

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

---

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

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SOIL SURVEY OF BRAXTON AND CLAY  
COUNTIES, WEST VIRGINIA.

BY

W. J. LATIMER, IN CHARGE, AND CHARLES N. MOONEY.

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W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1918.]



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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., October 28, 1919.*

SIR: Under the cooperative agreement with the West Virginia Geological Survey, a soil survey of Braxton and Clay Counties was carried to completion during the field season of 1918.

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 1918, as authorized by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

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

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### MAP.

Soil map, Braxton and Clay Counties sheet, West Virginia.



# SOIL SURVEY OF BRAXTON AND CLAY COUNTIES, WEST VIRGINIA.

By W. J. LATIMER, In Charge, and CHARLES N. MOONEY.—Area Inspected  
by W. EDWARD HEARN.

## DESCRIPTION OF THE AREA.

Braxton and Clay Counties are situated in the central part of West Virginia. Together they form an irregular-shaped rectangle, about 60 miles long and 25 miles wide, with the long axis running northeast and southwest. Braxton County is the larger, comprising 517 square miles. Clay County comprises 332 square miles, giving a total for the area of 849 square miles, or 543,360 acres.<sup>1</sup>

The area lies wholly within the Appalachian Plateau. The surface slopes gently northwestward, as is shown by the general elevation and the trend of the drainage. The original plateau surface has been severely dissected by stream erosion, which has produced a succession of V-shaped valleys with intervening narrow ridges.

The surface relief of Braxton County is less bold than that of Clay County, since a main drainage divide extends across the center of Braxton County, and Elk River, which flows through the center of Clay County, has, with its larger tributaries, cut down to grade.

The northwestern part of the area is rough and broken, made up of winding ridges with steep slopes and occasional low mountain knobs rising several hundred feet above the general level of the ridges. There are many fairly smooth benches and gently sloping areas at the base of hills, the latter usually situated near the heads of streams. A series of somewhat flattened, low ridges occurs in the vicinity of Flatwoods. There is no extensive development of terrace or first bottom land along the larger streams, one-half mile representing about the greatest width of the valleys. In

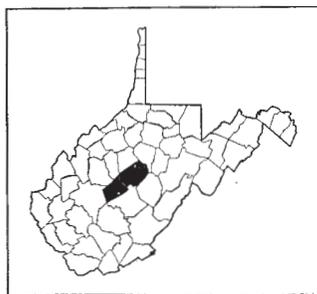


FIG. 1.—Sketch map showing location of the Braxton and Clay Counties area, West Virginia.

<sup>1</sup> U. S. Geological Survey sheets were used as a base map for this survey. North of 30° 45' parallel and west of 80° 30' meridian this map has 20-foot contour intervals; the remainder has 50-foot intervals.

the southeastern part of the area the hills are higher and the valleys narrower.

Along the western border of the area the hills and ridges range from 500 to 700 feet above the level of the main streams, and along the southeastern border from 600 to 1,000 feet above the level of the streams. The hills vary from 1,400 to 1,500 feet above sea level along the western border to 1,900 to 2,100 feet in the eastern part of the area. Elk River is 945 feet above sea level at the Braxton-Webster County line and 605 feet at Queen Shoals, where it leaves the area. The elevation of the Little Kanawha River at the Lewis-Braxton County line, where it enters the area, is 950 feet, and at the Gilmer-Braxton County line, where it leaves the area, 730 feet.

The larger streams and nearly all their tributaries have reached temporary grade level, although their narrow valleys indicate that they are comparatively young in their cycle of erosion. The smaller streams reach throughout all parts of the upland, leaving only ridges between the drainage basins. The area is divided into two main drainage basins. The Little Kanawha River drains the northern half of Braxton County, while the Elk River drains the remainder of the area except for a small part of the southeastern end of Clay County, which is drained into Gauley River. The forest cover of the upper Elk River basin retards the run-off and to some extent prevents excessive floods. It also causes retention of the rainfall to such extent that there is an abundant supply of water during dry seasons. The stream is usually clear. The Little Kanawha River is fairly well developed where it enters Braxton County, but is nearer its source than the Elk River. Much of the drainage basin of the Little Kanawha is under cultivation, resulting in rapid run-off causing disastrous floods during the spring. The stream is usually muddy.

Owing to the steep topography of the area as a whole and the large proportion of cleared land in the northern part, the run-off in general is rapid and surface drainage is excessive.

The first settlements within this area were made in 1790, at the mouth of Holly River in Braxton County. The first extensive land survey was made in 1784, embracing ten 1,000-acre tracts in the center of Braxton County and covering the present location of the towns of Sutton and Gassaway. Few permanent settlers came into the area prior to 1805, but following this time they came in large numbers. The first settlements in Clay County were made on Elk River opposite the mouth of Buffalo Creek in 1830. The pioneers that settled these counties came largely from Virginia, and were of English extraction. About 40 years ago a large number of farmers moved into Braxton County from the counties to the north.

The present population consists largely of descendants of the original settlers. During the last few years, however, many have come from Ohio and Pennsylvania and from other counties of this State, following the development of the lumber, coal, oil, and gas industries. The population of Braxton County in 1910, as reported by the census, was 23,023, and of Clay County, 10,233. This is an increase over 1900 of 21.8 per cent for the former and 24.1 per cent for the latter. The entire population of both counties is classed as rural by the census, no town having more than 2,500 population. The population in 1910 is reported as averaging 44.5 persons per square mile in Braxton County, and 30.8 persons per square mile in Clay County.<sup>1</sup>

Sutton, the county seat of Braxton County, is the largest town in the area, having a population in 1910 of 1,121. It is situated on Elk River and is connected by branch lines with the Baltimore & Ohio Railroad and the Coal & Coke Railroad. Gassaway is the next largest town, with a population of 1,086. It is situated on Elk River 6 miles below Sutton. It is on the main line of the Coal & Coke Railroad, and the division shops of the road are situated at this place. Burnsville, which had a population of 770 in 1910, is situated on the Little Kanawha River in Braxton County. It is served by the Baltimore & Ohio Railroad (Richwood Branch) and the Coal & Coke Railroad, and is the center of the oil and gas industry of the northern part of Braxton County. Flatwoods, on the Baltimore & Ohio (Richwood Branch), a junction point for Sutton, had a population in 1910 of 327. Clay, the county seat of Clay County, is situated on Elk River opposite the mouth of Buffalo Creek. Its population in 1910 was 392, but is estimated to be about 600 at the present time. Widen, an unincorporated coal-mining town 18 miles from Clay, on Buffalo Creek, has an estimated population of 1,200.

The inhabitants of Braxton and Clay Counties are largely engaged in farming, but in certain sections large numbers are engaged in the oil and gas fields, coal mines, and allied industries. It is only within the last few years that the oil and gas resources of this territory have been developed. The principal developments are in the gas field northeast of Burnsville, the oil pool at Rosedale, the oil field on the eastern edge of Union District, and in the Bomont gas district. The beginning of coal operations dates from about 1904 in Clay County and 1907 in Braxton County. According to the report of the State coal inspector, 294,206 tons were produced in Braxton County and 531,645 tons in Clay County in 1915. Coal operations have been extended considerably during the last few years. Lumbering began in this region about 1850, and at first was confined to the floating of timber down the Little Kanawha River to Parkersburg and down the Elk River to Charleston. This continued until the construction of the

<sup>1</sup> Since this report was written the preliminary announcement of the population of Clay County in 1920 has been issued by the Bureau of the Census as 11,486.

railroads, when the remaining timber, which for the most part was remote from streams, was sawed and hauled out by rail. Lumbering is still important in some of the rougher sections, but most of the merchantable timber has long been removed.

Both counties are fairly well supplied with rail transportation. The Baltimore & Ohio Railroad (Richwood branch) passes through Braxton County north and south, and has a spur line from Flatwoods to Sutton. The West Virginia Midland operates a narrow-gauge road which connects with the Baltimore & Ohio at Holly Junction and extends to Webster Springs in the adjoining county. The Coal & Coke Railroad extends north and south through both counties, and has a branch line from Gassaway to Sutton. The Elk & Little Kanawha Railroad operates a narrow-gauge line from Gassaway to Rosedale, in the western part of Braxton County. The Buffalo Creek & Gauley Railroad operates 18 miles of standard-gauge track from Dundon to Widen.

The public roads are not in good condition in either county, but an effort is now being made permanently to improve some of the main roads.

The principal markets for the farm products of the area are Charleston, Clarksburg, Pittsburgh, and Baltimore. The coal towns furnish good local markets.

#### CLIMATE.

The climate of Braxton and Clay Counties is mild and healthful. The winters are cold, but less rigorous than farther north and in the higher altitudes to the east. The summers are warm, but hot spells are of short duration, and the nights are generally cool.

The mean temperature for the winter varies from 37.2° F. at Sutton, in Braxton County, to 38.3° at Valley Fork, in Clay County. A temperature as low as -21° F. has been recorded at Sutton, but even zero weather is rare in either county. The mean temperature for the summer is recorded as 75.3° at Sutton and 71.7° at Valley Fork. The maximum temperature recorded is 103° F., in August, at Sutton.

The average annual precipitation is recorded as 47.99 inches at Sutton. The rainfall is well distributed throughout the year, being heaviest in the spring and early summer months, when most needed by the growing crops. In the driest year recorded in a period of 23 years at Weston, in Lewis County, the precipitation amounted to 31.17 inches. The annual average snowfall is about 27 inches.

As recorded at Sutton, where the elevation is 843 feet above sea level, the period between the average date of the last killing frost in the spring, April 27, and the first in the fall, October 21, is almost 6 months. This gives a fairly long active growing season. Killing

frost, however, has occurred at Sutton as late in the spring as May 12 and as early in the fall as October 10.

The climatic conditions in general are favorable for general farming and stock raising. The rainfall, although light in the fall, furnishes enough moisture to keep the pastures green. Floods usually occur in the spring before planting time, but late August floods do considerable damage to corn in some seasons. The following table contains climatic data taken from the records of the Weather Bureau station at Sutton:

*Normal monthly, seasonal, and annual temperature and precipitation at Sutton.*

| Month.         | Temperature. |                   |                   | Precipitation. |   |  |
|----------------|--------------|-------------------|-------------------|----------------|---|--|
|                | Mean.        | Absolute maximum. | Absolute minimum. | Mean.          | Total amount for the driest year. (1908). | Total amount for the wettest year. (1907). |
|                | ° F.         | ° F.              | ° F.              | Inches.        | Inches.                                   | Inches.                                    |
| December.....  | 33.7         | 70                | -21               | 3.73           | 2.38                                      | 3.70                                       |
| January.....   | 36.6         | 70                | -15               | 5.32           | 4.00                                      | 9.20                                       |
| February.....  | 41.3         | 76                | -6                | 3.16           | 4.25                                      | 2.02                                       |
| Winter.....    | 37.2         | 76                | -21               | 12.21          | 10.63                                     | 14.92                                      |
| March.....     | 42.5         | 82                | -5                | 3.22           | 5.40                                      | 4.60                                       |
| April.....     | 56.1         | 95                | 19                | 4.78           | 3.14                                      | 5.77                                       |
| May.....       | 63.2         | 97                | 30                | 4.19           | 5.75                                      | 3.79                                       |
| Spring.....    | 53.9         | 82                | -5                | 12.19          | 14.29                                     | 14.16                                      |
| June.....      | 75.5         | 101               | 39                | 5.79           | 3.90                                      | 7.47                                       |
| July.....      | 74.0         | 101               | 46                | 4.88           | 6.05                                      | 10.45                                      |
| August.....    | 76.4         | 103               | 44                | 3.76           | 1.50                                      | 5.10                                       |
| Summer.....    | 75.3         | 103               | 39                | 14.43          | 11.45                                     | 23.02                                      |
| September..... | 68.0         | 97                | 34                | 3.33           | 1.05                                      | 5.90                                       |
| October.....   | 59.2         | 92                | 14                | 3.13           | 1.39                                      | 2.75                                       |
| November.....  | 44.2         | 82                | 11                | 2.70           | 1.58                                      | 5.01                                       |
| Fall.....      | 57.1         | 97                | 11                | 9.16           | 4.02                                      | 13.66                                      |
| Year.....      | 55.9         | 103               | -21               | 47.99          | 40.39                                     | 65.76                                      |

#### AGRICULTURE.

The early settlers in this section of the State were hunters and trappers, who gave very little attention to agriculture. As game became scarcer, they began to make small clearings and grew a few subsistence crops. Cattle, consisting mostly of milk cows, sheep for wool, and horses for transportation purposes, were raised in small numbers. These counties were a little later in developing than many of the surrounding counties, as they were not located upon the main

lines of travel, the Staunton and Parkersburg turnpike passing through the counties to the north and the James River and Kanawha turnpike traversing those to the south. The pioneers were followed by a farming class that made larger clearings and gave more attention to cattle and sheep raising. Lumbering was carried on in connection with farming during this period. While much of the valuable timber from the best land was rolled into log heaps and burned in the process of clearing, the timber nearer the main streams was rafted to market. The development in agriculture of the two counties was slow, until 30 or 40 years ago, when a large number of farmers from the counties to the north bought farms in Braxton and the northwestern part of Clay County, where land was cheaper than in the more thickly settled counties from which they came. Following their immigration much of the hill land was cleared and put in permanent pasture, and cattle raising became the most important industry.

The completion of the Baltimore & Ohio Railroad in Braxton County between 1890 and 1892, and of the Coal & Coke Railroad through both counties between 1895 and 1906, marked the beginning of a more rapid development. These roads gave a better outlet for timber and timber products, for coal, and also for cattle, which hitherto had been driven long distances to market. These roads also enabled the bringing in of supplies which were difficult to obtain when the "canoe runners" of the Little Kanawha and Elk Rivers were the main dependence for handling freight. Up to this time the area produced its own flour, but the next decade shows a marked decrease in wheat production. In Braxton County the production of wheat dropped from 62,520 bushels in 1899 to 26,171 bushels in 1909, according to the census.

Corn production in Braxton County increased 66 per cent from 1880 to 1910, and the production of hay shows a steady increase during the last 30 years. Oats have gradually increased in acreage and production in Braxton County, while fluctuating in Clay County. The latter produced more oats in 1899 than Braxton County, but had fallen below this high mark by 1909. Irish potatoes show a remarkable increase in production, advancing from a 21,000-bushel crop in the two counties combined, in 1879, to 143,000 bushels in 1909. There seems to be every indication that corn is grown upon a larger acreage and with a higher production at the present time than during the past. Wheat growing has been stimulated to some extent by the temporary war demands, but the high production prior to 1900 has not been reached. Potatoes are grown extensively at the present time, and buckwheat is grown on a much larger acreage than at any time within the last 30 years. Clover, millet, cowpeas, and soy beans have all gained in acreage since 1910.

Timothy alone and timothy and clover mixed are chiefly relied upon for hay. Of the 21,473 acres in tame or cultivated grasses in 1909, 11,160 acres were in timothy alone and 7,090 acres in timothy and clover mixed. The remaining 3,223 acres were in clover, millet, and other grasses. A total of 2,183 acres is reported in coarse forage, grains cut green, and wild grasses.

At the present time the agriculture of Braxton and Clay Counties consists principally of the production of corn and hay and the raising and fattening of beef cattle. From the standpoint of development and methods of farming the area may be considered as divided into two sections, separated by a line running in a general northeast-southwest direction from Wildcat, on the Little Kanawha River, to Queen Shoals, on Elk River. To the south and east of this line much of the land is steep and stony, only the hilltops and bottom land being suitable for farming. While much of this smoother portion is cleared and cultivated, the total acreage under the plow is not great. Large tracts are held by coal and timber companies that make little effort toward the development of agriculture. The stock on the farms is not improved. To the north and west of this line more land is cleared and in farms, a large acreage is in permanent bluegrass pasture, the stock is usually improved, the equipment is fairly modern, and the number of silos is large. Most of the better developed section of the area surveyed lies in Braxton County. Of the total land area of Braxton County, approximately 330,880 acres, the 1910 census reports 265,181 acres in farms, while in Clay county only 83,093 acres of the total of 212,480 acres are reported in farms.

The table below shows the value of the various classes of farm products for the two counties, as reported by the 1910 census:

*Value of the various classes of farm products of Braxton and Clay Counties in 1909.*

| Class of product.                           | Braxton<br>County. | Clay<br>County. |
|---|--------------------|-----------------|
|   | <i>Dollars.</i>    | <i>Dollars.</i> |
| Cereals.....                                | 409,179            | 147,493         |
| Other grains and seeds.....                 | 2,961              | 1,521           |
| Hay and forage.....                         | 160,002            | 31,962          |
| Vegetables.....                             | 195,183            | 92,075          |
| Fruits and nuts.....                        | 96,822             | 60,240          |
| All other crops.....                        | 123,076            | 49,964          |
| Animals sold or slaughtered.....            | 439,338            | 117,287         |
| Dairy products (exclusive of home use)..... | 98,251             | 45,322          |
| Poultry and eggs.....                       | 120,536            | 31,242          |
| Wool and mohair.....                        | 16,254             | 2,024           |
| Honey and wax.....                          | 10,244             | 2,966           |
| Total.....                                  | 1,671,846          | 582,096         |

The following table shows the acreage and production of the five principal crops in 1909, as reported by the census:

*Acreage and production of principal crops of Braxton and Clay Counties in 1909.*

| Crop.         | Braxton County. |                 | Clay County.  |                 |
|---------------|-----------------|-----------------|---------------|-----------------|
|               | Acreage.        | Production.     | Acreage.      | Production.     |
|               | <i>Acres.</i>   | <i>Tons.</i>    | <i>Acres.</i> | <i>Tons.</i>    |
| Hay.....      | 20,207          | 13,749          | 3,449         | 2,478           |
|               |                 | <i>Bushels.</i> |               | <i>Bushels.</i> |
| Corn.....     | 18,840          | 496,063         | 8,110         | 186,561         |
| Wheat.....    | 2,999           | 26,171          | 852           | 7,097           |
| Oats.....     | 1,680           | 18,924          | 782           | 8,948           |
| Potatoes..... | 924             | 100,820         | 500           | 43,937          |

Apples, peaches, and various small fruits common to this section are grown on most farms in sufficient quantities for home use and to supply the local markets, but commercial orcharding has not been developed. The 1910 census reports 128,679 apple trees in Braxton County and 62,929 in Clay County. The most common varieties are the Rome Beauty, Baldwin, Winesap, and the Red Astrachan and a number of other summer varieties. Most of the fruit seems of good color and quality, but very little attention is given to the care of the orchards. A total of 31,347 peach trees is reported in both counties in 1909. Cherries, pears, and plums are grown in a small way on most of the farms. Few grapes are grown, only 5,551 vines reported in the entire area in 1910. Strawberries and raspberries are grown to a small extent.

The raising of live stock began early in the history of the county and has increased in importance to the present time. Improvement of the beef cattle began with the introduction of the Shorthorn breed about 40 years ago. Later the Hereford was introduced, and a few years ago the Aberdeen-Angus. The Hereford seems best adapted to local conditions, and it has gained rapidly in popularity with the breeders. About half the cattle in the area is improved stock, with the Hereford breed predominating. Most of the leading farmers have purebred bulls. In the southeastern part of the area cattle raising is not well developed, and there is much scrub stock, but lately more attention has been given to its improvement. Most of the cattle pastured during the spring and summer are sold in the fall, little attention being given to wintering cattle except those used for breeding purposes. Many silos have been erected during the last few years, and more cattle are carried through the winter than formerly. The number of cattle as reported by the 1910 census is

17,363 in Braxton County and 4,938 in Clay County; of the total, 9,139 are milk cows. The total value of all cattle was \$567,575. Although there are a few small dairies, dairying as an industry is not developed to any extent. The Jersey predominates among the milk cows, followed by the Holstein and Shorthorn.

Hogs are kept in considerable numbers on each farm. Most of the hogs are of improved breeds or grade stock, except on the mountain farms in the southeastern part of the area, where there are many scrub animals. The Berkshire, Poland-China, Chester White, Jersey Red, and Duroc-Jersey are the leading breeds. Many of these breeds have become mixed. The number of hogs in Braxton County in 1910 was 6,857, and in Clay County 4,251. The total value was \$70,667.

Sheep raising was more extensively carried on from about 1865 to 1890 than at the present time. During this early period they were kept largely for wool. The Merino was the first improved breed introduced, followed by the Cotswold, Southdown, Dorset, and Shropshire. During the last 20 years little attention has been given to sheep raising, with the result that the breeds have become badly mixed. Sheep are raised at the present time largely for supplying mutton and lambs. The number of sheep in Braxton County in 1910 was 24,730, and in Clay County 3,940. The total value was \$106,101.

The number of horses raised is small, but sufficient to supply the farm demands. The horses are either semidraft or standard-bred types. Most of the horses and mules used in the oil, gas, and coal industries are brought in from outside the county. The number of horses owned upon the farms in both counties in 1910 is reported by the census as 5,541, valued at \$550,260.

Chickens and turkeys are raised on most of the farms. The number of poultry in 1910 amounted to 100,137, valued at \$46,811.

Farming in this area has not declined materially as a result of oil and gas development, though this has been the case in adjoining counties. The bluegrass pastures have not been abandoned and allowed to grow up in brush, as in some sections. The fields are usually in good condition, having suffered very little from erosion. Few of them have been kept under cultivation for long periods after clearing, as was the case in many of the older settled counties of the State.

The influence of soil and topography upon the agriculture is marked over the northwestern half of the area, comprising a large portion of Braxton County and the northeastern corner of Clay County. Where red soils predominate, with a somewhat subdued topography and a uniformly smooth surface, farming is better developed than over the remainder of the area, where gray, stony soils with a steep and broken topography predominate. Over the north-

western section the bottomland and terrace development is usually more extensive, adding to the subdued topography. The low ridge land around Flatwoods, presenting a marked physiographic contrast to the remainder of the area in its gentle surface outline, was the first to be cleared and put in crops, and its productiveness has been depleted until at the present time it is spoken of as "thin" or "worn-out" land. The natural adaptation to grass and the large proportion of land too steep for successful cultivation, although suitable for pasture, has made stock raising the predominant agricultural industry. The distance from large markets also is a factor that has restricted agriculture to stock raising.

The farmers in general recognize that certain soils are best adapted to certain crops. The red soil of the stream bottoms is generally considered to be the best corn land in the area, and it is used extensively for that crop. The red hill land is considered the best for wheat, clover, and grass, and the best upland soil for corn. The high bottom and terrace soils are recognized as best for potatoes and vegetables, as well as for cowpeas and soy beans. The sandy bottom land is known to produce good sweet potatoes, sorghum, and melons.

The equipment is modern on some of the best farms, but ranges to primitive on the mountain farms. The draft animals are usually good or fairly good. The implements vary from labor-saving machinery such as mowers, reapers, hayrakes, tedders, heavy turning plows, disk harrows, cultivators, and grain and fertilizer drills, in use upon the best farms, to the one-horse plow, cradle, scythe, pitchfork, hand rake, and hoe of the mountain farms. Mowers and moderately heavy turnplows and other standard equipment are found on most of the farms. Spring-tooth and spike-tooth harrows are in common use. Much of the grain crop is harvested with the cradle.

The upland soil is usually broken 6 to 8 inches deep and brought into good tilth with the spring-tooth harrow. Subsequent cultivations are given with the plow or hand hoe. On the bottom land and terraces the plowing is usually deeper, disk harrows are frequently used for smoothing the surface, and tillage is done to some extent with cultivators.

Most of the hill land is in permanent pasture, which is rarely disturbed. Occasionally a field is reseeded, being put into cultivated crops during the transition. New ground, especially in the southern part of the area, is usually planted to corn for the first few seasons, before seeding to grass. Many of the gentler slopes and smooth ridge tops are cultivated. The bottoms and terraces are usually devoted to hay or corn.

The corn crop of the area is usually cut and shocked in the field, and later hauled to the barns. Some of it is shredded and used to

fill silos. The hay, with the exception of some of the better grades stored in barns, is stacked and fenced in the fields, the fences being removed as the hay is needed to feed the stock. Broom sedge, ox-eye daisy, blue devil, plantain, and various briars and other growths lessen the value of the hay crop, where the mowings are allowed to run for a number of years before reseeding.

The general crop system followed results in occasional alternations of the crops in a given field, but no systematic rotation is followed. Hill land which has been in grass for a number of years may be plowed and planted to corn, and winter wheat is often seeded on corn stubble and harrowed in. Grass is usually seeded with the wheat. Timothy or timothy and clover mixed is seeded if hay is desired, and bluegrass is added if pasturage is to be maintained after the hay crop fails. Grass is usually kept for four to seven years before reseeding. The bluegrass pastures remain for indefinite periods, some having stood for 40 years without reseeding. The terrace land is not kept in hay grasses for as long periods as the hill or bottom land, since it naturally gives out sooner and since all the farming here is more diversified. In the stream bottoms a field may remain in grass for long periods, or may be cultivated to corn for an indefinite number of years; when a change is made, timothy is sown upon the corn stubble and used for mowing until the stand begins to fail, when it is largely supplanted by native grasses and is used for pasture.

Commercial fertilizer is used to a very small extent in this area. Only 8.8 per cent of the farms in Braxton County and 2.2 per cent of those in Clay County reported the use of fertilizers in 1909, at a total cost of \$2,768. According to local information, the use of fertilizers has become much more general during the last few years. Acid phosphate and bone meal are the most common forms used. About 250 to 300 pounds per acre is applied for corn, and 250 to 500 pounds for wheat. Fertilizer is used mainly upon the terrace and high bottom lands, but to a considerable extent upon the hill land. Manure is applied upon intensively cultivated fields, gardens, and land in corn as far as the supply permits. Sod land is turned under occasionally, but more because the land is needed for crops than for the benefit to be derived from the organic matter. Clover, cowpeas, and soy beans are grown by some of the more progressive farmers as a means of increasing the nitrogen content of the soil, but cover crops are seldom or never plowed under. Liming has not become general, owing to the lack of available limestone within the area, to the high cost of the commercial products, and to the difficulty of local transportation.

Even under prewar conditions it was difficult to obtain farm labor, as much of the efficient labor had been attracted to the oil and coal fields in the area and in adjoining counties, where the price paid ranged about \$1 a day higher than that paid upon the farms. Farm labor was paid \$1 to \$1.50 a day. The price has advanced steadily under war conditions. Much of the work upon the farms at present is performed by the farmer and his family. According to the 1910 census, 47.1 per cent of the farms in Braxton County reported the hire of labor in 1909, at a cost of \$102,732, and 38.4 per cent of those in Clay County, at a cost of \$23,466.

The average size of the farms in Braxton County in 1910 was 92.4 acres, and in Clay County, 75.6 acres. The size of the farms shows a steady decrease since 1880. Nearly all the farms are owned by native-born white persons. The percentage of farms operated by owners is relatively large, amounting to 80.7 per cent in Braxton County and 79.5 per cent in Clay County in 1910. There has been little change in the percentage during the last 40 years.

In Braxton County, in 1910, 219 of the 537 tenanted farms were rented on shares, 34 on a combined share-cash basis, and 279 for cash. In Clay County, of the 224 tenants, 46 rented on shares, 8 on a cash-share basis, and 151 for cash. The terms of lease vary between wide limits. The most desirable farms in the better developed communities and the land held by the coal companies usually rent for cash. Cash rents usually amount to about 5 or 6 per cent of the taxable value, and range from \$1 to \$10 per acre. Where bottom land is rented upon a share basis the owner furnishes only the land and receives one-half the field crops or two-thirds of the corn. In the case of hill land the owner receives a much smaller proportion of the crops, usually about one-fourth. In many cases the tenants are in such poor financial condition that the owner furnishes much of the equipment. In these cases the crops are usually divided equally upon hill land, while the owner gets two-thirds of the crop on bottom land. Bottom land brings the highest rental. Pasture land rents for only \$1 to \$3 an acre.

The following table gives the value, by classes, of all farm property in Braxton and Clay Counties, according to the 1910 census:

*Value of farm property in Braxton and Clay Counties, 1909.*

|                     | All prop-<br>erty. | Land.       | Buildings.  | Imple-<br>ments. | Domestic<br>animals. |
|---------------------|--------------------|-------------|-------------|------------------|----------------------|
| Braxton County..... | \$6,868,065        | \$4,503,739 | \$1,144,061 | \$126,322        | \$1,093,943          |
| Clay County.....    | 1,565,858          | 941,911     | 280,594     | 40,774           | 302,579              |
| Total.....          | 8,433,923          |             |             |                  |                      |

SOILS.<sup>1</sup>

Braxton and Clay Counties lie wholly within the Appalachian Mountain and Plateau province, which extends from Pennsylvania to Alabama and includes the entire State of West Virginia. The upland soils of this area are all residual, being derived in place from the weathering of the underlying rock formations, among which are the Dunkard, Monongahela, Conemaugh, Allegheny, and Pottsville series of the Coal Measures.<sup>2</sup> These formations are sedimentary in origin, consisting of alternate strata of gray and red shales, and sandstone. The coal seams present in these formations have had little effect upon the soil. The rock beds dip gently northwestward, broken only by a few minor structural undulations. This brings the several formations to the surface in northeast-southwest belts, the youngest belt lying in the northwest and the oldest in the southeast part of the county. The lithological character and distribution of the formations play an important part in the topography and the distribution of the resultant soil types.

The Dunkard formation, which consists of alternating thin strata of gray, buff, and red shale and sandstone, caps the hills in the northwestern part of Braxton County. Only the lower 200 to 250 feet of this formation is present, and as the strata rise to the southeast it soon disappears. It gives rise to a steep or broken topography consisting of rather sharp ridge tops and hillsides.

The Monongahela and Conemaugh formations outcrop over the northern half of the area, and cover the ridge tops over the remainder of the area to the southeast. They have a combined thickness of about 1,000 feet, and consist of gray and buff shale and thin sandstone, with fairly well-defined belts of red shale. The red shale in the lower Conemaugh is irregular in occurrence and not usually found in the lower 200 feet, where the rock is more closely related in lithological character to the underlying Allegheny formation. The Monongahela and Conemaugh give rise to belts of smooth country, becoming steep in a few places only. In general the relief is more subdued, the soft shales weathering into many gently sloping hillsides, benches, and rounded hilltops.

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<sup>1</sup> Braxton County adjoins Calhoun on the southwest corner, while Clay County adjoins Calhoun, Roane and a small portion of Kanawha Counties on the northwest. Calhoun and Roane Counties were mapped in 1909 and, since that time, our classification of the soils has been changed considerably and, for this reason, the soils of Braxton and Clay Counties will not join those of Calhoun and Roane Counties. Clay County adjoins Kanawha County on the west and since the latter county was mapped in 1912, the classification of the soils has been modified and as a result, the Dekalb stony silt loam, Upshur silty clay loam, Dekalb silt loam in Clay County are mapped against the Meigs clay loam in Kanawha County. The Pope sandy loam of Clay county is mapped against Huntington sandy loam of Kanawha County. The Pope sandy loam is derived from material washed from sandstones and shales, whereas the Huntington, in our recent classification is confined to material washed largely or entirely from limestone soils, and since the sandstones and shales give rise to the soils of Clay County, it was not advisable to join up to the Huntington of Kanawha.

<sup>2</sup> The geological discussion in this report is based upon the West Virginia Geological Survey report on Braxton and Clay Counties.

The Allegheny formation is 250 to 300 feet thick, and consists of coarse-grained, massive sandstone interbedded with gray shale. It outcrops over the eastern and southern parts of the area, where it occupies steep valley walls, and in places extends over the narrow hog-backed ridges or divides. The surface is usually stony.

Relatively little of the Pottsville formation outcrops above the drainage level. It is found upon the lower slopes of the steep valley walls along the larger streams in the extreme eastern part of the area. It is composed of thick, hard, medium and coarse conglomerates, sandstones, and interbedded gray shale, and invariably gives rise to steep, stony land.

The hard, resistant sandstone strata, besides giving rise to steep, stony land, are often responsible for the occurrence of rock benches, flattened ridge tops, and other forms of subdued topography, especially where overlain by soft shale. The soft shales invariably give rise to smooth topography.

The soils of Braxton and Clay Counties fall into three natural divisions, upland or residual soils, terrace or old-alluvial soils, and first-bottom or recent-alluvial soils. For convenience of classification the soils are grouped into series, the soils within a series resembling each other in general characteristics, such as mode of formation, color, topography, and drainage conditions. The series is divided into types according to the percentages of stone, gravel, sand, silt, and clay which they contain. The type is the unit of classification and mapping.

The upland or residual soils, derived from the weathering of the underlying sandstone, gray shale, and red shale, are grouped in the Dekalb, Upshur, and Meigs series.

The Dekalb series includes types having gray to yellowish-brown surface soils and yellow to yellowish-brown subsoils. They are derived from the weathering in place of gray sandstone and gray shales. Two members of the series are mapped in this area, the stony silt loam and silt loam.

The Upshur series has a reddish-brown, Indian-red, or red surface soil and a red to Indian-red subsoil. It includes soils derived from red shale that is more or less calcareous. The Upshur silty clay loam is the only member of this series represented in this area.

The soils of the Meigs series represent intermingled Upshur and Dekalb material. They are derived from alternating thin layers of sandstone and gray and red shale. The clay loam is the only type of the Meigs series mapped in the area.

The terrace soils in this area are classed in the Holston series. This is characterized by gray to yellowish-brown surface soils and

yellow to yellowish-brown subsoils. The soils of this series are derived from material washed from sandstone and gray and red shale uplands, the deposits having been modified to some extent by subsequent erosion. The fine sandy loam and silt loam of the Holston series are mapped in Braxton and Clay Counties.

The soils occupying the present flood plains or first bottom along the streams vary with the character of the rocks occupying the different drainage basins from which the soil materials have been washed. This material differs enough to make it necessary to separate the first-bottom soils into two series, the Moshannon and the Pope.

The Moshannon series includes types having a reddish-brown surface soil and a reddish-brown to red subsoil. It represents material washed from the upland soils, principally those of the Upshur and Meigs series. The Moshannon silt loam is the only type mapped in this survey.

The soils of the Pope series are yellowish brown throughout the entire 3-foot profile, the subsoil being slightly lighter in color than the surface soil. These soils represent sediments washed from the upland sandstone and gray shales, and deposited by the streams during overflows. The sandy loam is the only type of the series mapped in this area.

Rough stony land includes small areas of steep land of stony-nature, mainly in forest and largely nonagricultural.

The following table shows a classification of the soils according to their physiography and mode of formation:

*Classification of the soils of Braxton and Clay counties according to physiography and origin.*

| Group.                           | Origin.   | Soil type.               |
|----------------------------------|---|--------------------------|
| Upland or residual.....          | Residual from sandstone and gray shale (sandstone predominating).                               | Dekalb stony silt loam.  |
|                                  | Residual from sandstone and gray shale (gray shale predominating).                              | Dekalb silt loam.        |
|                                  | Red shale (more or less calcareous).....  | Upshur silty clay loam.  |
|                                  | Alternating thin strata of sandstone and gray and red shale.                                    | Meigs clay loam.         |
|                                  | Massive, coarse-grained sandstone.....  | Rough stony land.        |
| Terrace, or old alluvial...      | Wash from upland soils, shales predominating over drainage basin.                               | Holston silt loam.       |
|                                  | Wash material modified by erosion and influenced by underlying strata, sandstone predominating. | Holston fine sandy loam. |
| First bottom or recent alluvial. | Derived by wash from mixed Upshur and Dekalb material.  | Moshannon silt loam.     |
|                                  | Derived by wash from Dekalb material, stony types predominating.                                | Pope sandy loam.         |

In subsequent pages of this report the various soil types recognized and mapped in this survey are described in detail, and their relation to the agriculture of the area discussed. The map accompanying this report shows the distribution of the various types. The following table gives their actual and relative extent:

*Areas of different soils.*

| Soil.                       | Acres.  | Per cent. | Soil.                        | Acres.  | Per cent. |
|-----------------------------|---------|-----------|------------------------------|---------|-----------|
| Dekalb silt loam.....       | 200,000 | 36.8      | Meigs clay loam.....         | 14,592  | 2.7       |
| Dekalb stony silt loam..... | 170,048 | 31.3      | Rough stony land.....        | 11,776  | 2.2       |
| Upshur silty clay loam..... | 103,168 | 19.0      | Holston fine sandy loam..... | 1,600   | 0.3       |
| Moshannon silt loam.....    | 23,552  | 4.3       | Holston silt loam.....       | 1,216   | .2        |
| Pope sandy loam.....        | 17,408  | 3.2       | Total.....                   | 543,360 |           |

DEKALB STONY SILT LOAM.

The Dekalb stony silt loam is essentially the same as the silt loam, except for the larger amount of stone and the usually steeper topography. The interstitial soil material is gray, the shade depending upon the content of organic matter. The forested areas are dark, while fields under cultivation are usually light gray. This surface soil quickly becomes grayish yellow to yellowish brown. The soil, which has a depth of 6 to 8 inches, is friable and not very compact, being for the most part loamy. The subsoil is a yellow or yellowish-brown to orange-yellow, fairly compact, friable silt loam, which in some places becomes a silty clay loam in the lower part of the 3-foot section. Scattered upon the surface and throughout the soil and subsoil are large quantities of sandstone fragments and a lesser amount of shale fragments. Sandstone boulders occur in places on the surface and imbedded in the soil, and narrow rock ledges outcrop here and there upon the steeper hillsides. The parent rock is often encountered within the 3-foot profile.

Small areas of rough stony land are included, usually along the steeper valley walls of the larger streams. These stony areas detract from the value of the land only locally. Small areas of stony loam are included, and in many places the soil contains a noticeable amount of sand. These areas are usually found adjacent to outcrops of weathered sandstone. Small areas of stony loam are often found at the head of the coves, and are known locally as "cove land." These areas are often very dark in surface color, owing to organic matter or the collecting of coal dust, and they remain dark even after cultivation for long periods.

The Dekalb stony silt loam is extensively developed in the region south and east of Elk River, and to a lesser extent west of this stream in Clay County, extending for a short distance up its tributaries. Important areas are also mapped in the northeastern part of Braxton County north from Elk River and along the Little Kanawha River and its tributaries as far as Bulltown.

The type occupies decidedly steep and broken surfaces. It occurs along the steep slopes of stream valleys, and in the eastern part of the county extends up over the narrow crest of the "hog-back" ridges. The run-off is very rapid, and drainage is excessive. The native forest growth consists largely of white oak, chestnut oak, beech, spruce pine, chestnut, and poplar, with a thick undergrowth of mountain laurel and other shrubs and smaller plants. There is some original forest, but most of the type is cut over.

Little of the Dekalb stony silt loam is used for agriculture. Large areas in Clay County are held by coal companies, and probably less than 10 per cent of the type is cleared and farmed. Most of the cleared areas are used for pasture, but corn is grown in patches on the more gently sloping areas and "cove land," and is the only cultivated crop of any importance. It yields 15 to 30 bushels per acre, with an average of about 25 bushels. All the vegetables common to this section are grown in gardens, and Irish potatoes, sweet potatoes, beans, and sorghum are grown in patches. Small orchards, in which apples predominate, are found on most of the farms. Some good beef cattle and sheep are grazed, but the sod of broom sedge, moonshine grass, and other native grasses furnishes poor pasturage. A considerable number of cattle and hogs are ranged in the woods. Most of the cattle are scrub stock.

The steep and broken surface and the stoniness of this type make cultivation difficult, but the stone acts to some extent as a mulch and is responsible for the good yields of corn and for the thriving condition of fruit trees. In plowing, the rows are run with the contour of the hill, but erosion is usually active on plowed ground and much of the loose surface material is removed after heavy rains. Fields are cultivated only a few years after clearing and then turned to pasture. Most of the plowing is done with the 1-horse single plow, and cultivation with the hoe, the use of larger plows and machinery being generally impracticable. Little fertilizer or lime is used on this soil.

The Dekalb stony silt loam is not valued very highly for agriculture. The price ranges from \$5 to \$25 an acre. Quantity of stone, steepness of surface, and location are the important factors influencing prices.

The same methods of improving the soil should be followed as recommended for the steeper parts of the Dekalb silt loam. Much of the steeper land could well remain in forest, and most of the remainder could best be used for grazing. The coves and gently sloping benches could be cultivated. Intertilled crops probably are to be preferred, as it is difficult to handle the small grains, which require machinery for economical harvesting. Truck crops, for sale at near-by mining towns, should prove profitable. Bright Burley tobacco probably would be a good crop on this soil, as it is grown profitably under much the same conditions in other sections of the State.

#### DEKALB SILT LOAM.

The Dekalb silt loam as developed over the northwestern three-fourths of the area, which region includes most of the type, has a surface soil of grayish-brown to yellowish-brown, friable silt loam, about 5 to 8 inches deep. The subsoil is a yellow, brownish-yellow, or slightly reddish yellow to buff-colored silty clay loam, friable and compact. Both surface soil and subsoil contain small fragments of partly decomposed gray and buff shale and sandstone fragments, and in some places, usually along the outcrop of sandstone strata, the stone content is sufficient to make the soil a stony loam. This condition is notable on the hillside near Lydia and Elmira, and along Boggs Fork. In general, weathering has taken place to a considerable depth, and only in a few instances is the parent rock encountered within the 3-foot profile. In some places the silty loam surface soil is very thin, and in plowed fields the top soil represents more nearly a silty clay loam. In many places the immediate surface soil is gray when thoroughly dry. The type occupies hillsides or benches and the top of ridges. The topography is steep to gently sloping, but the surface in general is moderately smooth. The run-off is rather rapid, but the soil does not suffer as much from erosion as would naturally be expected.

As developed in the southeastern part of the area the surface soil is a gray, grayish-yellow, or pale-yellow silt loam, underlain at 6 to 10 inches by a yellow, friable silty clay loam, which sometimes changes to yellowish brown in color. In places slight red mottlings are encountered in the deep subsoil, and where the underdrainage is imperfectly established there is usually some gray mottling in the same zone. Occasionally sandstone bedrock is encountered within the 3-foot profile, and small fragments of sandstone are often scattered upon the surface, with lesser amounts of shale.

The type in the southeastern corner of Braxton County and the eastern part of Clay County occurs to a large extent upon somewhat flattened ridge crests. It has a fairly smooth topography, and is

not subject to erosion. In some cases imperfect underdrainage exists. Small areas are encountered where the surface soil is more nearly a sandy loam, these occurring principally on Birch Mountain and in some of the gaps on the ridge west of Clay.

The Dekalb silt loam is derived largely from the weathering in place of gray and buff shale and sandstone of the Conemaugh formation and to a small extent from the Allegheny. Those parts of the type that have a marked brownish tinge have been influenced by the interbedded or overlying red shale strata that give rise to the Upshur soil. Where the type has not been influenced by the red shale, and is derived from the Allegheny formation, it usually has a gray surface soil and a yellow subsoil, the latter often grading to yellowish-brown or orange as a result of oxidation. Parts of the gray Conemaugh shale are slightly calcareous, and the resultant soil as well as that part of the type associated with the highly calcareous red shale, contains some calcareous material.

From 35 to 40 per cent of the Dekalb silt loam consists of cut-over land, on which the growth is principally white oak, red oak, chestnut oak, poplar, walnut, chestnut, ash, and beech, with scattered pine. Some second-growth locust is found. Sixty-five to seventy-five per cent of the cleared area is in pasture. Most of the cultivated land is on the gentle foot slopes of hills, the more nearly level benches, and on ridge tops. On the somewhat flattened crests of ridges in the southeastern part of the area most of the cleared land is cultivated, but on the steeper slopes, comprising most of the type in the northeastern part of the area, the cleared area is used for pasture. The live-stock industry is comparatively important. The stock consists principally of beef cattle, but a few sheep, horses, and hogs are raised on nearly all the farms.

Timothy for hay probably covers a larger acreage than any other crop. Corn comes next, with wheat, oats, clover, and cowpeas grown on smaller acreages. Buckwheat is produced to some extent upon the high ridge tops. Rye, millet, sorghum, beans, Irish potatoes, and sweet potatoes are grown in small patches. Nearly all the common vegetables are grown in small gardens, and some of them are produced in sufficient quantity to supply a small surplus for market. Nearly every farm has a small orchard, composed largely of apple trees, but commercial orcharding is not developed. The fruit when properly cared for is of fine flavor and color.

Yields on this soil vary between wide limits, depending upon the farming methods. Where an effort has been made to maintain the soil in a productive state the yields are usually good. Corn yields 15 to 35 bushels, wheat 10 to 25 bushels, and oats 15 to 30 bushels per acre. Potatoes give 100 to 250 bushels per acre. Timothy hay yields an average of about 1 ton per acre in ordinary seasons.

Liming is not general and commercial fertilizer is used only by farmers within easy reach of transportation. Where easily obtainable from 250 to 350 pounds of bone meal or acid phosphate is used upon small grains, wheat being rarely grown without the use of fertilizer. The supply of manure, usually inadequate, is generally applied to land used for gardens and for the production of corn.

The selling price of the Dekalb silt loam varies little, as the type is quite uniform. The price ranges from \$25 to \$40 an acre, with a few favorably located places held at a higher figure, from \$50 to \$75 an acre.

In most places the Dekalb silt loam is deficient in organic matter and lime. It would be benefited by the turning under of sod, preferably timothy and clover stubble, or timothy after it has run 3 or 4 years, with the addition of 1,000 pounds of burnt lime per acre. The more frequent growing of clover, cowpeas, and soy beans in the rotations also would improve the soil. Commercial fertilizer should be used more extensively. About 300 to 600 pounds of phosphate per acre should be applied to the land sown to small grains, and complete fertilizer at the rate of 500 to 600 pounds per acre can be advantageously used in growing vegetables, with heavier application for potatoes.

The Dekalb silt loam is well suited to the production of Irish potatoes, judging by the good results obtained upon this soil in other counties of the State. Soy beans make a good hay crop, and also tend to improve the soil through the addition of nitrogen and organic matter. Tobacco is grown successfully upon this soil in other parts of the State, bright Burley of excellent quality and heavy yield being produced with the use of 1,000 to 1,200 pounds of fertilizer per acre. The Dekalb silt loam is well suited to the production of apples, and includes many fine orchard sites. The fruit is of good quality and color, and the trees are prolific and remain healthy where given even moderate care.

#### UPSHUR SILTY CLAY LOAM.

The surface soil of Upshur silty clay loam as typically developed in this area is a dark reddish brown to dark-red, friable silty clay loam, 6 to 8 inches deep. The subsoil is an Indian-red to purplish-red, compact silty clay to clay, becoming more compact and heavier with depth. Fragments of red, gray, and green shale are encountered in places in the deep subsoil, but as a rule the parent rock is weathered to a greater depth than in the case of the other upland soils of this region. Lime nodules are found scattered upon the surface at certain horizons. The subsoil is slightly calcareous in some places, but the surface soil does not contain an appreciable amount of lime and gives no reaction with hydrochloric acid.

A characteristic feature of this soil is its friable to brittle structure when dry and its plasticity and tenacity when wet. In some places spots are found where the surface soil has been partly or wholly removed by erosion, leaving the subsoil near the surface or exposed. Here the soil has a tendency to bake and crack deeply upon drying, especially where there is not an ample supply of organic matter.

In some places a few patches of Dekalb soil, derived from thin interstratified beds of gray shale are included. Other included areas consist of fairly well defined belts of Dekalb stony silt loam, which are very narrow and "pinch out" entirely in places. Such belts are derived from strata of sandstone, which may be seen supporting benches about halfway between the top and bottom of the slopes along Elk River, in the general region between Sutton and Gassaway, and in adjacent territory, and in scattered areas in other parts of the counties. Aside from these minor variations the Upshur silty clay loam is fairly uniform.

The type is widely distributed over the area. It is extensively developed in the region north of Elk River, and it caps the hills to the south and west of this stream between Sutton and Clay. As the formations rise to the southeast it soon passes out, reaching as far as the Nicholas County line in only a few places between Birch River and Strange Creek. The type occurs in narrow strips winding around the hillsides at definite elevations, and occupying well-defined positions with reference to outcrops of the strata from which it is derived. The topography varies considerably, from gently sloping hill bases to steep hillsides, fairly level benches, rounded hill tops, and somewhat flattened ridge tops. The slope in all cases is sufficient to insure ample drainage, but the water-holding capacity of the soil is greater than that of the other upland types.

The Upshur silty clay loam is derived from the weathering in place of red, green, and purple shales, more or less calcareous. These strata outcrop over the area at fairly regular intervals.

The forest now remaining indicates that this soil at one time supported a notably heavy growth of hardwoods, mainly oak, with a scattering of hickory, maple, walnut, ash, poplar, and chestnut. The second growth consists largely of locust. About 70 per cent of the type is cleared and farmed, but from 60 to 65 per cent of the cleared land is in permanent pasture. The rest is devoted largely to the production of corn and timothy hay, with small acreages of wheat, oats, clover, and cowpeas.

A large number of beef cattle and a few sheep and horses are raised. This soil is capable of supporting more live stock to the acre than any other in the area, and is the foundation of the extensive cattle industry of this region. It is recognized as the strong-

est soil of the area. It supports an excellent bluegrass sod, with little broom sedge or other inferior grasses. Bluegrass comes in naturally where the land is cleared, but is usually seeded to insure a good stand. Pasture sod lasts for indefinite periods if care is taken to keep down the brush. The sod remains green even during dry seasons, when it burns badly upon the lighter soils. Timothy is generally seeded for hay. Mixed timothy and clover are sometimes sown, but clover alone is seeded to a very small extent, although it does better and is grown more extensively than on any other soil in the area.

Timothy hay yields 1 to  $1\frac{1}{2}$  tons per acre, and clover almost as much. Corn gives better results than upon any of the other upland types, the yields ranging from 20 to 60 bushels per acre and averaging about 40 bushels. Wheat and oats uniformly do better than upon the other soils, wheat yielding 12 to 30 bushels per acre, and oats 20 to 45 bushels. Buckwheat gives low yields. Orchard fruits do only fairly well, and since better adapted soils are generally available there is little orchard development upon this type.

This soil remains wet and cold late in the spring, and it is the usual custom to plow sod land deeply in the late winter or early spring, so as to subject the soil to some freezing and thawing before planting. In further preparation of the seed beds the soil is disked thoroughly and harrowed. Its heavy, intractable nature makes cultivation difficult, and clodding very often results from plowing while the soil is too wet. Where corn is to be planted, stable manure is applied if available, and the better yields of corn are usually obtained where this has been done. In some cases 250 to 350 pounds of bone meal or acid phosphate per acre is applied to corn land, but this is not a common practice. In growing wheat 250 to 500 pounds of acid phosphate per acre is applied if the farm is not too far from transportation facilities. The use of lime is not at all common.

Land of the Upshur silty clay loam is valued at \$30 to \$60 an acre, with some of the smoother or more favorably located areas ranging as high as \$100.

This soil is naturally durable and productive. The permanent pasture needs very little attention, except to be kept free from weeds, briars, and underbrush. When sod land begins to thin it can often be rejuvenated by applications of lime (preferably ground or crushed limestone) and bone meal or phosphate, or manure. When this fails, and eroded spots begin to show, the soil should be reseeded by turning the sod and putting in timothy and bluegrass, or underbrush may be allowed to grow until the soil is well filled with roots, which checks erosion, and the land then grubbed and seeded to bluegrass. This latter course is pursued on the steeper situations

where there is danger of erosion during cultivation. Reseeding, however, is seldom necessary. Cultivated crops should be confined to the more gently sloping areas, and on these a sod should be turned under at intervals of 3 to 5 years. It would be beneficial to apply lime on the cultivated areas, though its use is not as essential as on the Meigs and Dekalb soils. From 500 to 1,000 pounds of burnt lime per acre represents about the range in rate of application. Lime can be used economically only where the farm is near the railroads or a local supply. Manure should be applied, where practicable, on land intended for corn. About 250 pounds of acid phosphate per acre has proved effective in increasing the yield of small grains. The supply of organic matter should be increased. This would mitigate the tendency to bake and crack and form "galled" spots, which gives erosion a chance to become active. More organic matter is needed also to deepen and mellow the soil and improve its physical structure. Under the present system of farming little manure can be supplied. To offset this the sod on areas which it is advisable to cultivate should be turned under at shorter intervals, and more use made of green manure crops. Upon a soil of this heavy, intractable nature crop rotation should be arranged so as to require as little tilling as possible. In this view clover, wheat, and oats should be more extensively grown, where surface conditions favor their economical production.

#### MEIGS CLAY LOAM.

The Meigs clay loam consists of areas of Upshur and Dekalb soils so intricately associated that they could not be separated on the map. The included Upshur material ranges in texture from silt loam to silty clay loam or clay, and the Dekalb material from silt loam to silty clay loam. Upshur silty clay loam and Dekalb silt loam predominate. In most cases the soils are intermixed, but in many places the different soils are found in typical though small developments.

The Upshur clay has a very shallow surface soil of dark-red or Indian-red clay loam or silty clay loam, with a subsoil of heavy, compact, Indian-red clay, friable to brittle when dry and plastic and tenacious when wet. The soil of the silt loam is usually 6 to 8 inches deep and consists of a brown or reddish-brown to yellowish-brown silt loam, underlain by an Indian-red subsoil. The Dekalb silty clay loam has a gray to yellowish-brown soil, from 6 to 8 inches deep. Often the surface few inches is a silt loam in texture. The subsoil is a yellowish-brown to yellow silty clay loam to clay. The Dekalb stony silt loam has a dark-grayish to yellowish-brown soil, 6 to 8 inches deep, underlain by a yellowish-brown to yellow silty clay loam, both soil and subsoil containing a considerable quantity

of sandstone and shale fragments. The two dominant soils, the Upshur silty clay loam and Dekalb silt loam, are described in detail in preceding pages of this report. One unfailing characteristic of the Meigs clay loam is the quantity of fine, partially decomposed shale and sandstone fragments found scattered upon the surface and throughout the entire soil profile. The parent bedrock, in many places encountered within the 3-foot profile, consists of strata of red, gray, and buff shale and sandstone. The strata are usually thin, varying from a few feet to about 20 feet in thickness.

The topography is usually steep, and considerable mixing of the weathered material has occurred as the result of "slips," the sandstone strata giving way and the water-soaked mass sliding down the hillside. In some places, as on the tops of ridges, the horizon of the original strata is fairly well shown in the resultant soil type.

While the total area of the Meigs clay loam is not great, it is widely distributed over the western and southwestern parts of the area. Where it occupies the ridges or higher hills the topography is fairly steep; the surface, however, is fairly smooth. In a few places, scattered over the northern part of Braxton County, the type is encountered upon the steep hillsides below the horizon usually giving rise to it; here it is the result of slips and extends well down the hillsides. In the northwestern part of the area, where the Meigs is found capping the hills above the Upshur, the boundary coincides with the woodland limits, the Upshur usually being cleared while the Meigs is in forest. This is not the case in the southern part of the area, however, where the Meigs is found capping hills whose sides are occupied by the Dekalb stony silt loam; here the Meigs is cleared to a considerable extent.

Practically all of the type supports a cut-over growth of white oak, red oak, chestnut oak, poplar, and chestnut, with a scattering of walnut, hickory, beech, maple, and locust. The latter is found in many places as a second growth in pasture land.

From 20 to 30 per cent of the Meigs clay loam is cleared and either grazed or used for crops. Most of the cleared land is in permanent pasture. Corn and timothy hay are the principal crops. Wheat, oats, and rye occupy small areas in the more favorable situations. Mixed timothy and clover and clover alone are grown on a small acreage. Buckwheat is produced to some extent upon the hills in the southeastern part of the area. Millet, cowpeas, and sorghum are minor crops. Sweet potatoes, Irish potatoes, beans, and other vegetables are produced for home use and to a limited extent for sale on the local markets. Small orchards, in which apples predominate, are found upon most farms, and the trees seem to be in flourishing condition. A small number of beef cattle and sheep are grazed on this land.

Crop yields vary to some extent, the higher yields being obtained upon the "red spots" or where fertilizer is used. Corn yields about 15 to 40 bushels per acre. Wheat yields 12 to 20 bushels where grown upon the "red land." Timothy ranges from one-half ton to 1½ tons per acre. The production of hay is confined to the more level ridge tops, as mowers can not be used successfully on the steep portions. Bluegrass sod holds fairly well upon the Upshur material, but deteriorates more rapidly upon the Dekalb, where broom sedge and other weeds soon come in.

The methods of farming differ widely according to the location. On the high, narrow ridge tops throughout the northern and western parts of the area, where the roads and homesteads are invariably located in the valleys, the soil is left in forest or used for grazing. In the southern part, where it occupies somewhat flattened ridge tops, to which settlement has extended, it is cleared and used more extensively for cultivated crops. Agriculture here compares favorably with that upon the other leading soil types of the area. The farming methods vary to some extent with the predominance of Upshur or Dekalb material.

The value of land of the Meigs clay loam depends largely upon the location. Areas unfavorably located range in price from \$10 to \$20 an acre, while others are valued at about \$20 to \$35. Some of the more desirable places are held at even higher prices.

The same means should be adopted in improving this soil as suggested for the Dekalb silt loam and Upshur silty clay loam, respectively, according to the predominance from place to place of one or the other of these soils in the particular fields. The steeper and more inaccessible areas should be used for pasture. Where erosion is active it would be best to keep the land permanently in sod, which should be rejuvenated or reseeded when it begins to fail.

When land is being cleared, or changed from old sod to new, the surface should be left exposed as little as possible. The use of bone meal or other phosphate fertilizers will be found advantageous in rejuvenating the soil. Liming would benefit this type, but the long hauls necessary in most instances make its use costly and therefore impracticable.

#### HOLSTON FINE SANDY LOAM.

The Holston fine sandy loam as developed in this area is a yellowish-brown to brown, mellow fine sandy loam to loamy fine sand, passing imperceptibly at about 8 to 12 inches into a subsoil of light yellowish-brown to brown fine sandy loam, which is only slightly compact, even in the lower part of the 3-foot section. In many places the subsoil consists of a loamy fine sand which is fairly loose and open in structure. The substratum may consist of sandy and

gravelly material, but the surface is fairly free from gravel. Immediately along the streams the sand content is relatively high, and upon some of the terraces, at Cressmont, the soil contains a noticeable amount of medium sand and also waterworn pebbles and cobbles.

The Holston fine sandy loam occurs on the second bottoms, occupying low terraces that lie above normal overflow, but some parts of which are subject to inundations during excessive floods. It is developed mainly along Elk River in Clay County, but a few small areas lie along Buffalo Creek, in long, narrow bottoms, reaching a maximum width in the bends of the stream and pinching out entirely on the concave side. The type has a fairly level surface, 30 to 50 feet above stream level. The drainage is usually excellent, owing to the porous nature of the substratum.

Practically all the type is cleared, but the few remaining trees are large and indicate a heavy original growth. The tree species are more those of the first bottoms than of the upland, and include mainly the sycamore, elm, beech, and birch, with a scattering of poplar, maple, oak, and pine. Only a small acreage is devoted to agriculture, many towns, coal developments, and buildings connected with the oil and gas fields being located upon this soil. Most of the cultivated area is in corn. Small patches are used for the production of truck crops, of which beans, Irish potatoes, and sweet potatoes are the more important. Some attention is given to the growing of cowpeas, soy beans, and millet upon the better farms. Of the minor crops wheat, oats, rye, and buckwheat, oats occupy by far the largest acreage. Sorghum is grown in small patches. Very little attention is given to the growing of hay, and little of the type is in pasture. Many small orchards, consisting mainly of apples, have been set out on this soil. Little attention is given to farming, and on only a few farms is the equipment modern. Corn yields vary considerably, from 15 to 50 bushels per acre, owing to wide difference in farming methods. Oats yield 20 to 30 bushels per acre, Irish potatoes 100 to 150 bushels, and sweet potatoes slightly more. Hay cuts from 1 to 1½ tons per acre. The selling price of this land averages about \$100 an acre.

Very little fertilizer or lime is used on the Holston fine sandy loam. The content of organic matter is invariably low, and should be increased by using manure wherever it can be procured. Sod and cover crops should be turned under to increase the power of the soil to hold water. This is not a naturally strong soil, and fertilizer should be used with most crops. At least 500 pounds of complete fertilizer can be used profitably upon garden and truck crops, and 250 to 500 pounds of phosphate fertilizer on grain crops. This soil is well suited to trucking, and where the economic conditions

warrant this industry would doubtless prove profitable. Clover does not succeed very well, but cowpeas, soy beans, and vetch yield heavily. Redtop could well be substituted for timothy, as it is usually considered better for sandy soils. This type is well suited to such crops as sorghum, sweet potatoes, and melons, and these should not be overlooked in farm management.

#### HOLSTON SILT LOAM.

The soil of the Holston silt loam is a gray to grayish-brown, mellow silt loam, 6 to 10 inches deep, underlain by a yellowish-brown to yellow, slightly compact but friable silt loam to silty clay loam subsoil which extends to a depth of 3 feet or more. Scattered upon the surface in places are found small quantities of waterworn pebbles, chiefly quartz. Angular sandstone fragments also occur on the surface in some areas, for the most part near the base of hills or near local streamways that cross the type from the upland. In some areas the soil contains relatively large proportions of sand and fine sand.

The Holston silt loam occupies terraces representing the former flood plain of the streams along which it is developed. The surface is generally level to gently undulating, but the original deposits have suffered severely from erosion, as a result of which the outer or stream edge is deeply dissected by drainage ways, exposing in many places the underlying rock formations. The terraces in many places are supported by beds of sandstone. They lie from 20 to about 125 feet above stream level, the height varying to some extent even along the same stream. The elevation is much lower along the smaller streams, where it varies from 20 to 50 feet. The deposits, which vary in thickness from a few feet to about 20 feet, are composed principally of wash from the Dekalb soils. In a few places, however, there is relatively little Dekalb material present, wash from Upshur predominating, though the Upshur color is not retained. It is supposed that the color has been changed through leaching, as these deposits have been subjected to weathering for a relatively long time.

Along the Elk River, adjoining Kanawha County, this type corresponds to the low-terrace phase as mapped in that county. Its elevation above stream level is about the same as along the smaller streams, but is considerably less than the average along this river, ranging from 40 to 60 feet. The surface is more even than that of the remainder of the type, the terraces here having suffered less from erosion than elsewhere. The surface soil is usually darker brown in color than over most of the type.

The original forest growth on the Holston silt loam consists largely of oak, chestnut, poplar, sycamore, and beech. Practically

all the type is cleared. A considerable part of the larger areas is occupied by town sites. Of the cultivated part, which consists of about three-fourths of the total area, corn occupies the largest acreage. A fairly large acreage is devoted to the production of hay, but very little of the type is in permanent pasture. Wheat, oats, millet, rye, clover, and Irish potatoes are grown in small fields and sweet potatoes and vegetables are produced in most of the gardens. A considerable acreage is in orchards, in which apples predominate. The largest orchards in the area are located upon this soil. Fewer beef cattle and sheep are kept than on any other soil, but a larger number of horses, cows, hogs, and chickens are kept in proportion to the acreage, owing to the fact that the type is used for farmstead sites to a considerable extent. The population is much denser than on the upland or first-bottom soils. This more complete occupancy has resulted from the even topography, accessible location, and general desirability.

Crop yields vary widely according to the condition of the fields and the fertilizing material used. Corn yields 25 to 65 bushels per acre, wheat 10 to 25 bushels, oats 20 to 50 bushels, hay one-half to 2 tons, and Irish potatoes 100 to 300 bushels. Cowpeas, vetch, and soy beans do well. Bluegrass sod is not very strong, and soon gives way to broom sedge and other weeds.

Some of the farms on this soil have been allowed to run down, but others have been kept in a fairly high state of cultivation. Upon the latter a grass crop is made part of the rotation. Some lime is applied, but its use is not general. About 250 pounds of acid phosphate or bone meal is usually applied for small grains, while the available manure is applied to corn. Clover, cowpeas, and soy beans are grown to a small extent to improve the soil, but on many of the farms nothing is done to maintain the productiveness of the soil, and the yields are steadily decreasing.

The selling value of the Holston silt loam varies between wide limits. In the undeveloped districts the selling price ranges from \$30 to \$60 an acre, while in other places more desirable and nearer towns the type is held at a much higher price, seldom selling below \$100 an acre. Its price is also enhanced by its desirableness for town sites, industrial sites, rights of way, etc.

The productiveness of this soil would be materially increased by the incorporation of large quantities of organic matter. Only enough stable manure is produced under the present system to allow light applications to small patches and gardens. The turning under, every few years, of sod or a cover crop would serve to increase the organic content. This should be followed by the application of burnt lime at the rate of 1,000 pounds per acre. It has proved good

practice to use phosphate fertilizers in growing the grain crops. Applications of 250 to 600 pounds per acre are used, the heavier applications to be made when the grain is to be followed by grass. A complete fertilizer should be used on truck or garden patches, at the rate of not less than 500 pounds per acre. It would be wise to follow a short crop rotation (a two-year or three-year system), and to grow more intertilled crops. This is recognized as one of the best Irish-potato soils in the State, and excellent results have been obtained upon a commercial scale in other counties. Trucking should prove profitable near good markets, as most of the vegetables common to this section seem to thrive on this soil. Bright Burley tobacco has been successfully grown on the type in the southwestern part of the State. Alfalfa has proved successful in counties to the north, but only where the soil is heavily limed and inoculated.

#### MOSHANNON SILT LOAM.

The soil of the Moshannon silt loam is a brown or dark reddish brown to dark-red or Indian-red, mellow silt loam, grading imperceptibly between 8 and 14 inches into a subsoil of Indian-red to reddish-brown silt loam or silty clay loam, which is slightly compact but friable. Much of the type is underlain by beds of sandstone gravel, which in some cases are encountered within the 3-foot soil profile and which along some of the smaller streams extend in patches to the surface. Near the stream edge in places, especially along the larger streams, the soil is inclined to be sandy and is not as red in color as typical. Near valley walls along some of the streams there are developed flat or marshy areas. Similar areas also exist in old, partly filled stream channels.

Along some of the streams which have reached temporary base level formed by sandstone ledges, and where poor drainage conditions exist there is found a soil essentially the same as the Atkins silt loam. It has a gray to brownish-gray surface soil 7 to 10 inches deep, underlain by a subsoil of mottled gray, brown, and drab silty clay loam, which is somewhat sticky, and which becomes plastic in the deep subsoil. This included soil is developed along Granny Creek above McNutt, and along the head of Lower Flatwoods Run. In the latter place it resembles glade land in some features.

The bottom land along the headwaters of both forks of Falls Creek and along the Little Kanawha River from Bulltown to the mouth of Knawl Run has little or no red color and more nearly represents the Pope silt loam. It has a dark-brown to yellowish-brown soil underlain by a yellowish-brown silty clay loam subsoil. This soil is not quite so productive as the typical Moshannon.

The Moshannon silt loam is widely distributed over the northern and western three-fourths of the area along the streams which derive their sediments largely from Upshur material. The type occurs as almost flat bottom land lying from a few feet to about 20 feet above stream level. Along the larger streams it is above normal overflow, but even here it is subject to occasional flooding. The heavy floods usually occur in the early spring before planting time and do little damage, but floods late in August sometimes cause considerable injury to corn. Between overflows drainage is well established over the greater part of the type.

This soil originally supported a heavy forest, as is evidenced by the few remaining trees. These are mainly sycamore, elm, beech, and birch with willow immediately along the streams. Practically all of the type has been cleared and is now farmed. About one-half of it is in grass and used for the production of hay and pasture. Most of the cultivated area is planted in corn. Timothy is generally grown for hay, but timothy and clover mixed and clover alone are also used on some of the higher bottoms. Soy beans and cowpeas are grown to a small extent. Millet is sown to some extent in dry seasons, when the hay crop is short. Sorghum is planted in small patches for sirup. Oats and wheat are unimportant crops upon this soil.

Many beef cattle are kept on this soil, the stock being grazed and fed hay, ensilage, and corn. Most of the grass land is cut for hay twice a season and grazed after the last cutting, fences being built around the hay stacks and removed as additional feed is needed. Some of the bottom land is in permanent pasture, and furnishes good grazing even during the driest summers. Most of the poorly drained areas are used for pasture, although a considerable acreage is cut over for hay. Hogs are kept in considerable numbers on some farms. Gardens are planted in the higher parts of the bottoms.

The Moshannon silt loam is largely depended on for the production of corn in this area, and it compares favorably in productiveness with the soils of the corn belt. The yield ranges from 40 to 80 bushels per acre, averaging about 50 bushels. Oats and wheat give heavy yields but have a tendency to produce too much stalk and to lodge badly. Millet makes a heavy growth. Timothy yields 1 to 2½ tons of hay per acre. The second cuttings are usually light, but of better grade than the first. The poorly drained areas are somewhat less productive. The hay is usually heavy, but of inferior quality owing to volunteer native grasses.

Almost no fertilizer, lime, or stable manure is used upon this type, except small amounts upon the higher lying bottoms which are subject to only occasional overflows. No systematic rotation is followed,

the fields being used for one crop indefinitely. The soil is easy to handle, and forms a mellow seed bed with very little cultivation.

This type is valued very highly, the price ranging from \$40 to \$100 an acre, with the more desirable and better improved areas held at a still higher price.

Since there seems to be a demand for the greater production of corn, this soil should apparently be used more extensively for that crop. More attention could well be given to the careful selection of seed. The abundance of weeds in the grass fields shows that the sod is allowed to stand too long without reseeding. The best results seem to be obtained when the land is reseeded every third or fourth year.

The low-lying, poorly drained areas of Moshannon silt loam should be underdrained and given applications of lime at the rate of 2,000 pounds per acre, to secure the best results. The higher lying parts of the bottoms, which are not subject to annual overflow, may be improved by the methods suggested for improving the Holston silt loam.

#### POPE SANDY LOAM.

The surface soil of the Pope sandy loam is a light-brown to yellowish-brown, mellow sandy loam to loamy sand, from 6 to 12 inches deep. The subsoil is a yellowish-brown, slightly compact and friable sandy loam. Beds of waterworn sandstone gravel are found upon the surface in patches. In many places in the smaller bottoms masses of shale and sandstone fragments are encountered within the 3-foot soil profile, and in most places these underlie the type at varying depths. Some of the bottoms, especially near the channel of the larger streams, are comprised of more or less incoherent sand or loamy sand deposits that in some cases are badly washed and shift to some extent with each freshet.

The Pope sandy loam is developed extensively over the southeastern part of the area, where it occurs as first-bottom overflow land along the streams that receive their wash largely from Dekalb stony silt loam. It has a fairly level topography, with occasional low swells. Most of the type lies only 3 to 20 feet above stream level and is subject to occasional overflow. Some of the streams have cut channels wide enough to hold the run-off, except in excessive flood stages, and along these bottoms the type is seldom inundated. Drainage is inclined to be excessive, owing to the porous nature of the soil and substratum, the latter being composed more or less of gravelly material.

The original forest growth on the Pope sandy loam consists of sycamore, beech, birch, and willow. At the present time about one-half the type is cleared and under cultivation. Corn occupies prob-

ably three-fourths of the cultivated area. The type is used for hay and permanent pasture to only a small extent, as it is not naturally suited to grasses. Sorghum, cowpeas, oats, rye, and millet are grown in small patches. Irish potatoes, sweet potatoes, and other vegetables common to this section are grown in the gardens. Little live stock, except hogs, is kept. A dairy is maintained successfully upon this soil at Cressmont and furnishes milk to Widen, a coal-mining town.

In general, agriculture is not very highly developed on this soil. Very little fertilizer is used and organic matter is seldom turned under. The deposits from overflows are depended upon to keep up the productiveness, but the deposits apparently are not sufficient and as a consequence yields are low. Corn yields 20 to 45 bushels per acre, oats 15 to 25 bushels, timothy hay  $\frac{1}{2}$  to 1 ton, Irish potatoes 150 to 250 bushels, and sweet potatoes slightly more. This soil is easily cultivated, requiring only light draft. It dries out quickly and can be worked very soon after rains. Improved farm machinery is in use in only a few isolated cases.

The Pope sandy loam is valued at \$20 to \$40 an acre.

This soil is usually deficient in organic matter. Much of it lies above normal overflow and derives little benefit from the sedimentary deposits, and, in the lower lying areas, subject to constant overflow, the swift currents often do more damage than benefit. Such crops as rye, vetch, and cowpeas should be more extensively grown, and a cover crop or sod turned under occasionally to increase the organic content. An acreage application of about 300 to 600 pounds of complete fertilizer would benefit nearly all the crops. This soil is well suited to sorghum, sweet potatoes, melons, and light truck crops, and trucking could be developed into a profitable adjunct to general farming where the market conditions are favorable. Some method of protecting the soil from stream erosion should be adopted; removing the roads from the stream edge to the hill, and planting willows along the stream bank, might prove beneficial in some cases.

#### ROUGH STONY LAND.

The Rough stony land consists of steep, broken land so covered with stone or containing so much rock outcrop as to make cultivation impracticable. This type is found in its largest and most typical development along the steep valley wall of Elk River in Clay County. It occurs to a lesser extent along the upper part of this stream; along the upper part of the Little Kanawha River; and along Holly River, Birch River, and Buffalo Creek. Small developments are scattered along other streams. The type occupies steep bluffs or deep valley walls along the concave banks of the stream bends.

Most of this land is in forest, which consists of white oak, red oak, chestnut oak, poplar, chestnut, white pine, hemlock, and mountain laurel. Small patches, comparatively free from stone, can be cultivated, and other areas can be grazed to a certain extent, or used for forestry. Otherwise the type is of little or no agricultural value.

#### SUMMARY.

Braxton and Clay Counties are situated in the central part of West Virginia and comprise a total area of 849 square miles, or 543,360 acres. The topography in general is steep and broken, representing a succession of narrow ridges separated by narrow, V-shaped valleys. The surface of Braxton County is slightly more subdued and generally smoother than of Clay County. The elevations of the hills range from 1,400 to 1,500 feet above sea level along the northwestern edge of the area to 1,900 to 2,100 feet along the eastern border. The lowest points in the area are 605 feet above sea level, where Elk River leaves the area, and 730 feet where the Little Kanawha leaves the northern border of Braxton County.

The northern half of Braxton County is drained by the Little Kanawha River and its tributaries, the remainder of the area is drained into Elk River through numerous laterals. Owing to the steepness of the drainage basin, the former stream is subject to disastrous floods; the latter is comparatively free from floods.

The two counties had a total population in 1910 of 33,256. Braxton County is the more densely populated of the two, but the entire population of both counties is classed as rural. Sutton, in Braxton County, is the largest town, with a population in 1910 of 1,121. The greater part of the population of both counties is engaged in farming, although a large number of persons in different sections of the area are employed in oil, natural-gas, coal-mining, and lumbering industries.

The area is quite well supplied with rail transportation. The public roads, however, are in poor condition.

Charleston and Clarksburg constitute good near-by markets for farm produce. Pittsburgh and Baltimore are the principal markets for live stock. The coal mines furnish good local markets for all sorts of farm products.

The climate of Braxton and Clay Counties is mild and healthful, and well suited to general farming and stock raising. The mean temperature for the winter is about 37° F. and for the summer, 75°. The precipitation, whose annual mean ranges from 45 to 48 inches, is well distributed throughout the year. The active growing season averages about six months.

The agriculture of Braxton and Clay Counties consists mainly of general farming and stock raising. The crops grown are principally corn, oats, and hay (timothy). There is a large acreage of permanent bluegrass pasture. Raising of beef cattle is the chief live-stock industry.

The area is divided into two sections from the standpoint of agricultural development, the Elk River roughly dividing the two. North and west of this line the farms are generally in better condition, and dwellings and outbuildings are good, and the machinery and equipment are fairly modern. Over the remainder of the area the farms are less developed, as is reflected in the character of houses and farm buildings; the equipment is generally limited, and in some cases primitive. No general system of crop rotation is practiced. Fertilizer and lime are used in relatively small quantities. Efficient farm labor is scarce, owing to the higher wages paid in the oil, gas, and coal-mining industries.

The farms in Braxton County average 92.4 acres in size and in Clay County, 75.6 acres. About 80 per cent of the farms are operated by owners. The majority of the owners and tenants are native-born white persons. Most of the farm leases are on a cash basis.

The average value of all farm property in Braxton County, according to the census of 1910, is \$2,393 per farm, and in Clay County, \$1,425 per farm. The poorer grade of farm land ranges in price from \$5 to \$30 an acre, and the more desirable areas from \$30 to \$100.

Braxton and Clay Counties lie wholly within the Appalachian Mountain and Plateau Province. The upland soils are derived from the weathering in place of alternate strata of sandstone and gray and red shale, of the Upper Coal Measures, represented by the Dunkard, Monongahela, Conemaugh, Allegheny, and Pottsville formations. The stratigraphy rises gradually to the southeast, bringing these formations successively to the surface. These formations comprise a total thickness of 1,750 feet. The last two formations give rise to rocks differing in lithological character from the upper formations. Sandstone predominates in the lower formations, while red shale predominates in the upper.

The upland soils belong to the Dekalb, Upshur, and Meigs series. The alluvial deposits along the streams are derived wholly from material washed from the residual upland soils of the region. The Holston series occupies the terraces or second bottoms, and the Moshannon and Pope series the first bottoms.

The Dekalb series is characterized by gray to yellowish-brown surface soils and yellowish-brown subsoils. The stony silt loam covers a large area in Clay County and the southeastern part of Braxton County. The silt loam is an extensive type over nearly all parts of

the area. It is well suited to use as pasture land and in the more nearly level areas to general farm crops, such as corn, oats, and hay, as well as to fruit.

The Upshur silty clay loam, the only member of this series mapped, has an Indian-red or reddish-brown surface soil and subsoil. The type is widely distributed and is a durable upland soil. It is well suited to bluegrass, wheat, oats, corn, and hay.

The Meigs clay loam represents areas of Upshur and Dekalb soils undifferentiated. It occurs upon the caps of hills and ridges scattered over both counties. Most of this type is cut-over or pasture land.

The Holston silt loam, of the second bottoms, has a brownish surface soil and a yellowish-brown subsoil. It is not a strong type, but it responds readily to proper treatment. It has a smooth topography and is valuable for building sites and industrial developments.

Little of the Holston fine sandy loam is used for agriculture. It occurs inextensively on low terraces along the Elk River in Clay County.

The Moshannon silt loam, a reddish-brown soil, is the strongest bottom-land type in the two counties. It gives excellent yields of corn and hay without the use of fertilizers.

The Pope sandy loam is an overflowed first-bottom soil of gray to brownish color. It is encountered along the streams in the southeastern part of the area. It is mostly cleared and used for agriculture, but is less desirable than the Moshannon soil.

Rough stony land is of little agricultural value. It comprises small areas of steep land covered with stone or containing numerous rock ledges.



[PUBLIC RESOLUTION--No. 9.]

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

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

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

Approved March 14, 1904.

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



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