep it in a flourishing condition for a number of years. Many of the steep hillsides should be left in forest, as the soil is so thin that sods are of short duration and erosion soon carries the loose surface material away, leaving a surface unfit for agricultural purposes.

Orchards should be located preferably upon the north and east exposures upon the shelf land near the top of the ridges or at the base of the ridge. Terraces that occur over 50 feet above the stream bed make good locations for orchards. Little success can be had with fruit without spraying, and for this reason it is not advantageous to have a commercial orchard upon rough ground or steep hillsides.

The use of cowpeas and vetch is recommended on so-called "worn-out" soils, and all leguminous crops should be used more freely. In growing wheat where it is to be followed by grass, bone meal or floats should be used, as the effects are felt for several years, but if cultivated crops are to follow wheat a more readily soluble form of phosphate should be used. Where manures, cover crops, and leguminous crops are used there is little need for applying fertilizer to the soils of the area.

SOILS.

The soils of the Spencer area, ten in number, are separated physiographically into two grand divisions—bottom land, comprising four types, and upland, six types. The upland soils cover a larger part of the area and consist of gently rolling and steep hills. The soils of the upland division are residual and are derived from the shales, sandstones, and limestones of the Coal Measures and Permian beds of the Carboniferous era. The formations represented in the surface of the area are the Dunkard, Monongahela, Conemaugh, and Allegheny.

Three anticlinal folds and one syncline are found in the area. The greatest of these geological disturbances and the one that had the greatest effect upon the soil types is the extension of the Volcano anticline. It extends entirely through the area in a general northeast and southwest direction. Entering the area near the northern point of Wirt County, the cap of this anticlinal fold or "Break" passes from 1 to 2 miles to the east of the general alignment of Goose Creek to California; turning at this point, it goes south to Burning Springs, where it swings to the southeast and follows a semicircular course

through Hur and Altizer. Here, changing its course to the southwest, it passes through Beech and Linden and along the ridge by Nichols Knob and Kester, passing out of the county 2 to 3 miles west of Cotton. The axis of the "Break" oscillates, but rises gradually to the southwest from Altizer. The formations to the northwest of the "Break" rise in a southeast and southwest direction. This brings to the surface, over the central part of Roane County, large areas of the strong calcareous shales of the Monongahela. Another small fold occurs in the western part of Roane County, bringing to the surface the upper Monongahela.

The third fold is higher in altitude and occurs parallel to and 2 miles distant from the Braxton County line. This break brings large areas of the Conemaugh to the surface. The center of the syncline passes through Arnoldsburg and is parallel to that portion of the Volcano "Break" that passes through Beech and Linden.

Near the top of the Dunkard is found the Nineveh limestone, which caps the hills in the western corner of Wirt County and gives rise to the Brooke clay loam. The red shales below upon weathering result in soils of the Upshur series found on the hillsides in that part of the area. The predominance of Upshur clay in the central part of the area is due to the heavy red shales of the lower Dunkard and the calcareous shales of the Upper Monongahela. These soils contain limestone nodules and give to Roane County one of the best grazing sections of the State.

In the northern and western parts of the area the soils are derived largely from the Dunkard and in the southern and eastern parts from Monongahela and Conemaugh.

Where the rock strata are found weathered in place and not affected by slips of other material the gray shales, shaly sandstones, and fine-grained sandstones weather into Dekalb silt loam, and the coarse-grained sandstone into Dekalb sandy loam, the red shales into Upshur clay, and limestones into Brooke clay loam. The Meigs clay loam is derived from a mixture or intimately associated occurrence of the shales and sandstones. As slips are frequent and gray shale and sandstone formations are numerous in the Coal Measures, Meigs clay loam is the dominant type of the area. Where massive unweathered sandstone strata outcrop Rough stony land occurs.

The soils that are derived from the weathering of certain rock strata are not always found at the same levels as the rocks. If rock outcrops on the top of a hill, where there is nothing to contaminate it from above, the soil is characteristic of soils derived from that formation, but if upon the hillside, slips often cover the outcrop many feet and the outcrop has very little or no effect upon the soil type at that point. Usually these slips mix the material of different strata, so that the resultant types are representative of these mixtures and

have different values from the soils that are derived from the weathering of an individual stratum.

Occurring over small areas in almost every upland type, but usually found in Meigs clay loam, are "blossoms" of coal that give rise to a well-marked soil phase. These spots are found along coal outcrops. They occur mostly in the southeastern part of the area where the Pittsburg coal outcrops.

The soils of the upland are best adapted to grazing and only a few low-lying hills, level ridges, and small plateaus are suitable for cultivation.

The bottom land is of Recent geological age. It occurs, as the name implies, along the streams, usually in narrow strips, but sometimes along the larger streams in bodies from one-fourth mile to 1 mile wide. It is the result of deposition of material by the streams upon their flood plains. As this material is eroded from the different rocks and soils found along the several streams, the resultant types vary in character.

The Tyler series occurs as second bottom land on a well-defined terrace along the larger streams. It was deposited by these streams during a much earlier period, when their flood plains were at a higher level. These terraces are usually supported by massive sandstone strata and were formed while the stream slowly cut its way through the underlying rocks. The Tyler soils are deficient in organic matter and are like the upland soils in all but formation. The series is represented by two types—a silt loam and a sandy loam, which differ very little in agricultural value.

The Huntington silt loam is the only type of the Huntington series encountered and it represents nearly all the present flood plains of the area.

Where the hillsides are composed largely of Upshur clay the resultant bottom-land type is the Moshannon silt loam. The type takes some of its character from the soil from which it is derived and some from the conditions to which it is subjected. The result is the richest agricultural type of the area.

The following table gives a list of the soil types, with the actual and relative area of each:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Meigs clay loam.....	536,576	79.6	Moshannon silt loam.....	5,248	0.8
Rough stony land.....	48,256	7.2	Brooke clay loam.....	1,344	.2
Upshur clay.....	39,616	5.9	Dekalb sandy loam.....	832	.1
Huntington silt loam.....	20,416	3.0	Tyler sandy loam.....	448	.1
Dekalb silt loam.....	14,784	2.1	Total.....	674,560
Tyler silt loam.....	7,040	1.0			

MEIGS CLAY LOAM.

The Meigs clay loam is quite a variable soil; in fact, it embraces several distinct types and gradational types so intricately associated that it was found impracticable to separate them. By far the greater part of the area consists of a pale-yellow to brownish-yellow silt loam from about 2 to 8 inches deep, overlying a yellowish slightly compact clay loam to clay, which at an average depth of about 24 inches is underlain by red to mottled yellow and red clay. This lower subsoil in many places is slightly sandy and carries a considerable quantity of sandstone fragments. Much of this character of land is very similar to the Dekalb clay loam. Small patches of Indian-red clay (Upshur clay) occur at all elevations throughout the type. These were not of sufficient size to map on the scale used. A phase of this type having a reddish cast or color intermediate between the yellow and red areas described above is of common occurrence in Roane County. On the whole the clay or clay loam subsoil is near enough to the surface to warrant the classification as a clay loam type. Small gray shale and sandstone fragments are frequently encountered on the surface and throughout the soil mass, sometimes in sufficient quantity to give local areas the characteristics of a shale, or gravelly silt loam. These fragments are rarely abundant enough to cause the classification of the areas where they occur as a gravelly loam.

The topography is usually steep and the unweathered rocks are found from 2 to 5 feet below the surface. The drainage is rapid and often excessive, and crops upon the type suffer during droughts. Upon many of the narrow ridges the soil is quite sandy in texture. In Calhoun County, where the soft calcareous shales of the Conemaugh come to the surface, this type is found weathered into long steep slopes. The soil is usually deeper and the clay content slightly higher and the type supports a better bluegrass sod than is usually the case. This characteristic phase derived from the Conemaugh is found in other areas in the State. The yellow portion of the Meigs clay loam is derived through the place weathering of the soft gray shales and sandstones of the Coal Measures, while the included red areas are from the red shales. This is the most extensive type and is found in all parts of the area. The soil is easy to cultivate, but produces only fair crops. Erosion is very active, and it is advisable to cultivate only a few areas, such as ridge tops, shelf land, and other gently sloping surfaces. In the process of changing this type from woodland to sod it is necessary to cultivate for several seasons. If it were not for the roots of the trees it would often be impracticable to do this. These tend to hold the soil in place until the grass is established. The grass is generally cut for

three to four years, when the land is ready for pasture. The type furnishes good grazing for about ten years; after that time dead spots and broomsedge begin to show. If proper attention is not given immediately washes start, and the hillside is soon stripped of its thin layer of soil. The life of a pasture can be prolonged many years by proper attention. The use of lime, phosphates, and manure are recommended to invigorate and renew the pasture sods. If the dead spots do not show any signs of revival after treatment with these fertilizers it is best to resod them.

This type produces one-half to 1 ton of hay per acre. It is the best plan to feed the hay to stock upon the ground from which it is taken, and in this way to return as much organic matter to the soil as practicable. Bluegrass makes the best pasture on this type. It is usually sown with clover or timothy, and in a few years the bluegrass predominates, forming a splendid sod. When the sod fails entirely the best plan is to allow the field to grow up in brush until the soil is filled with roots, when it may be plowed and the same rotation used to bring in the bluegrass again.

Corn yields from 20 to 40 bushels per acre, usually of inferior grade. Wheat will produce from 5 to 15 bushels to the acre. All fruits, especially apples, do well, and the part of this type having the proper exposure would pay in orchards.

The native growth on this type is largely oak, hickory, maple, walnut, and poplar. Much of the type is still in forest and sells for about \$10 an acre. When cleared it brings about \$20 an acre.

BROOKE CLAY LOAM.

The Brooke clay loam has a dark-gray to grayish-brown soil, varying from 3 to 5 inches in depth. The subsoil, where typically developed, is an ashy-gray heavy clay to clay loam. In many places the subsoil is mixed with materials from the underlying formation, giving rise to a hillside phase of the type. Under these conditions the subsoil is a yellowish-gray to brownish-gray clay, changing to a reddish-gray color at about 20 inches. Light-gray mottlings occur in the upper 20 inches of the subsoil. The red color is more pronounced and the texture slightly lighter in the lower parts of the profile. Scattered upon the surface and through the soil and subsoil are found fragments and bowlders of gray and bluish-gray limestone. Irregular cracks are found upon the sun-baked surface, varying from one-fourth to three-fourths inch wide and extending through the soil into the subsoil. These "sun-cracks" are like those found in the Upshur clay, and are common to many soils of heavy clay content.

In cultivating this type care must be taken not to plow when it is too wet, although the results are not as disastrous or as lasting as upon the Upshur clay, owing to the high lime content of the Brooke clay

loam. When plowing is done under the proper moisture conditions this type is easy to manage and if plowed in winter it breaks down into a fine mellow seed bed. If plowed in the fall the soil becomes compacted.

The Brooke clay loam occurs in small areas along the tops of the ridges and hills in the western corner of Wirt County. Areas extend down the ridge between Jackson and Roane counties as far as Garfield. The geological formation which gives rise to this type is a remnant of the Nineveh limestone which originally covered a more extensive area, much of it having been removed through the agencies of weathering and erosion. The greater proportion of the type is derived from the weathering in place of a limestone stratum, which averages about 10 feet in thickness. In many places, however, the limestone material is mixed with material derived from calcareous red shale, gray shale, and to a less extent from sandstone. These are usually underlying formations. In a few places small spots or knolls of Meigs clay loam, too limited to be shown on the map, occur within the Brooke clay loam. These are derived from the shale and sandstone formations that lie immediately above the limestone in the geological column.

Very little erosion shows upon the surface of the type, as the natural bluegrass sod is vigorous and its strong root system prevents washing. The drainage is good and the soil absorbs and retains large amounts of moisture, as is shown by the flourishing condition of the sod during dry weather.

The Brooke clay loam is considered the best upland soil of the area. It produces, under good conditions, from 1,000 to 1,800 pounds of tobacco, 50 to 75 bushels of corn, 20 bushels of wheat, 30 bushels of oats, and 2 tons of hay per acre. The bluegrass pastures upon this type will support a larger number of cattle than those of any other type in the area, and pastures sodded forty years ago are still in good condition and show no signs of giving out.

All leguminous crops, especially clover, do well on this type. It is too heavy for garden crops, though potatoes do fairly well. Although alfalfa does not yield as well upon this type as it does on typical alfalfa soils, it will yield better than on any other type in the area, and it will give as much hay to the acre as any other grass. The high feeding value of alfalfa hay makes it a profitable crop to grow. In preparing a seed bed for alfalfa every precaution should be taken to put it in perfect condition. Inadequate preparation of the field has been the cause of most of the failures to secure stands upon this soil. To follow red clover in seeding to alfalfa is a good plan. In all probability bluegrass will crowd out the alfalfa in the long run as it does every other grass sown upon this type.

Nearly all of the Brooke clay loam is cleared and under cultivation or in bluegrass sod. Crop rotation is an important factor in main-

taining the productiveness of this type, and the use of leguminous crops in the rotation makes it doubly advantageous. Manure should be applied freely to gardens.

The average price of land of this type, taken in connection with poorer types of soil, is about \$30 an acre. This soil segregated would sell for a much higher price.

The following table gives the results of mechanical analyses of the soil and subsoil of the Brooke clay loam:

Mechanical analyses of Brooke clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
20562.....	Soil.....	9.6	3.1	2.1	6.6	5.1	44.1	38.5
20563.....	Subsoil.....	.0	1.7	2.5	7.5	6.7	34.1	47.7

UPSHUR CLAY.

The Upshur clay is found more extensively developed in the Spencer area than in any area hitherto surveyed in the State. The soil is a reddish-brown clay to clay loam from 2 to 6 inches deep, underlain by a heavy Indian-red tenacious clay subsoil. Small areas of this typical development are found in many places, with a heavy dark Indian-red clay grading imperceptibly into a heavy tenacious clay of slightly lighter color and containing many reddish white argillaceous limestone concretions. Iron concretions are also found in many places, but over a large proportion of the type the limestone and iron concretions are wanting. In the southwestern part of Roane County is encountered a phase of this type, where the soil is a gray or brownish gray silt loam 4 inches deep resting upon the usual Indian-red subsoil. In a few places gray mottlings are found in the lower part of the profile. The Upshur clay, in common with all heavy clay soils, bakes and cracks badly when exposed to the hot summer sun after heavy rains.

On account of the tenacious character of the soil cultivation is very difficult, and the best results are obtained by winter plowing. The alternate freezing and thawing, referred to in the chapter on climate, pulverizes the soil and forms a good seed bed. If plowing is done in the fall, the soil compacts and by spring is almost as hard as if it had not been plowed. On the other hand, if the plowing is delayed until spring, the cold and damp condition of the soil at this season is very unfavorable to the formation of a good seed bed. Plowing should only be attempted when the soil is in the proper moisture condition. Many cases were seen where fields had been abandoned for many years following plowing in a wet condition. This type is easily eroded, and where hillsides are cultivated washing is very active.

For this reason if for no other the hillsides should be kept in sod. The root system of the bluegrass sod holds the soil in place and prevents gullies from starting. Every effort should be made by the farmer to keep the sod in perfect condition. If dead spots in the sod are left very long without attention, the surface soil will soon be washed away. Upon the hilltops or gently sloping shelf land cultivation can be practiced, but the difficulty attending the growing of crops prohibits extensive cultivation.

The Upshur clay is derived from the weathering in place of red calcareous shales of the Coal Measures. It is mainly developed in the southwestern half of the area. Small spots occur in other parts of the survey, usually upon hilltops where thin strata of shale are exposed. Upon the hillsides these strata are usually covered by landslides of sandstone and shaly material from the overlying formations.

There are three principal developments of this type in the area, each of which is derived from a different geological formation. As found in the western part of Wirt County the type is derived from the red calcareous shales of the upper Dunkard, and here limestone fragments are very often scattered through the soil. The second and most extensive development extends intermittently over a large part of Roane County south of an east-and-west line passing through Spencer. It is typically developed upon the hillsides around the headwaters of Reedy and Spring creeks and upon the hilltops around Red Knob and Centerville and extending along the ridges upon the "Break" south of Henry Fork of Little Kanawha River. It is derived from the thick-bedded red calcareous shales of the lower Dunkard and Upper Monongahela. The third development is found in the southern part of Calhoun County along the hillsides and on Beech and West Fork of the Little Kanawha and extends from their bases up to 200 feet above. The type here is derived from the Cone-maugh formation.

The natural forest growth is hardwood, consisting mainly of oak, hickory, maple, walnut, and locust. Nearly all of it is cleared and under bluegrass sod.

The Upshur clay produces from 35 to 50 bushels of corn, 10 to 15 bushels of wheat, and 1½ to 2 tons of hay per acre. Oats will yield from 20 to 30 bushels per acre, but this crop is not generally grown. The soil is not adapted to the growing of garden crops, and fruit does not do well. The soil tends to pack and bake. Timothy suffers from this cause and does not do well after the first year. The clovers do well, especially upon the phase containing lime concretions. A large part of the Upshur clay, owing to its sloping topography, is best adapted to pasturage. Bluegrass sod will remain in good condition from twenty to thirty years, and even longer where properly cared for.

The method of reestablishing the pastures when a sod gives out is to put the land in locust or let a natural locust thicket grow, assisting by cutting out the other brush. By the time the locust is large enough for posts the soil will be in fine shape to sod again. Much better crops could be grown upon this type if cowpeas were used in the rotation and turned under. This practice greatly improves the mechanical condition of the soil by replacing humus which has been exhausted from most of the type. The less rolling areas, as the shelf areas and the tops of the many hills and ridges, are topographically well suited to the production of the general farm crops.

During the winter the roads upon this type become all but impassable. The mud becomes very deep and the stiff plastic nature of the clay makes difficult hauling.

The price of the Upshur clay usually ranges from \$20 to \$25 an acre. Hillside land that should only be used for grazing purposes is valued at \$15 to \$20 an acre.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Upshur clay:

Mechanical analyses of Upshur clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
20393, 21814.....	Soil.....	0.1	0.7	0.7	2.4	4.5	54.8	36.6
20394, 21815.....	Subsoil.....	.0	.7	.9	4.1	4.6	42.7	46.7

The following sample contained more than one-half of 1 per cent of calcium carbonate (CaCO₃): No. 20394 1.88 per cent.

DEKALB SILT LOAM.

The soil of the Dekalb silt loam, to a depth of 8 to 10 inches, is a fairly compact grayish-brown silt loam, the particles of which have a smooth talcy feel when rubbed between the fingers. The subsoil, to a depth of 36 inches or more, is a silt loam to clay loam, becoming slightly heavier as the depth increases, yellow in the upper part, but changing to a reddish-yellow below 24 inches. Occasionally small pieces of sandstone and fragments of shale are found on the surface and scattered through the soil and subsoil. The quantity of such materials is usually greatest in the deeper subsoil. The unweathered rock from which the soil is derived is found 4 to 6 feet below the surface. Although this rock is almost invariably sandstone, the type is not of a sandy character. The gray shale that rests upon the sandstone is responsible to a large extent for the character of the soil. The shale is a soft formation and breaks down readily and the disintegration has been very complete and the weathered product has mingled with the weathered upper portion of the sandstone.

These rocks are found in all the coal measures, but only in a few places are they exposed in a position to give rise to this type.

The Dekalb silt loam occurs on the flat hilltops along the Little Kanawha River, such as the Annamorah Flats, and around the headwaters of Flat Fork of Pocatalico River and Looneyville. In small detached places it occurs as shelf land and as low hills adjoining streams in all parts of the county, but it is typically developed in the northern part of the area along the Little Kanawha and in the southern part along the Big Sandy at Osbornes Mills and Amma. The typical areas represent remnants of an ancient plateau.

The mechanical structure of the soil and its gently rolling topography make cultivation easy and give perfect drainage conditions. Where located near towns and intensively cultivated the yields are very high, but under general farm conditions they are below the average for the area. The average yields per acre are as follows: Corn, 20 to 30 bushels; wheat, 10 to 20 bushels; oats, 20 to 25 bushels; potatoes, 100 to 175 bushels; hay, 1 ton per acre. Garden crops and fruit do well. Apples do better on this type than on any other type in the area. Bluegrass does not flourish, and the land should not be grazed after the clover and timothy fail, but put back into cultivated crops. Fertilizers are used to advantage for wheat. Some form of phosphate, together with bone meal, has been found to give good results. Bone meal is best used when the wheat is to be followed by timothy or clover, as the effects of the slow disintegrating bone is felt for several years; but when applied for the immediate crop more readily soluble forms of phosphate are used. Although commercial fertilizers give good yields, they can not be compared with the results from use of barnyard manure or leguminous crops, such as cowpeas or hairy vetch, turned under. The growing of leguminous crops furnishes nitrogen cheaper than can be done in any other way. Lime is very beneficial, but should only be used to correct the acidity of the soil.

The topography over most of this type is level to gently rolling, and erosion is not active, though drainage is excessive. The soil mulch should be used to conserve the moisture whenever practicable, as crops are very often injured by drought. Owing to the tendency of this type to pack when wet, the roads are in good condition during all seasons of the year.

Although this type is not naturally a strong soil and is not especially adapted to any one crop, the ease with which it is cultivated, together with its comparatively level surface, makes it one of the most desirable soils in the area. The price usually ranges from \$15 to \$30 an acre. It makes good sites for buildings, and where it occurs even in small areas it enhances the value of the adjoining land.

Nearly all of the natural forest growth of white oak and chestnut has been removed, and practically all of the type is under cultivation.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Dekalb silt loam:

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>						
20391, 21802, 21804.	Soil.....	0.4	1.5	1.6	5.6	5.5	66.2	19.1
20392, 21803, 21805.	Subsoil.....	.3	1.4	1.3	5.7	8.5	51.2	31.1

DEKALB SANDY LOAM.

The Dekalb sandy loam has a dark-brown loose sandy loam surface soil, changing at about 8 inches into a yellowish-brown or yellow sandy loam subsoil of slightly heavier texture. In many places the unweathered rocks from which the type is derived are found at 24 to 36 inches below the surface. Where this condition exists the subsoil is more open in structure and coarser in texture.

The type is found only on the top of ridges and is the result of the weathering in place of massive sandstone strata. Owing to the rough topography and the rare occurrence on the crests of ridges of sandstone strata, thick enough to influence the soil, the type is limited to a few small scattered areas. It is found typically developed on the ridges north of Grantsville and on a single ridge south of Vicars. It occurs in many places in all parts of the survey on narrow ridges, but such areas are too small to be shown in a map of the scale used.

The Dekalb sandy loam is not naturally strong and is usually deficient in organic matter. Its open texture admits of easy cultivation and it responds readily to the use of fertilizers, manure, and legumes. Although its topography is rolling to steep and its drainage is thorough, it is not subject to erosion and can be kept under cultivation for an indefinite period. It is not very well adapted to general farming, but it is a good garden, truck, and fruit soil. Apples, peaches, pears, plums, and small fruits, such as raspberries and blackberries, all do well. Irish and sweet potatoes, tomatoes, and cabbage are profitable crops. Wheat, corn, and oats make fair yields when fertilizers are used. It is not adapted to the growing of grass and should never be used for that purpose. Small quantities of rock phosphate and complete fertilizers have been used upon this soil with wheat and general farm crops and have given good results. All fertilizers should be applied at a time when the crop can quickly assimilate them, otherwise they will be lost, as the soil is leachy. As much organic matter as possible should be incorporated in the soil to increase its power to hold moisture.

Nearly all of the natural growth of chestnut and chestnut oak has been removed from the mapped portion of this type, but most of the narrow sandy ridges are still in forest. The second growth, especially on abandoned fields, is largely locust. This type is known locally as "chestnut" land.

ROUGH STONY LAND.

Not as much Rough stony land is developed in this area as in the areas hitherto surveyed in West Virginia, a fact due to the soft shaly character of the prevailing rock outcrops. The Rough stony land consists of the abrupt cliffs and stony outcrops, and steep surfaces so covered with stone that cultivation is impossible. The little soil that occurs among the rocks may be Upshur clay, Meigs clay loam, or Dekalb sandy loam, but it usually has the characteristics of the Dekalb series of soils.

Most of the type is caused by the outcrop of massive sandstone and is usually found on hillsides along streams. It occurs most typically developed around the curved banks of streams where the sheer rock cliff rises sometimes 200 feet above the stream bed. Along the "Break" it is found occasionally as the cap of a high peak or ridge, but such areas are usually small.

This type is found extensively developed in the northwestern part of the area, where the Little Kanawha River has cut its way through the "Break." The type should remain in forest.

TYLER SANDY LOAM.

The Tyler sandy loam consists of about 10 inches of medium-textured brown sandy loam, resting upon a subsoil of brownish-yellow fairly heavy sandy loam which extends to depths of 36 inches or more. Along Pocotalico River the soil is dark brown in color, about 12 inches deep, and contains a relatively large percentage of fine sand, but the subsoil is similar to that underlying the rest of the type.

The material forming the Tyler sandy loam has been derived largely through wash from contiguous upland areas of soil derived from the Conemaugh sandstone formation. The areas occupy second bottom land along the Little Kanawha River at Newark and along the Pocotalico River for several miles above and below Cicerone. It also occurs on Big Sandy Creek between the mouth of Pigeon Run and Osbornes Mills. Sandstone strata do not underlie this type as in case of the other second terrace soil, the Tyler silt loam. The boundaries of the type are well defined and the character of the soil is distinctly different from any soil type in the area. It occurs at a lower elevation with respect to stream level than the silt loam type of the series, but is entirely above normal overflows. The type occurs in small scattered areas.

While the Tyler sandy loam is not naturally a productive soil it responds readily to applications of fertilizers, stable manure, and green manuring crops. The surface is practically level and the texture of the soil is also favorable to cultivation. Drainage is everywhere excellent.

The soil through hard usage has been depleted of its original organic constituents over most of its extent and the yields of crops are correspondingly low. Corn averages 25 bushels per acre. Under good conditions the yields reach 80 bushels per acre. Wheat yields 12 bushels, oats 20 bushels, rye 10 bushels, and buckwheat 15 to 18 bushels per acre. Millet gives fair yields. Sweet potatoes yield well and are more profitable than any of the other crops grown. From 250 to 300 bushels per acre of a very fine quality of potatoes are readily secured. Irish potatoes do not do quite so well, though yields are good. Orchard fruits, especially apples, thrive. The soil is well suited to market gardening where it is situated within easy reach of railroad shipping points. Strawberries and tomatoes pay best. Cabbage, asparagus, onions, radishes, and lettuce also do well. Large pumpkins and squashes of fine quality are grown. Fertilizers and manure are necessary to get the best results in growing these intensive crops. All of the Tyler sandy loam is cleared and most of it is in mowing or orchard.

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

Mechanical analyses of Tyler sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
21812.....	Soil.....	0.8	16.8	27.1	13.5	7.6	21.5	12.2
21813.....	Subsoil.....	.4	12.5	10.5	31.5	6.8	24.8	12.9

TYLER SILT LOAM.

The soil of the Tyler silt loam is a grayish-brown to brown mellow silt loam, with an average depth of 10 inches. The subsoil to 30 inches is a grayish-yellow slightly compact silt loam, becoming slightly heavier as depth increases. From 30 to 36 inches and deeper the subsoil is a yellowish-brown clay loam, containing in poorly drained places gray or drab mottlings and dark iron stained spots.

A phase of this type of soil occurs in Roane County. Here the soil to 10 inches is a brown mellow silt loam. The subsoil is of the same texture, of a slightly lighter shade of brown, and becomes lighter in color and heavier in texture as depth increases. The mottlings are absent. The brown color is due to the predominance of the Upshur

clay on the hillsides above, from which there has been some wash and to the fact that the underlying rock strata are tilted in such a way as to give better drainage.

The Tyler silt loam occurs as a second bottom or terrace land along the Little Kanawha and its larger tributaries, along Pocotalico River, and bordering Big Sandy Creek. The topography, which is in general level, in large areas becomes gently rolling and in such locations a great many fields are badly eroded.

The most extensive development of this type is found on the Little Kanawha from Elizabeth to the Wood-Wirt county line. The grounds of the hospital for the insane at Spencer, W. Va., offer a typical example of Tyler silt loam as it occurs in small areas. Here it rests upon the Waynesburg sandstone about 40 feet above the bed of Spring Creek. The type is found on second terraces lying above overflow or at about 20 to 100 feet above the stream level and is always supported by a massive sandstone formation which may be encountered usually at a depth of about 3 to 10 feet.

The Tyler silt loam is strictly an alluvial soil. It was formed as bottom land during a past geological age when the stream was at a much higher level than at present. These older second terrace soils contrast interestingly with the commonly associated red colored Moshannon soils of the first bottoms in the very much lighter color of their soil mass. This is apparently due to the fact that the second terrace soils were deposited first, and consequently were derived more largely from the Dekalb or lighter colored soils derived from the overlying light colored shales of the region. Erosional processes have exposed more of the red shales, and as a result the later first bottoms have been tinged red by the greater proportion of material washed from soils coming from these rocks. The type is never overflowed, but receives small amounts of colluvial material from the hillsides above it. In the gently rolling portions the drainage is usually good, but in the level areas the underlying rock interferes more or less with downward percolation and the drainage conditions are often very bad. The type, as it naturally occurs, is not a very good soil for general farming. It yields 1 to 1½ tons of hay per acre, and much of the type is used for that purpose. Corn yields 30 to 60 bushels and oats 20 to 30 bushels per acre. Although not much used for wheat it gives fairly good yields. Millet gives fair yields and does not injuriously affect the land, as it does in case of the heavier soil types. Fruit does well on account of the sheltered position of the terraces. Potatoes and garden crops also give satisfactory results. Lime will give immediate results by correcting the acidity of the soil, but no permanent improvement can be brought about until the type is thoroughly underdrained. The growing of cowpeas, rye, and hairy vetch in all rotations and the liberal application of barnyard manure is also recommended.

Practically all of the original forest has been removed, but the few trees left indicate that the native growth was largely beech. The second growth, which is scattering, is composed of oak, walnut, poplar, and hickory.

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

Mechanical analyses of Tyler silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
20566.....	Soil.....	0.4	3.5	3.5	11.6	8.4	52.7	19.9
20567.....	Subsoil.....	.2	2.2	1.6	8.7	8.8	49.8	28.5

MOSHANNON SILT LOAM.

The Moshannon silt loam has a reddish-brown or dark Indian red silt loam surface soil that passes into a subsoil of about the same texture at an average depth of 10 inches.

The only feature distinguishing the soil from the subsoil is the more compact structure and lighter color—brighter red or Indian red—of the latter. Both the soil and subsoil have a tendency to become plastic when wet. The subsoil is usually heavy in the lower part of the profile, but in many places the sand content is noticeably high. Below 30 inches beds of gravel, sandstone, and shale fragments are occasionally found. The soil contains considerable quantities of organic matter and small quantities are found in the subsoil. When plowed in a wet condition the soil has a strong tendency to clod. This should be guarded against, especially when the land is to be plowed in the spring, as at that season it is likely to contain relatively large quantities of moisture.

The type, like the Huntington silt loam, is derived from Recent materials, but these come wholly from the Upshur clay area, whereas those materials giving the Huntington series of soils are more heterogeneous, being washed from widely separated regions of diverse geological origin.

All of the type occurs as first bottom land and is found in its largest development in the central parts of Roane County, where the heavy red shales of the lower Dunkard and upper Monongahela formations are exposed. The most typical example of this soil is the area along Stover Fork of Reedy Creek. The Moshannon silt loam in places grades rather imperceptibly into the Huntington silt loam. Although the types are similar in many respects they are very different where typically developed.

The yields of most crops are about the same upon the two types. Clovers and grasses yield from one-half to 1 ton more per acre and

fruits do better upon the Moshannon silt loam than upon the other soil. But potatoes and other vegetable crops do not do so well as upon the Huntington silt loam. Wheat and oats give good yields, though some trouble is caused by the tendency of the rank growth of straw to lodge.

The growing of alfalfa is recommended for this type where the proper drainage conditions exist naturally or where underdrainage can be readily supplied. The type receives the wash from limestone lands and the soil is mellow enough to furnish a good seed bed and the subsoil is not so close as to retard the downward extension of the roots. The spring overflows are not detrimental as the crop is dormant. Summer floods rarely overflow the higher bottoms.

Fertilizers are needed only on spots next to the hills, where overflows are rare. The turning under of leguminous crops would improve the physical condition of the soil.

The original growth, consisting largely of hardwood, has been removed and at least three-fourths of the type is in mowing.

HUNTINGTON SILT LOAM.

The Huntington silt loam occupies much of the bottom land of the area and is a very variable type. Where typically developed it consists of 12 inches of a slightly compact brown silt loam that grades imperceptibly into a heavy silt loam to clay loam subsoil of light-brown color. In many places the subsoil becomes lighter in texture near the lower limit of the profile, and in other places beds of rounded pebbles and fragments of sandstone and shale are found from 1 foot to 3 feet below the surface. Near the stream or where the current is strongest during floods the soil is more sandy, and below the massive sandstone outcrops sand beds are frequent. These sand beds occur for the most part along Green and Big Sandy creeks. A red cast is found throughout the profile over the larger part of this type, the result of some admixture of material derived from Upshur clay, and is proportional in intensity to the area of red-shale outcrops included in the drainage system of the different streams. This red cast is especially noticeable along Reedy Creek. The variation is not great enough to throw the soil into another series. Where the reddish tinge is found the type has a somewhat higher agricultural value.

The Huntington silt loam is most extensively developed along Right Reedy and Reedy creeks, where in many places the areas reach the width of one-fourth of a mile. The type is derived from material of Recent age and is still in the process of forming. It is composed of alluvial material deposited by streams upon their flood plains. This type is subject to floods in February, March, April, and July. The spring floods are very beneficial, but the July floods often do much damage to the hay crop. Fertilizers are not needed,

as the deposits of silty material left by the overflows keep up the productiveness. In many low places underdrainage would increase the yield of all crops. The mellow condition of the soil makes cultivation easy and the large organic matter content distributed through the soil and subsoil keeps the type in splendid condition. The surface of the areas is level to gently sloping and is very often gently rolling next to the hills.

The type is best adapted to the growing of corn, of which it produces from 50 to 100 bushels per acre, with an average of 65 bushels. The tendency of wheat and oats to lodge when grown on this type and the damage done by spring floods make these crops very uncertain. Upon the gently rolling portions less subject to overflow potatoes make good yields. Both sweet and Irish potatoes yield from 100 to 175 bushels per acre. Market gardening and trucking are profitable where the type lies near good markets or shipping points. Fruit, especially apples, is produced to some extent. The crop is reasonably certain on account of the protected position of the orchards, but the trees are very susceptible to disease and the fruit is of inferior quality. The type grows luxuriant grass and yields 1½ to 2½ tons of hay per acre. Pumpkins and squashes are grown in abundance.

The original hardwood forest has been cleared from most of the type. The trees that remain are mostly sycamore, elm, beech, tulip poplar, and willow. The sycamores grow to enormous size. About one-half of the type is in mowing and at least three-fourths of the remainder is planted in corn each year.

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

Mechanical analyses of Huntington silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
21806, 21808.....	Soil.....	0.0	0.4	1.9	11.4	11.3	54.5	20.2
21807, 21809.....	Subsoil.....	.0	.1	.5	4.9	12.5	55.0	26.6

SUMMARY.

The Spencer area is situated in the west-central portion of the State of West Virginia and is composed of Wirt, Roane, and Calhoun counties. It has a total area of 1,054 square miles, or 674,560 acres. The topography is characteristic of the Appalachian Plateau region, being rough and broken for the most part. Spencer, the largest town in the area, has a population of about 3,000. Elizabeth, Reedy, Creston, and Grantsville are smaller but important towns.

The climate is well suited to general farming, especially to stock raising. The thermometer rarely goes below zero in winter or above 100° F. in summer, the average annual temperature being about 52° F. The annual rainfall of about 42 inches is well distributed throughout the year, the greatest precipitation falling during the growing season. The snowfall is usually light.

The principal field crops grown in the area are corn, wheat, potatoes, and hay. Apples are produced in great abundance and other fruits on a smaller scale, but there are no strictly commercial orchards. Large areas are in bluegrass pastures and support large numbers of cattle and sheep. Most of the cattle are shipped out of the area on the "hoof." Pittsburg is the best cattle market for the area. The raising of purebred cattle is quite an industry. The Hereford, Polled Angus, and Shorthorn are the three principal breeds.

The soils of the area are all derived from the Permian beds and Coal Measures of the Carboniferous era. Six of the ten soil types are residual upland soils, while the four remaining are alluvial or bottom-land soils, two being terrace, or second-bottom, soils and two first-bottom soils.

The Meigs clay loam is the most extensive type in the area. It occurs mostly upon the hillsides and narrow ridges. The topography is very steep and broken and the type is very susceptible to erosion. Much of it is still in forest and the larger part of that cleared is used for grazing. It supports a good bluegrass sod, which is usually short lived.

The Brooke clay loam is of limestone origin and is one of the most productive soils in the area. It occurs over small areas on ridge tops and is well adapted to wheat, tobacco, clover, grasses, and fruits.

The Upshur clay is extensively developed in Roane County. It is nearly all cleared and in pasture. The more level ridge tops and shelf land are the only portions cultivated. It produces good crops of wheat, corn, and clover, but garden crops and fruits do not thrive.

The Dekalb silt loam occurs in small spots throughout the area, usually on small broadened ridges or plateaus. The topography is level to gently rolling and, although the type is not naturally productive, it is easily improved and produces good crops of corn and oats; garden crops and fruits do exceptionally well.

The Dekalb sandy loam occurs in very limited areas, usually upon ridges where massive sandstone or sandy shale has weathered in place. It produces very poor crops and has a very low agricultural value.

Rough, stony land is not as extensively developed in the area as in other areas in West Virginia. It has little or no agricultural value.

The Tyler silt loam is found upon the terraces of the larger streams. It is suited to wheat, oats, corn, and potatoes, and produces fair crops

of hay. Where it occurs 60 to 100 feet above the stream bed it makes good sites for orchards.

The Tyler sandy loam is found in only a few places and occupies the same relative position as the Tyler silt loam. It is a fine soil for truck crops, but is not strong enough to produce the staple crops.

The Huntington silt loam represents a larger proportion of the first bottom soil of the area. It is a very productive soil and yields large crops of corn and hay.

The Moshannon silt loam occupies the same position as the Huntington silt loam, but represents the wash from the Upshur clay and has a little higher agricultural value.

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