Issued February 10, 1915.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WEST VIRGINIA GEOLOGICAL SURVEY,
I. C. WHITE, STATE GEOLOGIST.

SOIL SURVEY OF BOONE COUNTY, WEST VIRGINIA.

BY

W. J. LATIMER.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1913.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1915.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Soils,
Washington, D. C., August 25, 1914.

Sir: Under the cooperative agreement with the West Virginia Geological Survey, I. C. White, State Geologist, a soil survey of Boone County was carried to completion during the field season of 1913.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1913, as authorized by law.

Respectfully,

Milton Whitney,
Chief of Bureau.

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

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SOIL SURVEY OF BOONE COUNTY, WEST VIRGINIA.

By W. J. LATIMER.

DESCRIPTION OF THE AREA.

Boone County is in the southwestern part of West Virginia. It is bounded on the northeast by Kanawha County, on the northwest by Lincoln County, on the southwest by Logan County, and on the south and east by Wyoming and Raleigh Counties. It has an area of 506 square miles, or 323,840 acres.

The county lies within a severely dissected part of the Appalachian Plateau, and the topography is rough and broken. Viewed from the highest points, the tops of the ridges have a general level, which represents the level of the original plateau surface. The hillsides are usually steep, the valleys narrow and V-shaped, with but little bottom land, and the ridge tops in general are narrow and "hog backed." In a few places there are ridges that are comparatively broad and flat. Such areas are encountered on the divides back from the streams, and are usually not very extensive.

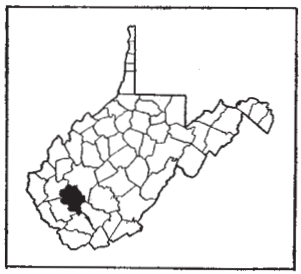

FIG. 1.—Sketch map showing location of the Boone County area, W. Va.

In the northwestern part of the county the hillsides are less precipitous and the topographic features are less rough than in other sections. The hilltops in the northwestern part of the county have a general elevation of 500 to 1,000 feet above the level of the streams, while the elevation of those in the southwestern part ranges from 1,000 to 1,500 feet. The general elevation of the ridge tops above the sea level is 1,250 to 1,750 feet in the northwestern section, and 1,750 to 2,250 feet in the southwestern part of the county. At the lowest points, where Coal River and Little Coal River pass out of the county, the elevation is about 630 feet above sea level. The greatest elevation, 3,300 feet above sea level, is attained on Pilot Knob, in the southeastern corner of the county, where the Raleigh-Wyoming County line joins the Boone County line. This is one of the highest points south of the Kanawha River.

The regional drainage of Boone County falls into two divisions. The northeastern part of the county, comprising about one-fourth of the area, is drained by the Coal River; the remainder, with the exception of a small area in the western corner of the county which drains into the Guyandot River, is drained by the Little Coal River and its tributaries.

Settlement in the territory now included in Boone County began during the first decade of the last century, and the county organization was established in 1846. The settlers were mainly from Virginia and North Carolina. The valleys of the larger streams were first occupied.

Before the Civil War there was some development in the county along industrial lines. Coal River was locked and dammed from its mouth to Peytona. A short railroad line connected Peytona with the coal mines along the Drawdy Creek. Coal mining became an important industry, but during the war work was discontinued and much property destroyed. The dams in the river broke and the locks were carried away by high water. After the war the country remained in a wild and undeveloped state, except that some lumber was rafted down the rivers, until within comparatively late years. The recent development of the county began with the construction of the present railroads. The Coal River Railroad, a branch of the Chesapeake & Ohio, was built in 1907, and subsequently extended up both branches of Coal River. This gave a great impetus to both the lumber and coal industry. Coal is now being mined to some extent, mainly along Laurel Fork of the Little Coal River and along Coal River, and the industry is developing rapidly with the improvement of transportation facilities. The Kanawha coal beds have their maximum thickness in the southeastern part of the county. Oil is not produced in commercial quantities in the county.

A number of gas wells are found along the general alignment of the Warfield anticline in the vicinity of Danville and Peytona. These wells supply local towns with natural gas.

Lumbering is the most important industry of Boone County, and the value of the timber output is increasing. Only about 25 per cent of the county is cleared. The remainder consists largely of cut-over land, with large tracts of original forest, and the cut-over land contains timber that can be used for staves, boxes, etc.

Boone County has a population of 10,331, according to the 1910 census. Madison, the county seat, with a population of about 300, is the largest town. Danville, Peytona, Seth, and Clothier are small towns of local importance as centers of the coal and lumber industries.

A part of the county is fairly well supplied with transportation facilities. The Little Coal River branch of the Chesapeake & Ohio

Railroad extends along the Little Coal River to Clothier, Logan County. The Coal River branch extends from the main line to Seth. The upper end of the Coal River is reached at Jarrolds Valley by the Cabin Creek branch of the Chesapeake & Ohio Railroad. There is a large section in the southeastern part of the county that is without railroad facilities. The streams furnish excellent means for transporting lumber to market.

The public-road system is fair, considering the rough topography of the country and the road-building material available.

Huntington and Charleston are the principal markets for the products of Boone County.

CLIMATE.

The climate of Boone County is favorable for the production of general farm crops, orcharding, and stock raising. There is no Weather Bureau station within the county, but the data in the following table, compiled from the records of the station at Powellton, Fayette County, are fairly representative of the climate conditions in Boone County:

Normal monthly, seasonal, and annual temperature and precipitation at Powellton, Fayette County.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
December	34	70	− 5	3.6	0.9	3.0	4.8
January	34	74	− 5	4.1	1.8	4.4	6.1
February	33	68	−20	3.1	5.2	2.1	9.5
Winter	34			10.8	7.9	9.5	20.4
March	46	83	1	5.2	4.9	5.2	7.0
April	53	93	20	3.2	5.2	2.7	1.7
May	64	93	31	4.7	2.9	3.8	T.
Spring	55			13.1	13.0	11.7	8.7
June	70	96	42	5.3	5.2	2.8	0.0
July	73	98	46	3.5	4.6	7.6	0.0
August	72	99	42	3.8	1.9	9.6	0.0
Summer	72			12.6	11.7	20.0	0.0
September	66	99	33	2.4	1.3	1.8	0.0
October	53	92	16	1.4	1.1	3.6	T.
November	44	74	10	3.0	1.7	3.4	1.5
Fall	54			6.8	4.1	8.8	1.5
Year	53	99	−20	43.3	36.7	50.0	30.6

The winters are cold, but the temperature rarely falls below zero, and periods of extremely cold weather are of short duration. The average temperature for the winter months is about 34° F. The snowfall, averaging about 31 inches annually, is so distributed throughout the winter that it is never very deep and lasts for only a short time.

The summers are warm, but not excessively hot. A few "hot waves" occur during the summer months, but these usually last only a few days and the heat is not intense. The mean temperature for the summer months is about 72° F. Temperatures as high as 100° F. are seldom if ever experienced. For the spring months the temperature averages about 55° F. and for the fall months about 54° F.

The average date of the last killing frost in the spring is April 23 and of the first in the fall October 12, according to the records of the Powellton station, giving an average growing season of 173 days. The latest date of killing frost in the spring recorded is May 13 and the earliest in the fall October 1.

The rainfall is well distributed throughout the year. The heaviest precipitation occurs during the spring and summer months, when it is most needed by the growing crops, and the lightest during fall at harvest time. Spring floods do relatively little damage, as the bottom lands are not used during this part of the year. The late summer and autumn floods are of little consequence. The mean annual rainfall is about 43 inches.

The alternate freezing and thawing of the ground during the winter is a great advantage to the farmer. It aids in pulverizing the soil and in bringing it into good condition for spring planting. For this reason winter plowing is beneficial.

AGRICULTURE.

Agriculture was first practiced along the terraces and bottom land of the larger streams of Boone County, mainly along the Coal and Little Coal Rivers, and later the lands along the smaller streams and the adjoining uplands were occupied. Cattle and sheep raising was the principal occupation of the early settlers, and this is still the most important form of agriculture. The crops grown during the early history of the county were corn, wheat, oats, tobacco, hay, and vegetables.

Lumbering is the leading industry of Boone County, while coal mining has developed rapidly during recent years, and these industries have largely diverted attention from agriculture.

About one-fourth of the total area of the county is cleared and either under cultivation or in pasture. The greatest development, along industrial as well as agricultural lines, has taken place in the western part of the county.

The principal crops grown are corn, oats, hay, potatoes, and vegetables. Since the early settlement of the county corn has been grown on a larger acreage than any other crop. The 1910 census reports a production of 194,834 bushels from 9,936 acres. The acreage of corn remains about the same. The quality of corn is not of the best, for little or no attention is paid to the selection of seed or the introduction of improved strains. Hickory King, Boone County White, and Reids Yellow Dent are grown in the county, but the greater part of the corn produced is from nondescript seed.

Wheat was at one time an important crop, but its production has declined rapidly since the introduction of railroads. The 1900 census reports 1,694 acres in wheat, with a yield of 9,020 bushels. In the 1910 census no wheat is reported for the county. The acreage devoted to oats also has decreased. An acreage of 597 acres is reported in oats in the 1900 census, with a yield of 4,620 bushels, and only 231 acres in 1910, with a production of 2,232 bushels.

Buckwheat and rye are grown, but to only a very small extent.

Tobacco was grown by the early settlers for home use and in small quantities for market. Orinoco was the principal variety. Bright Burley has been introduced from Lincoln County, but has not become popular. The climate and soil are well suited to the production of tobacco, and there is a strong tendency on the part of the smaller farmers to make this the leading money crop, as it is in the adjoining counties to the west. The census of 1910 gives a total of 152 acres in tobacco, with a production of 99,464 pounds.

Irish potatoes are grown to some extent, but mainly for home use. The average yield per acre is not very high, but this is due in a large measure to the fact that the crop is not fertilized. According to the 1910 census, 475 acres were devoted to potatoes in 1909, with a yield of 42,515 bushels. Sweet potatoes are reported on a total of 84 acres, yielding 11,816 bushels.

For hay timothy is planted more than any other of the grasses. Millet is next in importance as a hay crop. Some redtop is seeded with timothy. Clover is not in general use. Cowpeas are not used to a great extent for hay, but are usually planted in the corn. The 1910 census reports a total of 1,402 acres in hay and forage crops, and a production of 1,318 tons of hay. Nearly all the vegetables common to the region are grown for home use. Sorghum is produced to some extent.

The general reduction in the acreage of all crops is due largely to two causes, the buying up of the land by lumber and coal companies, with the subsequent exclusion of agriculture, and the occupying of the bottom land for town sites and for use in connection with mining operations.

A large acreage of the upland is devoted to grazing, probably about one-half of the cleared land is in pasture, and the uncleared land is used more or less as an "open range." Bluegrass comes in naturally in some parts of the county, but can not be depended upon to make a sufficient stand. When seeded properly it makes a good sod and lasts for a number of years, even upon the steep hillsides. Many wild grasses in forested areas furnish fair grazing during the summer months. Lespedeza (Japan clover) grows in abandoned fields. It has well-developed nodules upon the roots and forms a thick sod, but does not usually grow tall. The pastures of the county are in fair condition, although they receive but little attention.

The cattle and sheep raising industry has steadily declined since the Civil War. The number of sheep has decreased until at the present time there are comparatively few flocks in the county. The decrease in the number of cattle raised has been less marked, and there is still a large number of cattle in the county. The 1910 census gives the number of sheep in Boone County as 1,972, and of the cattle as 5,417. A total of 6,447 hogs is reported. The number of hogs has increased during recent years. Very little attention is given to the introduction of pure-bred stock. A few Shorthorns and Shorthorn grades are found, and a few Herefords and grade Herefords, but for the greater part the herds consist of scrub cattle. Grade Merino, Shropshire, and Southdown sheep and mixtures of these breeds make up the greater part of the flocks. The Chester White and Poland China are the dominant breeds of hogs, and crosses of these breeds are common.

The climatic conditions and most of the soil types in the county are well suited to fruit growing. Apples, peaches, plums, and cherries are grown in small orchards and produce good yields. The apple probably does better than any other fruit. Rome Beauty, York Imperial, Tompkins King, Ben Davis, Winesap, Grimes Golden, Pearmain, Maiden Blush, Early Harvest, and Yellow Transparent are varieties which seem to give the best results. Small fruits, such as raspberries and strawberries, do well. Wild fruit, including blackberries, dewberries, and huckleberries, grows abundantly. The total value of fruits and nuts produced in Boone County is given in the 1910 census as $41,120.

The census of 1910 reports a total of 88,860 acres in farms in Boone County, of which 31,552 acres are improved. The aggregate value of all farm property is given as $2,263,348. The average size of the farms is 75.8 acres.[1] A little over one-half of the farms are operated by the owners. The majority of the tenants rent for cash, the amount paid varying in different sections of the county. Under

[1] Each tenancy was tabulated by the census as a "farm." The average holding is larger than the figure given.

the share system the owner usually receives one-half of the crops as rent. A large part of the farm land is leased from the coal and timber companies.

It is difficult to secure efficient labor on the farms, owing to the opportunities for employment offered in the coal mining and lumbering industries, and the greater part of the farm work is performed by the owner or tenant and his family. Wages paid farm laborers average about $1 per day. The 1910 census reports a total cash expenditure of $15,514 for agricultural labor during 1909.

Very little commercial fertilizer is used in the county, the census of 1910 reporting an expenditure of only $117 for such material. The fertilizer used is mainly ammoniated phosphate, rock phosphate, or bone meal.

No general system of crop rotation is practiced in this county. Where hill land is cleared it is devoted to corn for a few years until the yields decrease, and then used for pasture until sod fails, when it is either put in corn or allowed to grow up in brush. On the first-bottom land corn is in many cases grown continuously. On terrace areas farming is usually more systematic and there is a greater diversification of crops than elsewhere in the county. On the steep hillsides when a sod fails a crop of cowpeas or vetch, to be turned under and followed by grass, is preferable to a cultivated crop or to allowing the field to grow up in brush. A rotation which is generally satisfactory, especially upon the terrace land and smoother upland, is corn with cowpeas, followed by winter wheat and oats, grass, either timothy or redtop to be sown with the wheat, or, if pasture is desired, bluegrass with the timothy, the grass to be cut for hay for two or three years, or until the yields become low, and the sod then turned under and the field returned to corn. Excellent sites for commercial fruit orchards exist in the county and a good opportunity is offered to undertake fruit growing. The production of potatoes and tobacco might also profitably be extended.

SOILS.

The soils of Boone County are derived from the weathering of strata of the Conemaugh, Allegheny, and Pottsville formations of the Carboniferous era. The lower part of the Conemaugh caps the hills of the county. In the northwestern part of the county, alternate layers of red shale and sandstone give rise to the Meigs clay loam type. To the east these formations are not encountered. The Mahoning sandstone occurs near the base of the Conemaugh. This formation is massive and hard and underlies the hilltops of the county. Below the Mahoning sandstone, and extending about half way down into the Allegheny, is found a series of thick sandstone beds known as the Charleston sandstone group. About the outcrops and along

the belt of these sandstones the soil contains large quantities of rock and many areas of Rough stony land are encountered. Below this the formations are composed largely of shale, with some scattered sandstone. Along this belt the soil is mapped as the Dekalb stony silt loam, but it is a better agricultural soil than much of the more typical Dekalb stony silt loam heretofore mapped in the State. There are a few thin limestone formations which influence this soil to some extent, but not sufficiently to change the soil to another type. The upper stratum of the Pottsville formation is exposed where the large streams cut across the Warfield anticline,[1] but this formation does not enter into the composition of the soils of the county. At these points, however, it is responsible for the enlargement of the bottom land by the streams cutting broad bottoms in wearing through the hard rocks.

The soils of Boone County fall into three groups—the upland, or residual soils; the terrace, or second-bottom soils; and the first bottoms, or overflow land.

The following table gives the soil types, the groups to which they belong, and the material from which they are derived:

Group.	Material from which derived.		Name.
Upland or residual	Sandstone and red shales		Meigs clay loam.
	Sandstone, sandy shale, and gray shale.		Dekalb loam.
			Dekalb silt loam.
	Gray shale and sandstone, sandstone predominating.		Dekalb stony silt loam.
			Dekalb sandy loam.
	Hard massive sandstone		Rough stony land.
Terrace or second bottom	Old terrace, Dekalb material		Holston silt loam.
	Recent terrace,	Dekalb material.	Holston silt loam, low phase.
		Dekalb material, sandstone predominating.	Holston fine sandy loam.
First bottom or overflow land.	Dekalb material, sandstone predominating.		Huntington fine sandy loam.
			Riverwash.

Below are given the names and the actual and relative extent of the several types mapped in Boone County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dekalb stony silt loam	276,032	85.2	Dekalb loam	896	0.3
Huntington fine sandy loam	17,792	5.5	Riverwash	768	.2
Dekalb silt loam	15,744	4.9	Meigs clay loam	768	.2
Rough stony land	5,568	1.7	Dekalb sandy loam	192	.1
Holston silt loam	2,240	1.0			
Low phase	1,088		Total	323,840	
Holston fine sandy loam	2,752	.9			

[1] See West Virginia Geological Survey, Boone County, or U. S. Geological Survey, Charleston folio.

Holston Series.

The Holston soils have yellowish-brown to brown surface soils and yellow subsoils. The series is developed in the eastern part of the United States. The soils occupy old alluvial terraces, which are in some places 200 feet or more above the first bottoms of the streams. They consist mainly of material washed from sandstone and shale soils and are somewhat less productive than the Elk soils, which they closely resemble, but which contain more limestone material. The Holston soils are generally underlain by sandstone or shale, and in places the lower subsoil is apparently partly residual from these rocks.

HOLSTON FINE SANDY LOAM.

The soil of the Holston fine sandy loam is a brown or yellowish-brown fine sandy loam, about 10 to 12 inches deep and fairly loose and open in structure. The subsoil is a yellowish-brown to yellow fine sandy loam, which is only slightly compact and a little heavier than the soil. Along the banks of the streams the type is more of a loamy sand. As developed in Boone County, this soil has a higher sand content than usual. Otherwise the soil is fairly typical.

This soil is developed along the larger streams above the points at which they cross the line of the Warfield anticline. It occurs along Coal River above Orange, along Pond Fork of Little Coal River from Uneeda to Bald Knob, and along Spruce Fork from south of Madison to Clothier. It is a terrace or second-bottom type, and lies about 30 to 50 feet above stream level.

The Holston fine sandy loam is derived very largely from material washed from the Dekalb soils. A few waterworn pebbles of sandstone and occasionally quartz are scattered over the surface, and gravel beds are sometimes encountered in the substratum. The topography is gently rolling to level, the type occurring in many places as low ridges or swells running in the same direction as the streams.

This soil can be cultivated at almost any time without danger of clodding. The organic content is usually very low, and on the majority of the farms little or no effort is made to increase it. The addition of humus results in increased yields, and an improvement of the moisture-holding capacity of the soil, preventing to some extent the droughty condition due to excessive drainage. Very little manure or fertilizer is used on this soil.

The greater part of the type is under cultivation. The crops grown are corn, wheat, oats, rye, timothy, redtop, cowpeas, sorghum, millet, Irish and sweet potatoes, watermelons, pumpkins, cantaloupes, and garden vegetables. Wheat yields 10 to 15 bushels, oats

20 to 30 bushels, corn 30 to 40 bushels, Irish potatoes 100 to 150 bushels, sweet potatoes 200 to 250 bushels, and hay about 1 to 1½ tons per acre.

This is not a naturally strong soil, and crops require fertilization for maximum results. Clover does not do well, but such crops as cowpeas, soy beans, and vetch thrive and constitute excellent catch crops in rotations. Melons are grown to some extent and are a profitable crop. The soil is a good type for use in the production of rye, sorghum, melons, redtop, sweet potatoes, and light truck crops. Strawberries and brier berries do fairly well. In most places the areas are too low to afford good sites for orchards. There are a few home orchards, but these are generally in an unsatisfactory condition.

The original forest growth consists of sycamore, poplar, elm, beech, and birch.

Land of this type of soil is valued at $50 to $150 an acre, the higher prices applying to areas near towns.

The results of mechanical analyses of samples of the soil and subsoil of this type are given in the following table:

Mechanical analyses of Holston fine sandy loam.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
221221	1.5 miles northwest of Van.	Fine sandy loam, 0–12 inches.	0.0	7.9	13.9	29.0	18.2	21.7	9.5
221222	Subsoil of 221221.....	Fine sandy loam, 12–36 inches.	.1	7.4	17.4	29.0	19.0	18.4	8.8

HOLSTON SILT LOAM.

The soil of the Holston silt loam as developed in Boone County is about 8 to 10 inches deep and consists of a yellowish-brown mellow silt loam grading through about 6 inches of pale-yellow friable silt loam into a light yellowish brown friable heavy silt loam subsoil. The subsoil becomes more compact and slightly heavier with increasing depth, and the deeper subsoil in many places is bright yellow. A few waterworn pebbles and small bowlders are scattered over the surface and in places are encountered throughout the soil section.

The type occurs as old alluvial deposits, which have been reduced by erosion to a few scattered remnants. It has an average elevation

of about 100 feet above the present stream level. The topography is gently rolling to level over small areas and the drainage is good. A small amount of the underlying material, usually partially weathered sand or shale or Dekalb silt loam, has been exposed through erosion. The soil has been washed from Dekalb material. The deposits vary from a few feet to about 30 or 40 feet in thickness. On the higher elevations the soil differs somewhat from the type as mapped in adjoining areas to the north, but it seems to occur at about the general level of the Teays formation,[1] which gives rise to the typical soil.

Locally this ancient terrace has suffered severely from erosion, very little of the original deposit being left, and more residual material is incorporated with this type than usual.

The Holston silt loam is not very extensively developed in Boone County. It occurs along Coal River between Comfort and Dartmont, and to some extent along Little Coal River, in the vicinity of Madison.

The crops grown are wheat, oats, corn, timothy, clover, potatoes, and garden vegetables. Corn is grown more extensively than any other crop, and yields about 30 to 50 bushels per acre. Wheat and oats are not grown extensively. Wheat yields 10 to 15 bushels and oats 20 to 30 bushels per acre. Clover and cowpeas are the only leguminous crops grown. The type is fairly well suited to clover and gives excellent crops of cowpeas, soy beans, and vetch. Potatoes are grown for home use and good yields are obtained, ordinarily from 150 to 200 bushels per acre. The soil is used to some extent for grazing. In some adjoining counties tobacco is grown successfully upon this soil.

The soil is deficient in organic matter, and in general is in poor condition as the result of exhaustive cropping. The physical condition of the soil is improved by the addition of lime, but its great need is organic matter.

Holston silt loam, low phase.—This phase occurs as comparatively low terraces along the larger streams.

The topography is fairly level and the drainage good, except in narrow swales. The phase sometimes adjoins hills, and its general elevation is from 40 to 60 feet above stream level. It occurs along the Coal River from the Kanawha County line to Orange, along the Little Coal River from the Kanawha County line to Madison, and extends a few miles up Spruce and Pond Forks. This soil has suffered very little from erosion.

[1] See Charleston or Huntington folio, U. S. Geological Survey. Kanawha County Report, West Virginia Geological Survey, or Soil Survey of the Huntington Area, West Virginia. Field Operations, Bureau of Soils, U. S. Dept. of Agr., 1911.

The soil and subsoil of the low phase are slightly darker than the remainder of the type, and the subsoil is considerably heavier, approaching a silty clay loam in texture. It is a slightly better agricultural soil than the higher areas of the main type. The crops grown are corn, wheat, oats, tobacco, timothy, redtop, millet, clover, cowpeas, soy beans, sorghum, sweet and Irish potatoes, and vegetables. Corn produces about 30 to 60 bushels per acre, wheat 10 to 20 bushels, oats 20 to 30 bushels, hay 1½ to 2 tons, potatoes 150 to 250 bushels, and tobacco 1,000 to 1,200 pounds. Potatoes, vegetables, and sorghum are grown for home use.

The type in general is too low for profitable fruit production, but the higher areas support small orchards that do well. The soil is well suited to strawberries and bramble berries, but these are grown to only a small extent.

Fertilizer is used for the tobacco crop at the rate of 400 to 600 pounds per acre, and about 200 pounds of bone meal, phosphate, or ammoniated phosphate per acre is applied for wheat. Some areas are in need of lime, especially where clover is to be sown. The organic-matter content is maintained by occasionally turning under green crops.

Practically all of this phase is cleared. The native growth is similar to that common to the bottom-land soils, consisting mainly of sycamore, elm, and beech. This is one difference between the typical soil and its low phase. Drainage conditions are the chief factor influencing this variation in vegetation.

Land consisting of the Holston silt loam, low phase, is valued at $75 to $200 an acre, depending on its position above overflow, its availability for town sites, and rights of way. The higher lying agricultural areas range in value from $35 to $100 an acre.

The results of mechanical analyses of samples of the soil and subsoil of the typical Holston silt loam are given in the following table:

Mechanical analyses of Holston silt loam.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
221217	1 mile north of Madison.	Silt loam, 0–8 inch.....	0.0	2.0	7.7	21.6	15.2	42.6	10.9
221218	Subsoil of 221217.....	Silt loam, 8–36 inches....	.0	2.0	7.6	20.6	14.4	37.9	17.5
221225	Danville.....	Silt loam, 0–10 inch.....	.2	1.4	2.4	8.2	16.2	48.3	23.4
221226	Subsoil of 221225.....	Silt loam, 10–36 inches...	.2	1.0	2.4	7.8	17.8	48.3	22.7

Huntington Series.

Types grouped in the Huntington series have light-brown to brown surface soils and yellow to light-brown subsoils. Frequently there is little change in the color or character of the material from the surface downward throughout the soil section. The soils are developed in the first bottoms of streams, where they are subject to overflow, but are otherwise well drained. They consist generally of material derived from limestone, sandstone, and shale soils.

HUNTINGTON FINE SANDY LOAM.

The Huntington fine sandy loam in the northwestern part of the county is normal in texture and structure, but in the southeastern part it is sandier than the average of this type and contains more gravel beds. This soil occupies all the bottom land or overflow land in the county with the exception of the very small area mapped as Riverwash.

The type as developed over the northwestern half of the county has a soil consisting of a yellowish-brown, mellow fine sandy loam about 8 to 10 inches deep. The subsoil is a yellowish-brown to yellow, fairly heavy fine sandy loam, which is slightly compact and friable. Over the southeastern part of the county the subsoil is slightly lighter than the soil. Along the smaller streams in this section of the county the gravel content is very high, and the type is underlain by extensive beds of gravel, consisting of sandstone and shale fragments. In many places these beds are encountered within the 3-foot soil section. In other places the soil has been removed from large areas, leaving the gravel and sand exposed. In general the texture of the type is lighter near the stream banks and heavier in the swales. The body of the soil, however, is fairly uniform in texture.

This soil occurs as first-bottom or overflow land along nearly all the streams in the county. The stream basins from which the type is derived are occupied largely by the Dekalb stony silt loam. The topography is level to gently undulating, or marked by slight swells upon which the soil is usually light in texture. The drainage is well established over the greater part of the type, being deficient only in a few swales and abandoned stream channels. Such areas are small and unimportant.

The crops grown are corn, oats, rye, cowpeas, timothy, and redtop, sweet and Irish potatoes, sorghum, millet, and vegetables. Of these crops corn has the largest acreage and yields about 30 to 50 bushels per acre. Oats are grown to some extent, yielding about 20 to 30 bushels per acre. Timothy and redtop produce 1 to 1½ tons of hay per acre, but are grown on a relatively small acreage. The grasses upon this type are only fair, and but a small acreage is devoted to grazing. A little rye and millet is grown. The yields are moderate. Sorghum makes an excellent growth and a fair quality of sirup is

produced. Irish potatoes yield about 150 to 200 bushels, and sweet potatoes 200 to 250 bushels per acre. Cowpeas, soy beans, and vetch are well suited to the soil, but the two latter crops are not used, and the former is grown only on a small scale. Vegetables are grown successfully in home gardens, but notwithstanding the demand at local markets for such products is active, no market gardening is carried on at present.

This type is too low for successful orcharding, but such small fruits as strawberries and brambleberries do well.

The Huntington fine sandy loam is not naturally a strong soil, and the use of commercial fertilizers is generally necessary. The type also needs organic matter, which may be added by turning under cover crops where stable manure is not available. This is necessary over most of the type, as the soil in general is subject only to occasional overflow. A part of the type is so seldom overflowed that it is much like the Holston fine sandy loam in its relation to cropping practices.

The heavier areas of this soil are slightly better for agriculture than the remainder of the type. The soil is easily cultivated, and there is little danger of clodding. Crops do not "burn" during dry weather as upon soils of similar texture but higher elevation. This is probably due to the position of the water table, which is relatively near the surface.

The native forest growth consists of sycamore, poplar, elm, beech, birch, and willow. The greater part of the type has been cleared.

The value of agricultural areas of this land varies from about $20 to $100 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Huntington fine sandy loam:

Mechanical analyses of Huntington fine sandy loam.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
221215	1 mile west of Jeffery...	Fine sandy loam, 0–8 inches.	0.1	4.4	14.6	38.4	16.6	18.6	7.4
221216	Subsoil of 221215.....	Fine sandy loam, 8–36 inches.	.4	6.8	18.6	35.0	14.0	16.7	8.4
221219	1 mile west of Foster....	Fine sandy loam, 0–8 inches.	.2	3.3	9.6	33.2	20.0	25.0	8.9
221220	Subsoil of 221219.....	Fine sandy loam, 8–36 inches.	.2	2.6	9.4	33.0	21.4	23.1	10.3

DEKALB SERIES.

The surface soil of the types grouped in the Dekalb series is gray to brown, and the subsoils commonly some shade of yellow. These soils are derived from the disintegration of sandstone and shales. They occur principally in the Appalachian region of eastern United States, from Pennsylvania southward to Alabama.

DEKALB SANDY LOAM.

The Dekalb sandy loam is typical of this soil as encountered in other areas of West Virginia. The soil is a brownish loose sandy loam about 8 to 10 inches deep. This grades imperceptibly into a yellowish-brown to yellow sandy loam which is somewhat heavier in texture and slightly compact in the deeper subsoil.

The type is encountered in only a few places. It occurs on the caps of hills where it has been weathered from strata of massive sandstone. In this county the weathering has extended to a considerable depth, the parent rock being encountered 4 to 6 feet below the surface. Very few fragments of sandstone are present, either on the surface or within the soil.

The Dekalb sandy loam is most prominently developed on the ridge between Pond Fork and Spruce Fork. Small areas occur within areas mapped as the Dekalb stony silt loam, but are too scattered and irregular in occurrence to be mapped separately on the scale used in the present survey.

This is not naturally a strong soil and crop yields are usually low. The crops grown are corn, oats, potatoes, sweet potatoes, vegetables, and cowpeas. The soil is best used in the production of crops requiring a soil of moderately heavy texture, such as potatoes, sweet potatoes, vegetables, cowpeas, soy beans, vetch, and melons.

The topography is rolling and the drainage excessive. Crops often suffer from lack of moisture during dry seasons.

Blackberries, raspberries, and strawberries do well on this soil. Apples, peaches, plums, pears, and cherries produce large yields and the fruit is of good quality. The soil is not very well suited to grasses, usually giving poor yields of hay. The legumes constitute the best hay crops.

A forest growth of oak, chestnut, poplar, and pine originally covered this soil. The greater part of this, however, has been removed.

DEKALB LOAM.

The soil of the Dekalb loam is about 10 to 15 inches deep, and consists of a brown, mellow loam. The subsoil is a yellowish, slightly heavy silt loam, which is friable and slightly compact. The surface soil is darker and somewhat more friable than usual. The subsoil,

however, is typical in both color and texture. Small fragments of sandstone and shale are scattered over the surface and throughout the soil section.

The type is not very extensively developed, although it occurs in larger areas than in Logan County. It occupies the tops of ridges in the southeastern part of the county, and is typically developed on Jarrolds Flats. It is derived from the weathering in place of sandstone and gray shales and a residue from similar formations.

This soil is too far from railroads and markets for the profitable production of truck crops, to which it is texturally well adapted, and for which it is used successfully in Logan County. In Boone County the general farm crops are grown. Corn constitutes the leading crop. Some hay is produced and a part of the type is in bluegrass sod. The soil is well suited to the production of apples, peaches, plums, and cherries. At present much of the type is forested with oak, chestnut, poplar, and wild cherry.

DEKALB STONY SILT LOAM.

The Dekalb stony silt loam is the most extensive soil in Boone County, comprising 85.2 per cent of the entire area of the county. In general the fine-earth material of the soil is identical with that of the Dekalb silt loam. It differs from the latter in the larger content of stone, which is scattered over the surface and throughout the soil section, and in having a steeper, rougher topography. The soil material consists of a gray to brownish-gray silt loam, 4 to 8 inches deep, grading into a yellow or brownish-yellow silty clay loam. The parent rock is often encountered within 3 feet of the surface.

Throughout the greater part of its extent the type is quite similar to that developed in adjoining areas. Near the Warfield anticline, however, the lower part of the Allegheny formation, containing a few thin strata of limestone and fossiliferous shales, appears at the surface, and these formations influence the soil to a slight extent, making it somewhat better adapted to grass than the typical soil.

Within the Dekalb stony silt loam area are included small areas of Rough stony land, Dekalb stony sandy loam, and Dekalb loam, which are not mapped separately. Along the outcrop of the Charleston sandstone formation, consisting of a group of sandstone strata about 300 to 400 feet thick found near the tops of the hills over most of the county, a large quantity of rock is present, and the sand content is much higher than elsewhere. The surface soil in the coves is generally much darker than typical, owing to the greater accumulation of organic matter in such moist positions. In the northeastern half of the county a few thin-bedded impure limestones and fossiliferous shales influence the soil to a small extent. This has the effect of making the land slightly better for grass.

Most of the type has a steep and broken topography, giving a very rapid run-off and excessive drainage. These conditions are more pronounced in the southeastern part of the county than over the rest of the county.

The forest growth is very heavy, consisting of oak, chestnut, poplar, pine, spruce, beech, and walnut. Most of the type is forested. While much of it is cut-over land, there are large areas of original forest, and in the cut-over areas there is some excellent timber.

Steeper areas of the type are best left in timber, as erosion is active on the unprotected slopes. Much of the type is fairly well adapted to grazing, but after the roots of trees and the larger plants decay there is little to keep the soil from washing. Where the steep hillsides are cultivated erosion is destructive.

In general the land is too steep for commercial orcharding, although fruit of excellent color and quality is produced. Corn is the principal crop. The yields are usually low, averaging about 10 bushels per acre. When first cultivated, however, the soil produces 25 to 40 bushels per acre. Such crops as wheat, oats, or hay are not successfully grown, owing to the difficulty of harvesting. The type is not especially adapted to grasses, although bluegrass makes a fairly good stand in some places. It does well in areas in which the soil is influenced by calcareous material. In most cases there is not enough lime in the soil for clover to thrive. Cowpeas do fairly well. Tobacco can be grown to advantage upon the bench land and more gently sloping areas. It is grown successfully upon this soil type in adjoining areas.

This type is best utilized for raising cattle and sheep. As few intertilled crops as practicable should be grown, and the land kept in sod much of the time.

The value of this land varies from about $5 to $30 an acre. Much of it is held by coal and lumber companies, and is not in farms.

DEKALB SILT LOAM.

The soil of the Dekalb silt loam is a grayish-brown, medium heavy, mellow silt loam about 8 to 10 inches deep. It grades abruptly into a yellowish, compact, friable silty clay loam. The parent rock is rarely encountered within the 3-foot section, but is usually 4 to 6 feet below the surface, the weathering being deeper than in the case of other soils in this section. In small, level areas the drainage is sometimes imperfect and the deep subsoil is slightly mottled with gray or drab. In general the drainage of the type is good. The topography is undulating to gently rolling.

The materials forming the Dekalb silt loam have been derived from fine-grained sandstones and gray shales, relatively small quan-

tities of which are scattered in fragments over the surface. These fragments are usually small and fairly well decayed.

The type is most prominently developed in the eastern part of the county, where it occupies slightly broadened ridge tops and overlies the Mahoning sandstone. A few detached areas of similar character are encountered in the northwestern part of the county.

Corn, wheat, oats, hay, potatoes, and vegetables are the principal crops. Owing to the fairly even surface, which permits the use of mowers, reapers, etc., such crops as wheat, oats, and hay can be successfully grown, although texturally the soil is not especially adapted to these crops. It is well suited to tobacco, potatoes, and vegetables. Cowpeas are grown to a small extent. The soil is usually deficient in humus, and the yields are low compared to what they would be were this condition remedied.

Wheat yields 10 to 12 bushels, corn 20 to 40 bushels, oats 20 to 30 bushels, potatoes about 100 to 150 bushels, and hay about 1 ton per acre.

Areas of this type are admirably adapted to fruit growing. An even surface favors the use of spraying machinery, and all the various operations can be economically performed on a commercial basis. The apple gives the best results, producing a fruit of excellent quality and color.

The natural forest growth consists of oak, chestnut, and poplar. The greater part of the type is cleared and under cultivation. The soil supports a fair bluegrass sod, and a large acreage is in pasture.

Excluding coal rights, the land is valued at $20 to $50 an acre.

The results of mechanical analyses of samples of the soil and subsoil of the Dekalb silt loam are given below:

Mechanical analyses of Dekalb silt loam.

No.	Locality.	Description.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
221223	3 miles north of Gordon.	Silt loam, 0–8 inches.....	0.6	2.0	2.1	3.2	12.7	62.2	17.1
221224	Subsoil of 221223.....	Silt loam, 8–36 inches....	1.4	1.1	.7	1.2	5.2	59.3	30.9

MEIGS SERIES.

The Meigs series is variable in character and particularly in color, which ranges from the Indian red of the Upshur to the gray or pale yellow of the Dekalb. The soils are derived from red fine-grained

sandstone and shales and from grayish sandstones and shales. The series includes Upshur clay loam and Dekalb silt loam and intermediate types so intimately associated as to preclude detail mapping on the scale of 1 inch to the mile. The topography is prevailingly steeply rolling, and a large part of the series is so hilly that cultivation is impossible. So far soils of this series have been mapped only in West Virginia and Ohio.

MEIGS CLAY LOAM.

The Meigs clay loam represents Upshur-Dekalb material undifferentiated. The type is derived from alternate strata of red shale and sandstone. The weathered material from these strata is more or less mixed on the hillsides, and consists of brownish-yellow, friable silt loam about 6 to 8 inches deep, overlying a reddish to yellowish compact clay loam to clay. Both soil and subsoil contain an appreciable quantity of small, partly weathered sandstone and shale fragments which give them a mottled appearance.

This type includes small areas of the Dekalb silt loam, which is typical of this soil as mapped in the county, and of the Upshur clay, which is a dark-brown to reddish-brown or Indian-red clay loam or silty clay loam, underlain at about 2 to 6 inches by a red to Indian-red, stiff, plastic, tenacious clay. The surface of the Upshur clay areas cracks badly upon drying. The clay is derived from red and green shale, and is more or less calcareous.

The Meigs clay loam occurs only on the tops of ridges in the extreme northwestern corner of the county. The topography is rolling to moderately steep, and the drainage well established. Erosion is, therefore, very active and it is generally necessary to keep the steeper areas in sod. Bluegrass makes a good growth, and the sod lasts for 10 to 40 years.

The crops grown are corn, wheat, oats, tobacco, and hay. Corn yields about 20 to 40 bushels, wheat 6 to 12 bushels, and hay about 1 to 1½ tons per acre. A fair average yield of tobacco is 800 pounds per acre. The leaf is of fair grade. Clover does well and can be grown to advantage with timothy for hay or alone in rotations.

Fruits do fairly well. Apples are probably best suited to this soil. Small fruits give excellent yields.

The variable character of the soil and the usually heavy nature of the subsoil make cultivation difficult, and in general this type is not well suited to the production of intertilled crops. Plowing this soil when it is wet is very injurious, as it clods badly. Where practicable fall or winter plowing, which submits the upturned soil to alternate freezing and thawing, gives the best seed bed. The type is best utilized for stock raising.

The forest growth, consisting of oak, hickory, ash, walnut, and poplar, has been cleared from a large part of the type. Land of this type is valued at $10 to $20 an acre.

Miscellaneous Material.

RIVERWASH.

Riverwash includes bottom land which has been eroded during overflows, leaving beds of sand and gravel. The gravel consists of both sandstone and shale with small, rounded quartz pebbles.

Spots of Huntington fine sandy loam, too small to be mapped separately, occur along the bank and scattered through the type where the bottom land is still intact. Aside from these spots this type is of little agricultural value.

Riverwash is most prominently developed along the larger tributaries of the Coal River and Little Coal River. Where the surrounding hills are very steep and the run-off rapid this type occurs along the smaller streams. The development of Riverwash along the larger streams is largely due to the use of "splash dams" to float logs and rafts down the streams.

The natural forest growth is largely the same as that over the remainder of the bottom land. Very little of it, however, is left standing.

ROUGH STONY LAND.

The Rough stony land comprises those areas which are so covered with rocks as to be of little or no agricultural value. It is not extensive in Boone County.

The material is derived from partly weathered massive hard sandstone strata. The soil is usually a silty loam or sandy loam, and contains a large quantity of small sandstone fragments. Areas of Rough stony land include rock cliffs along the streams and almost everywhere the surface is steep and broken.

Small areas of the Rough stony land are suitable for grazing, and still smaller patches can be cultivated, but in general it is best left in forest. Oak, pine, spruce, and chestnut, with some poplar and beech, are the more important trees in the present forest cover.

The Rough stony land occurs along the Coal and Little Coal Rivers and the larger tributaries of the latter.

SUMMARY.

Boone County is located in the southwestern part of West Virginia. It has an area of 506 square miles, or 323,840 acres. It lies within a severely dissected part of the Appalachian Plateau, and the topography is very rough and broken.

The lowest point in the county is about 630 feet and the highest about 3,300 feet above sea level.

The northeastern part of the county is drained by the Coal River, and the remainder mainly by the Little Coal River and its tributaries.

Only about 25 per cent of the area of the county is cleared.

The greater part of the population is engaged in agricultural pursuits; the remainder in lumbering and coal mining.

The population of the county is 10,331. Madison (the county seat), Danville, and Peytona are the largest towns.

A part of the county is fairly well supplied with transportation facilities, although a large area is not reached by railroads. The streams furnish a means of transporting lumber.

Labor is scarce and most of the farm work is done by the owner or tenant.

The mean annual temperature is about 53° F. The temperature rarely reaches 100° F. in the summer and seldom falls below zero in the winter. The precipitation, averaging about 43 inches annually, is well distributed throughout the year.

The principal crops are corn, wheat, oats, millet, sorghum, cowpeas, potatoes, timothy, and redtop. Vegetables are grown only for home use. Bluegrass is indigenous in parts of the county. Cattle, sheep, and hogs are raised in large numbers. Apples and peaches are found in home orchards. There are no commercial orchards of any consequence.

The soils fall into three groups—upland, terrace, and first-bottom soils. The upland is occupied by the Meigs and Dekalb series. They are derived from the shales and sandstones of the lower Conemaugh, the Allegheny, and the upper Pottsville formations of the Carboniferous era. The terrace soils fall in the Holston series, and the first bottoms in the Huntington series and Riverwash.

The Holston fine sandy loam as mapped in Boone County is slightly sandier than is typical of this soil as encountered in other areas. The crops to which it is best suited are corn, cowpeas, soy beans, vetch, melons, potatoes, sweet potatoes, and light truck. It is not naturally a strong soil.

The higher areas of the Holston silt loam vary from the typical, the soil having suffered more from erosion and containing larger quantities of residual material. The low phase is typical of the soil as mapped in adjoining areas. This type produces good crops of corn, oats, wheat, tobacco, potatoes, peas, and hay.

The Huntington fine sandy loam is found upon nearly all the overflow land of the county. In general, it is typical of the soil as mapped in adjoining counties, although in the southeastern section

it is sandier than the average. The principal crops grown are corn, sorghum, sweet potatoes, melons, and cowpeas.

The Dekalb sandy loam is found in four small but well-defined areas. It is best suited to cowpeas, soy beans, vetch, potatoes, and vegetables.

The Dekalb loam as mapped in Boone County has a darker soil than is typical. It occurs in small, isolated areas. Corn is the principal crop grown. The soil is well adapted to truck crops.

The Dekalb stony silt loam is the most extensive soil type in the county, covering 85.2 per cent of the entire county. Much of the land is too steep for profitable cultivation, and is best left in forest. It is fairly well suited to grass, and a large area is in pasture. Corn is the leading crop. Tobacco does well, but is grown only to a limited extent.

The Dekalb silt loam is quite extensively developed. It occurs as flat or gently rolling hilltops in many parts of the county. It is used for the production of tobacco, corn, wheat, potatoes, and vegetables.

The Meigs clay loam is very inextensive, occurring on the caps of the hills forming the ridge along the northwestern boundary of the county. It is well suited to grass, tobacco, and wheat and to stock raising.

The Riverwash is inextensive and of no practicable agricultural value.

Rough stony land is confined to the steep valley walls of the larger streams. It is of little agricultural value.

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[PUBLIC RESOLUTION.—No. 9.]

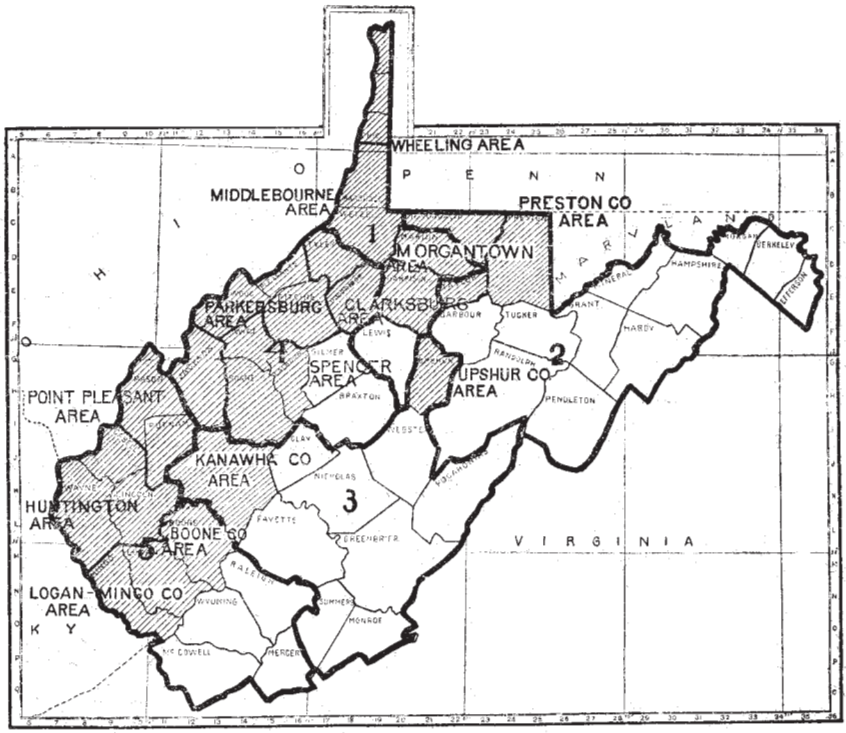
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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.]



Areas surveyed in West Virginia.

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