

# SOIL SURVEY OF THE PARKERSBURG AREA, WEST VIRGINIA.

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## DESCRIPTION OF THE AREA.

The Parkersburg area is located in the northwestern part of West Virginia and comprises the adjoining counties of Wood, Ritchie, and Pleasants. Wood County contains 357 square miles, Ritchie 457, and Pleasants 142, thus making the area covered by the survey 956 square miles. The area is bounded on the north by the Ohio River

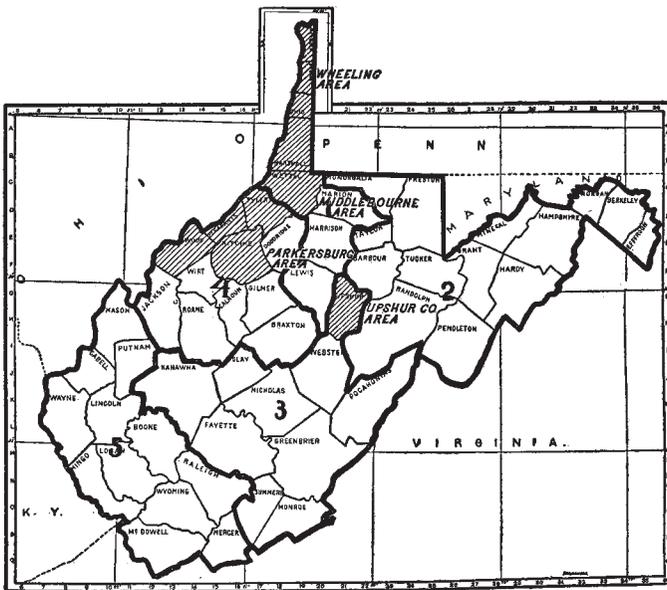


FIG. 28.—Sketch map showing location of the Parkersburg area, West Virginia.

and Tyler and Doddridge counties; on the east by Tyler, Doddridge, Gilmer, and Wirt counties; on the south by Gilmer, Calhoun, Wirt, and Jackson counties; and on the west by Calhoun, Wirt, and Jackson counties and the Ohio River. In an east-and-west direction it has a length of about 50 miles, while from north to south its greatest width is about 33 miles.

All of the upland of the Parkersburg area is very rough and hilly. From many of the hilltops and ridges the region presents a pic-

turesque appearance, resembling a very mountainous country on a small scale. The hills often converge to sharp peaks, while the ridges are in many cases only a rod or two wide. The most of the hillsides are steep and the valley bottoms are usually very narrow. Although the topography of the area is rough throughout, generally speaking, the roughest areas are to be found along the streams flowing into the Ohio and Little Kanawha rivers. Immediately along these rivers the country is, if anything, less broken than that along their tributaries. A large number of the smaller streams throughout the area have valley walls rising quite abruptly from 100 to 400 feet above the stream bed. The hillsides are often precipitous in character and in many cases show massive sandstone rock strata from 20 to 30 feet in thickness, while in others they are seen to be strewn with huge, irregularly shaped bowlders which have been broken off the underlying rock strata occurring farther up the hillsides. The high and low water levels of the Ohio River, as given by the United States Geological Survey, in the southwestern part of the area near Belleville, are 606 and 550 feet above sea level, respectively. At Parkersburg the same levels are 618 and 564; at Marietta, 621 and 570; and at Long Reach, a point about  $2\frac{1}{2}$  miles north of this area, they are 632 and 581 feet, respectively. One of the highest peaks in the area is Kings Knob, in Ritchie County, about half a mile south of Five Forks. It has an altitude of 1,367 feet, so that within the area there is a range in elevation of over 800 feet.

In the western part of the area, between Lubeck and the Ohio River, the topography is somewhat more gently rolling. The same is true in a few sections near the Little Kanawha River, but outside of these sections a topography of this character is seldom seen in the uplands, except here and there over small areas on the somewhat broadened ridge tops.

The most valuable farming land in the Parkersburg area is the bottom land, occurring irregularly along both the Ohio and Little Kanawha rivers. Its greatest width along the former river is about three-fourths mile, while along the latter it sometimes reaches a width of a mile. A very noticeable feature about the bottom land along the Ohio is that it is in many places made up of quite well-formed terraces, the height of one terrace above another varying from about 5 to 20 feet. Above the so-called "first bottom" the terraces are locally termed "second" and "third" bottoms. Only a comparatively small amount of first bottom occurs along the Little Kanawha River, the largest area being only a short distance from its mouth, at Tavennersville. Nearly all of the remaining bottom land along this stream as it occurs in this area lies at a higher point above water level, and at Tavennersville a high and well-defined terrace is seen.

The Ohio River receives the drainage waters of the entire area. It has an average width of about one-fourth of a mile and forms the northwestern boundary of both Wood and Pleasants counties. The largest stream flowing through the area is the Little Kanawha River. This stream rises in the central part of the State, in Upshur County, and flows in a northwesterly direction, crossing the southeastern boundary of Wood County,  $2\frac{3}{4}$  miles east of Leachtown. From this point it flows irregularly in a northwesterly direction, reaching the Ohio River at Parkersburg. The two principal streams in Ritchie County are the North and South Forks of the Hughes River. The North Fork rises in the northeastern part of the county and flows in a southwesterly direction through its northwestern part. The South Fork rises in the southern part of Doddridge County and flows irregularly in a westerly direction through the southern part of Ritchie County. The two forks unite just at the boundary line of the latter county near Cisko, forming the Hughes River proper, which flows in a northwesterly direction through Wirt County, reaching the Kanawha River at the boundary line between Wood and Wirt counties. The principal tributaries of these two streams are Grass Run, Bonds, Spruce, and Bone creeks. A good-sized stream in the northern part of the area is Middle Island Creek. It enters Pleasants County at its extreme northeastern part and flows in a southwesterly direction through the northern part of the county, reaching the Ohio River at St. Marys. The principal smaller stream of Pleasants County is McKim Creek, which enters Middle Island Creek near Union Mills. The principal smaller streams in Wood County are Pond, Tygart, and Worthington creeks. Many of the larger streams are very crooked and wind back and forth, often making loops of half a mile or so. The drainage basin of these streams is made up of an irregular network of smaller streams which very often flow on bedrock through deeply carved V-shaped channels. The depth of these valleys varies from 100 to 400 feet and the fall per mile is often over 100 feet. The main roads are very frequently in these valleys, and in many cases the stream bed is utilized as a road. After leaving the stream the road winds its way up to the top of the divide, only to descend at once into another valley.

The first permanent settlers in this area came mainly from Maryland, Virginia, and Pennsylvania in about 1770 and located along the Ohio River, principally around Williamstown and in the vicinity of Parkersburg. During the following sixty years many others came to the area from the same States, some also from New York and New England, and a few of these were from Scotland and Ireland. Nearly all of the earliest settlers were attracted to the area by the rich lands and the transportation advantages afforded by the Ohio and Little Kanawha rivers. Others coming later located along the principal

streams some distance away from these rivers. The present farming population is made up principally of descendants of the original settlers. The other classes are composed of those who have been attracted here in recent years, mainly on account of the discovery of oil and gas. Only a very few negroes are found in the area, and almost all of these are at Parkersburg.

The population of the counties forming this survey at each decennial period, commencing with 1820, is shown in the table following:

*Population of the counties comprising the Parkersburg area.*

County.	1820.	1830.	1840.	1850.	1860.	1870.	1880.	1890.	1900.
Wood.....	5,860	6,429	7,932	9,450	11,046	19,000	25,006	28,612	34,452
Ritchie.....				3,886	6,809	8,992	12,184	16,621	18,901
Pleasants.....					2,945	3,012	6,256	7,539	9,345

Wood County was formed from Harrison County by act of assembly passed December 21, 1798. The act creating Ritchie County was passed February 18, 1843, the county being made up of parts of Lewis, Harrison, and Wood. Pleasants County was formed from territory taken from Wood, Tyler, and Ritchie on March 29, 1851.

The largest town within the area is Parkersburg. It is a thriving city and is growing rapidly. The census of 1900 gave the population as 11,703, and conservative estimates place the present population at about 22,500. It not only has a large number of manufacturing plants, but it also is an important center for both jobbing and retail trade. St. Marys is also a thriving place. The population has probably doubled since 1890 and is now thought to be about 2,000. Both of these places are situated on the Ohio River. Two other small but quite important places, located on the same river, are Belleville and Williamstown. The city of Marietta, in Ohio, is located directly across the river from the latter place. Pennsboro, Cairo, and Harrisville are three other enterprising towns in Ritchie County. The first two are situated on the main line of the Baltimore and Ohio Railroad, while the latter is at the terminus of the Lorama Railroad, a line connecting with the Baltimore and Ohio Railroad at Pennsboro. Throughout the area there are a large number of smaller but thriving places having from 100 to 200 inhabitants.

The most important industry in the area is that of obtaining petroleum. This was first begun in about the year 1864, when oil was found at Volcano. Within a short time after this many other wells were drilled near this place, and for a period of fifteen years the production was very large. It, however, gradually decreased until at the present time only a comparatively small amount of oil is obtained from that field. In 1879 the town was burned, and since

then little or nothing has been done toward rebuilding it. About 1890 both oil and gas were discovered in other parts of the area, and as a result the business activity in several of the towns was increased very materially. At the present time producing wells are to be found over the larger part of the area and many new ones are being sunk. The lands are usually leased to the oil companies for a stipulated price per acre, which amount is ordinarily paid to the owner of the farm until a well is obtained, when in the place of the rental the farmer receives a royalty of one-eighth of the oil produced. The oil production within the area at the present time is not as large as it was in the earlier history of the industry.

About 1865 an asphalt mine was discovered near Macfarlan, and for a number of years a material of high grade was obtained from it, but at the present time it is worked only in a small way. Through the area there are a few small coal mines, but none of them have a production other than for local use. Sandstone is quarried in several places for building purposes.

The area is well supplied with transportation facilities. The Baltimore and Ohio Railroad extends from Parkersburg east through Cairo, Ellensboro, and Pennsboro, thus giving through connections with all eastern points. At Parkersburg the same road connects with Cincinnati, St. Louis, and other points to the west. Following the Ohio River on the West Virginia side is the Ohio River division of the Baltimore and Ohio Railroad, connecting all points in the area along the river with Pittsburg to the northeast and with Kenova and intervening points to the southwest. Passing from Parkersburg across the river is also the Zanesville branch of the Baltimore and Ohio Railroad, which gives good service to Chicago and points to the northwest. The Little Kanawha Railroad extends from Parkersburg through Wood County along the Little Kanawha River to Palestine, in Wirt County. The Lorama Railroad connects Harrisville, the county seat of Ritchie County, with the main line of the Baltimore and Ohio at Pennsboro. The Cairo and Kanawha Railroad extends from Cairo to Macfarlan, a point in the southern part of Ritchie County. Reaching from Parkersburg to Marietta is an electric line which connects these two places with all intermediate points. This line is equipped to carry both freight and passengers. At the present time two other short railroads are being built within the area—one from Cornwallis to Harrisville and the other from Goose Neck to Pullman, in the eastern part of Ritchie County. The area has excellent water transportation facilities. By this means materials may be shipped both to and from points to the north and northeast or southwest into the Mississippi and its tributaries. The Little Kanawha River also affords good shipping connections with all points in the interior of Wood and Wirt counties.

The Parkersburg area has a fairly good public road system. In the most hilly sections, however, many of the roads are very rough, and during the winter and after continuous rains are very heavy, especially over areas of red clay. At such times teams of from four to six horses are ordinarily used for hauling purposes. During the summer months the roads are usually in very good condition.

The cities of Parkersburg and Marietta, together with the other smaller places through the area, constitute the local markets. These towns usually furnish a greater demand for general farm and dairy products and truck crops than is supplied from the surrounding country. The most important agricultural products of the area are corn, hay, cattle, and sheep. Of these the last two are the most important. Sheep are raised for both mutton and wool, while the cattle are handled both for veal and for beef. Nearly all of the veal and mutton is sold to local dealers. The principal cattle market is Pittsburg, while that for wool is Philadelphia, though some wool is sold in Pittsburg and Baltimore. The farmers generally sell these products to local dealers, who in turn ship to the distant markets.

Practically the same conditions as regards means of communication exist in this area as are found in southeastern Ohio. Not only are all of the towns and villages connected by telephone, but nearly every farmer is likewise provided with this means of communication. The farmer owns his own instrument and a share in a line leading to some central or exchange point. Small annual fees are paid to meet the expense of line maintenance and for paying attendants at the central points. Throughout the area there are several independent telephone companies of this character, and in most cases arrangements are so made that those having an interest in one line are allowed free service over other lines. The outlay to the farmer is very small and is many times compensated for by the service obtained.

#### CLIMATE.

The climate of the Parkersburg area is healthful and is well suited to general farming. The annual average temperature is 53° F. The average temperature of the two coldest months—January and February—is about 34° F. The temperature seldom reaches 100° in summer or the zero point in winter. The absolute minimum temperature for Parkersburg during a period of fifteen years is about 27° below zero, while the absolute maximum for the same period is about 102° F. The annual rainfall of the area averages about 41 inches. The greatest precipitation usually takes place during June and July, when it is needed for growing field crops, while the least generally occurs during September, October, and November. Comparatively little snow falls during the winter,

and this melts quickly, seldom remaining on the ground more than a few days. Some of the more progressive farmers practice winter plowing, and thus gain the benefit to be derived from the alternate freezing and thawing of the ground during this season.

The first table following gives the normal monthly and annual temperature and precipitation for the area, as shown by the Weather Bureau records at Parkersburg, Cairo, and Bens Run. For Parkersburg the data are based on records for nineteen years; for the other stations the records are for the years 1903 to 1907, inclusive. In the last table the dates of the last killing frost in spring and the first in fall are given for the same places, showing the growing season to cover about one hundred and sixty days.

*Normal monthly and annual temperature and precipitation.*

Month.	Parkersburg.		Cairo.		Bens Run.	
	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.
	° F.	Inches.	° F.	Inches.	° F.	Inches.
January.....	33.0	3.50	32.8	4.79	31.0	4.10
February.....	36.4	3.67	30.0	3.23	29.1	2.52
March.....	42.4	3.63	47.1	4.88	44.4	5.84
April.....	53.0	2.95	51.3	4.10	50.3	3.70
May.....	63.3	3.40	64.0	2.62	62.9	5.29
June.....	71.5	4.92	69.1	5.21	70.9	4.94
July.....	75.6	4.66	73.2	4.16	74.4	4.84
August.....	73.4	3.53	72.7	3.33	74.3	4.39
September.....	66.1	2.72	68.5	2.96	69.2	2.68
October.....	54.6	2.44	55.5	3.88	54.5	3.44
November.....	43.1	2.83	41.4	3.19	42.8	2.07
December.....	35.2	2.77	33.3	4.11	34.7	4.10
Year.....	54.0	41.02	53.2	46.46	53.2	47.91

*First and last killing frosts.*

Year.	Parkersburg.		Cairo.		Bens Run.	
	Last in spring.	First in fall.	Last in spring.	First in fall.	Last in spring.	First in fall.
1901.....	Apr. 5	Oct. 4	.....	.....	.....	.....
1902.....	Apr. 15	Oct. 15	.....	Sept. 15	.....	.....
1903.....	Apr. 5	Oct. 24	May 5	Oct. 19	.....	.....
1904.....	Apr. 21	Oct. 16	May 16	Sept. 16	Apr. 22	Oct. 7
1905.....	Apr. 19	Oct. 13	.....	Oct. 13	Apr. 19	Oct. 13
1906.....	May 10	Oct. 12	May 18	Oct. 12	May 10	Oct. 11
1907.....	Apr. 20	Oct. 15	May 28	Oct. 14	May 5	Oct. 19
Average.....	Apr. 18	Oct. 14	May 17	Oct. 5	Apr. 29	Oct. 12

## AGRICULTURE.

In the year 1770 Washington came on his first trip down the Ohio River, seeking locations for the grants given him for services rendered in the French and Indian war, and chose lands along the Ohio River about 7 miles west of Parkersburg, now known as Washington Bottoms. One of the first real settlements in the area, however, was made by people from Maryland at what is now Williamstown, just opposite the mouth of the Muskingum River. In 1773 some Pennsylvanians made settlement at the mouth of the Little Kanawha River, where the city of Parkersburg now stands. A so-called "settlement title" was obtained to 400 acres at this point. At both of these settlements corn, wheat, flax, and Irish potatoes were raised. Both wild game and fish were very plentiful. Shortly after these first settlements, and before many others along the river had become at all permanent, Dunmore's war and a long period of troubles with the Indians occurred. Many settlers to the northeast, about Wheeling, were obliged to take refuge at Fort Henry at Wheeling or to go back to their old homes in Pennsylvania and Maryland until the danger should be passed. After the close of the Revolution, however, the danger from the Indians was not so great and permanent settlers and surveyors began to come back to this locality. In 1785 a party from Pennsylvania came by boat down the Monongahela and Ohio rivers, intending to go to Kentucky. They, however, did not go farther than the mouth of the Little Kanawha, up which stream they went for a short distance, landing on its south bank. This was the beginning of another permanent settlement in this area. At about this same time still another one was started at Belleville. Between the years of 1785 and 1800 quite a large number of new settlers came to this section, locating principally along the Ohio and Little Kanawha rivers. Settlements reached as far up the latter river as Elizabeth, just southeast of Wood County. The principal crops raised were corn, wheat, flax, and potatoes, together with some garden vegetables. Supplies were brought into the country from Pittsburg by boat and from Virginia by wagon and were exchanged for furs and pelts.

Development of the eastern part of the area began about the year 1800. It was first brought into notice through the opening of what was known as the "state road," the act authorizing the surveying and opening of which passed the Virginia house of burgesses in 1789. This road extended from Alexandria, Va., westward over the Allegheny Mountains to the Ohio River, opposite the town of Marietta. From Clarksburg, W. Va., it extended westward through the northern part of the area and was for many years one of the most important thoroughfares between the east and west. At first settlers built cabins at intervals along this road, mainly for the purpose of accommo-

dating travelers; but within a few succeeding years settlements were made away from the road in several different localities. Probably the first one in the eastern part of the area was made along this road near what is now Pennsboro. A little later, in 1801, another settlement was started in the vicinity of Harrisville. Others were gradually made in other parts until by about 1830 they were quite fairly well distributed over the whole of the area away from the Ohio and Little Kanawha rivers. A great many of the settlers were from Harrison County in this State, but nearly all originally came from Virginia, Maryland, or Pennsylvania. Practically the same crops were grown as by the somewhat earlier settlers in the western part of the area. Early history of Ritchie County states that the settlers usually made trips to Marietta once a year, mainly for the purpose of obtaining salt and iron, which articles they paid for in skins of wild animals and venison hams, supplemented occasionally with snakeroot and ginseng.

Between 1830 and 1840 the Northwest Turnpike was completed. This road passed through the northern part of the area from Parkersburg to Winchester and helped very materially in the development of the country. Up to 1832 there had always been considerable trouble in regard to land titles. In this year, however, the legislature passed an act providing for the quieting of land titles and for the sale of forfeited lands. This gave new impulse to immigration and tended strongly to increase land values. Up to this time the price of woodland ranged from 25 cents to 50 cents per acre. Between 1850 and 1860 another main road in the southern part of the area, known as the "Staunton and Parkersburg Turnpike," was completed. This, too, gave great impetus to improvement. The one thing, however, which more than all other causes combined contributed to the rapid settlement and development of the country was the building of the Baltimore and Ohio Railroad at about this same time. It soon gave origin to the villages of Pennsboro, Ellensboro, Cornwallis, Cairo, and Petroleum. The most recent cause for increased development within the area, although not particularly along agricultural lines, has been the discovery of oil and gas.

The early settlers within the area kept only a few cattle, and it was not until the late forties that they began to be raised for market purposes. These were all of a grade type and were driven overland to eastern markets. In the same way sheep were raised on a small scale almost from the time of the earliest settlements, but the industry was of little importance until after the civil war.

According to the census crop reports corn takes first rank of all the crops grown in the area, showing a steady increase in production from 1840 to 1900. The same authority shows that the production of wheat has varied considerably, being greatest in 1900. The yield

of oats has also varied, and generally speaking the production has been inversely proportional to that of wheat. Hay has never been an important crop, but the number of tons produced gradually increased until 1890, since which date it has slightly decreased. In 1870 about 43,000 bushels of rye were raised, but since then the production has decreased very materially, until at the present time very little of the crop is grown. Little or no barley has ever been grown within the area. Tobacco has been grown in the area since 1840, but statistics show that the amount produced in 1840 was over four times as great as in 1900. Over 200,000 pounds were produced in both 1860 and 1880, but in 1900 the production was only 20,430 pounds. The decrease has been due mainly to the decrease in prices obtained. A fair amount of buckwheat was grown up to 1880, but since then the production has been small.

Fruit has been grown in the area from an early date. Apples, peaches, and pears were first obtained as seedlings, but later standard varieties were introduced in nearly all parts of the area. The principal varieties of apples grown at the present time are Rome Beauty and Ben Davis. Other varieties are the York Imperial, Northern Spy, Grimes Golden, and Baldwin. Very little of the fruit is disposed of in other than local markets. Peaches are grown in a limited way over the entire area. Several varieties are found here, but the one most preferred is the Elberta, on account of its good shipping qualities. The principal varieties of pears grown are the Bartlett and Kieffer. Grapes are also grown quite generally. The principal difficulties in fruit growing in the area are damaging frosts and loss through winter-killing.

Small fruits, such as strawberries, blackberries, and raspberries, can all be grown successfully within the area. Grapes also do well. The nursery business is carried on to some extent mainly in Ritchie County, in the vicinity of Harrisville. At the latter place a general line consisting of fruit trees, shade trees, and ornamental stock is raised, about 30 acres being under cultivation. The larger part of the seedlings used in grafting stone fruits is imported from France. Apple seedlings are obtained mainly from Kansas, in the locality of Topeka.

The raising of sheep is one of the most important agricultural industries in the area. Nearly all of the early settlers produced wool for home use, but it was not until about 1860 that the industry began to be engaged in on a somewhat larger scale. Spanish Merinos were the principal breed raised at that time. About 1870 Cotswolds and Leicesters were introduced and in 1875 the Southdowns and the Shropshires. The two latter breeds, together with some Dorsets and Delaines, are the principal ones now handled. In 1893 many farmers within the area discontinued raising sheep on account of the

low price of wool. About six years later, however, better prices were obtained, and as a result the business was extended. At the present time considerable quantities of both wool and mutton are produced.

The raising of cattle is also an important industry within the area. Both beef and veal are produced. The principal breeds handled are Aberdeen Angus, Shorthorn, and Hereford. Quite a large number of Jerseys are kept for dairy purposes. Comparatively few purebred horses are raised within the area. An important industry in the locality of Parkersburg is the raising of Shetland ponies.

Considering broadly the question of soil adaptation, the use to which a large part of the lands of the Parkersburg area would seem to be best adapted is the raising of sheep and cattle, both on account of the topography, which is unfavorable to extensive cultivation, and because of the ability of the soils to produce excellent pasture grasses. Some of the pastures have been in grass for over twenty-five years and are still in fine condition. Many of the steep hillsides and ridges are still covered with the original forest or with a second growth consisting largely of locust. Nearly all of the upland soils seem to be well adapted to the raising of fruits, especially apples. The red clay land of the hilly section is considered best for wheat. The lowest bottom land along the Ohio and Little Kanawha rivers is used mainly for corn, while that occurring at the higher levels is valuable for Irish potatoes and truck crops. Some of the more sandy areas lying immediately between the river bottoms and the upland are most valuable for early truck.

The usual crop rotation upon the tillable uplands is as follows: (1) corn, (2) wheat (or oats), (3) timothy and clover, ordinarily allowed to continue for hay from one to five years, after which the field is used for pasture. The timothy is sown in the fall with the wheat and the clover in the early spring. The first hay crop is largely clover, but in the following years the timothy predominates. In sections where there is a sufficient amount of limestone material in the soil the timothy is gradually displaced by bluegrass, which affords excellent pasturage and which remains in good condition from ten to forty years. On the river bottom lands and in the upland valleys the rotation is usually (1) corn, (2) wheat, (3) timothy and clover continued for one to five years, then corn. In other localities on these lands where dairying is an important industry the following rotation is practiced: (1) corn, (2) corn, (3) clover and timothy, (4) clover and timothy. In the fall of the first year a cover crop of crimson clover and hairy vetch or rye is sown on the corn ground and in March or April is plowed under. In the fall of the second year the same ground is sown with timothy and seeded to clover in the following spring. During the two years following the hay crop is cut, after which the field is again plowed up for corn.

Usually in this section of West Virginia and the adjoining parts of Ohio, the farm methods are those which look forward to obtaining good pasture lands. Where the topography is not too steep, after clearing the land is planted to corn, other crops following in the order of rotation commonly practiced in the hilly uplands. In many instances, however, where the hillsides are very steep clean tillage crops are avoided, as the resulting injury to the land through erosion would be great. In such sections the cutting of the timber growth is generally completed before the early part of July. In August the land is burned over, shortly after which it is broken up as thoroughly as possible for the purpose of preparing a seed bed. Early in September a mixture of redtop, bluegrass, orchard grass, timothy, white clover, red clover, alsike, and rye are sown. The last-named crop, owing to its rapid growth, acts as a cover crop and helps very materially, through its large root development, to hold the soil in place until the root systems of the grasses shall have become well established.

The ordinary method of growing the corn crop in the hilly uplands illustrates the adaptation of methods to the local conditions. The soil is plowed to a depth of 6 or 7 inches, after which the corn is either drilled or planted in rows following the contours of the hills. The sod which is plowed under for the corn crop helps to keep the soil in place during times of heavy rains. By the end of the first year, however, these sods are thoroughly rotted and no longer act to bind or hold the soil together. For this reason corn is seldom planted on the same field two years in succession. In the cultivation of the steep hillsides the farmers quite often cultivate the upper half one year and the lower half the following year. This is done to check erosion, and whatever material is washed from the upper half of the hill is caught in the grass and sod in the lower half. Small depressions, gullies, and the slopes of runs are so far as possible kept in sod to prevent further washing. For the same purpose stones and brush taken from the fields are very often thrown into the gullies and runways. A still further precaution to prevent erosion is often practiced by the best of farmers. This consists in having alternate strips of sod land and corn. The strips are usually 2 or 3 rods wide and follow the contours of the hill. Whatever washing takes place in the corn fields is caught in the strip below, thus adding to its fertility. As a result of this method the hillsides in many cases have the appearance of being slightly terraced.

On many of the slopes the influence of the more resistant sandy shales is very apparent, and a series of small natural terraces is found. The level part of each terrace is usually very productive soil, and the steeper part is kept in sod for the protection of the more productive lower lying slopes.

Throughout the hilly sections of the area the character of the farm work is such that comparatively little barnyard manure is accumulated and placed upon the land. While generally speaking a comparatively small amount of commercial fertilizer is used, in some sections a considerable quantity is applied to the fields, particularly in growing wheat. Upon the bottom lands the best farmers use a great deal of manure, a large part of which they obtain from livery stables in nearby towns. On many of the first bottoms along the Ohio and the Little Kanawha rivers, as well as bordering the smaller streams, the productivity of the land is maintained by deposits of sediments from overflows.

Over quite a large part of the area the farmers seem to be in a prosperous condition. Most of the farmhouses are very well built and on many farms up-to-date machinery is used. This condition is, however, in part due to profits coming from oil and gas, for within recent years much wealth has accrued to the farmers from these two sources.

The demand for labor caused by the rapid development of business in connection with oil and gas is possibly the greatest drawback to farm work within the area. In many localities such high wages are offered by oil companies that it is well-nigh impossible for the farmers to obtain labor. From other localities many young men have been attracted to nearby towns, where they have shorter hours for work and better pay. Wages paid farm laborers vary from \$15 to \$30 a month, with board, lodging, and washing. In localities away from oil sections a common wage is \$18 a month or 75 cents a day and board. One instance was noted on river bottom land where a laborer who was retained the year through was paid \$18 a month, besides being furnished with a house, rough feed for a cow, cow pasture, a truck patch, and fallen fruits. During the busiest seasons of the year the daily wage is from \$1 to \$1.50 with board.

About 30 per cent of the farms of the area are leased to tenants, and these mostly on a share basis. On bottom lands when the owner furnishes merely the land he commonly receives one-third of the crop, but where he furnishes land, seed, work animals, and tools he receives two-thirds of the crop. The cash rental in the bottom lands is usually about 5 per cent of the taxable valuation, which ordinarily makes the rate from \$3 to \$9 an acre. In the upland sections if the owner furnishes only the land he commonly gets two-fifths of the crop. If he furnishes stock, such as cattle, sheep, and hogs, and one-half of the seed, he receives one-half of the grain and one-half the increase in the stock. The cash rental in the upland areas varies from 25 cents to \$3 an acre.

According to the census of 1900 the average size of farms within the area is about 87 acres.<sup>a</sup> According to the same authority the number of acres in farms in the entire area is 527,314, of which 304,451 acres is improved land. The average valuation per farm, including farm buildings, implements, machinery, and live stock, is about \$2,200. Within the upland parts of the area land values ordinarily vary from \$10 to \$30 an acre. There are, however, some exceptions to these prices, depending upon location. The value of bottom land along the Ohio and Little Kanawha rivers is about \$100 an acre, and of that along the smaller streams from \$60 to \$75 an acre. Oil and gas underlies a large part of the area, and on account of this values vary considerably. The prices stated, however, are based on agricultural value.

As the greater part of the Parkersburg area is well adapted to the raising of cattle and sheep, it would seem that many farmers within the area could very profitably increase their business in these lines. It is to be suggested also that more attention could well be given to the raising of both hogs and horses. On the rougher parts of the area goats should prove a very profitable investment. Whatever kind of stock is kept, it is furthermore to be suggested that pure breeds should be handled and that grades should as far as possible be eliminated. There are many good opportunities for the extension of dairying.

Several instances have been noted where draining the bottom lands by tiling has proved very beneficial. Careful attention should be given to this. Barnyard manure should not be allowed to accumulate, but should be distributed over the land as promptly as possible. Wherever the land is nearly level or gently rolling, the best method of doing this is by means of a manure spreader. One instance was noted where "floats" was used as an absorbent in the stable. This is an excellent practice.

In some sections of the bottom lands complaint is made that clover does not do well. Where this trouble prevails considerable care should be taken in selecting good seed and also in seeing that the lands are made alkaline through application of lime. During the past summer a fungus disease known as anthracnose of clover was noted. This disease affects the plant in the fall and in many cases causes it to winterkill. No remedy seems to be known except that of introducing a resistant variety, of which alsike and crimson clover are said to be among the best. Resistant strains of ordinary red clover have been developed by the Tennessee Experiment Station and the Bureau of Plant Industry of this Department.

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<sup>a</sup> The average size in Wood County is about 75 acres, in Ritchie County 105 acres, and in Pleasants County about 80 acres.

Comparatively few apples and peaches are grown within the area. Under normal conditions both of these fruits do well, and it would therefore seem that more attention could well be given to their production. To obtain the best results spraying should be practiced. Much of the roughest land within the area could be used to good advantage by carrying on systematic work in forestry; the growing of locust trees for posts, it is believed, would be especially profitable.

SOILS.

Eleven soil types have been recognized in the area, varying from a loose incoherent sand to a stiff heavy clay. In some cases the types pass very gradually into one another, so that it is difficult to define their limits, while in other cases the boundaries are very sharply marked. The greater part of the upland is not naturally of high agricultural value, although the soil in those parts of the area where the topography is less rough produces very good crops where properly managed.

The map accompanying this report represents the different types in colors; the following table gives the name of each type and its actual and relative extent:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Meigs clay loam.....	427,264	68.5	Wheeling silt loam .....	5,696	0.9
Rough stony land.....	59,456	9.5	Wheeling fine sand.....	2,624	.4
Dekalb silt loam.....	54,592	8.8	Brooke clay loam.....	1,856	.3
Huntington silty clay.....	40,832	6.6	Wheeling fine sandy loam.....	1,344	.2
Upshur clay.....	15,232	2.4	Wheeling gravelly loam.....	320	.1
Tyler silt loam.....	14,656	2.3	Total.....	623,872	.....

All of the upland of the area belongs to the Coal Measures of the Carboniferous period. The geological formations represented are the Dunkard (Permian), Monongahela, Conemaugh, Allegheny, and Pottsville. Passing from Belmont southward by way of Horseneck, Borland, Volcano, and Volcano Junction is an anticlinal fold locally spoken of as "the break."<sup>a</sup> It may be identified in many places along road cuts by the dip of the rock strata. Its width varies from 2 to 2½ miles. The principal formations represented within the area of the fold are the Monongahela, Conemaugh, Allegheny, and Pottsville. Outside of the area of the fold the principal formation is the

<sup>a</sup> The center of the fold is about three-fourths of a mile east of Volcano, 1 mile east of Volcano Junction, one-fourth of a mile west of Borland, one-fourth of a mile west of Horseneck, and at Belmont.

Dunkard. The strata of all five of the series are made up of shales, sandstones, sandy shales, limestones, and coals, of which the first two are by far the most important from a geological standpoint.

The soils of the upland are formed mainly from sandstones and shales. Quite a large number of thick, massive sandstone rock strata occur throughout the area, but the extent of these is not sufficient materially to influence the soil. On some of the hilltops and narrow ridges the soil is somewhat lighter, though this characteristic is not sufficiently marked to warrant the establishing of a type. A very large proportion of the surface is of a silty character. Clay occurs in many small, irregularly shaped areas, either as a limestone soil or as derived from more or less calcareous red shales.

The most important soil in the upland, from point of extent, is the Meigs clay loam. There is only one type of the Dekalb series, the Dekalb silt loam, and it is very closely associated with Meigs clay loam. Two heavy types occur, the Upshur clay and Brooke clay loam, both of the Appalachian province. Rough, stony areas have been indicated as Rough stony land.

The soils of limestone origin are generally recognized as being strong and are especially well adapted to supporting permanent bluegrass pastures. They are also well adapted to the growing of wheat. The hilly upland soils derived from the shale and fine-grained sandstones are used mainly for pastures. Considerable damage is caused by landslides. Large areas of both soil and subsoil sometimes slide down to lower levels, and the frequent occurrence of these has tended to mix the soils, often giving rise to many variations within the same type. Erosion is also very active on these hillsides whenever the soil becomes exposed, and for this reason they should be kept either in sod or forest.

The bottom land along the smaller streams, as well as the first bottoms along the Ohio and Little Kanawha rivers, has been mapped as Huntington silty clay. This type is frequently overflowed and is being formed from the deposition of materials washed from the adjoining hills and from the drainage area of the Ohio River to the northeast.

Along the course of the Ohio River are four members of the Wheeling series—Wheeling silt loam, Wheeling fine sandy loam, Wheeling gravelly loam, and Wheeling fine sand. The first three of these are locally known as river-bottom land, and in many cases occur in well-formed terraces. Beginning with the Huntington silty clay, which is known as first bottom, the other terrace levels above are known as second and third bottoms. The vertical distance between the levels of these terraces varies from 15 to 25 feet. It is very evident from the character and position of these terraces that they were formed of materials transported from long distances

to the northeast when the current of the river was much swifter and when it flowed at a much higher level than it does at present. The Wheeling fine sand occurs at an intermediate position between the terraced bottom lands and the upland. The origin of this type of soil is very similar to that of the other members of the series, but it has been somewhat modified by the action of wind. The types of the Wheeling series are rarely overflowed. A good condition of drainage usually exists over these types, and this is generally true of the Huntington silty clay.

Of all the soils within the area those along the river are the most valuable for farming. The Huntington silty clay is the strongest soil, but somewhat undesirable because of overflows. In the uplands the best soil for farming purposes is the Dekalb silt loam. The Brooke clay loam and Upshur clay are strong productive types, but are very difficult to work. The Meigs clay loam is best adapted to grazing.

#### MEIGS CLAY LOAM.

Locally the Meigs clay loam is quite often spoken of as "slaty land" or "gravelly land." It is closely associated with the Dekalb silt loam. The soil to a depth varying from 2 to 6 inches is usually a reddish or yellowish gray to a grayish-brown silt loam to heavy silt loam, containing numerous fragments of yellowish or grayish-yellow shale or shaly sandstone. These do not interfere with cultivation. On small hillsides and narrow ridges the soil is quite often somewhat lighter in texture, due to the more sandy character of the underlying formations. The subsoil to a depth varying from 10 to 20 inches is usually a yellowish silt loam to clay loam, below which is found a clay loam to clay varying in color from yellowish to mottled yellow and red. In other instances the subsoil throughout its entire profile of 36 inches may be a yellowish-red, reddish-yellow, or mottled red and yellow clay loam to clay. In some instances also red clay occurs in the lower part of the profile at depths varying from 24 to 36 inches. Rock fragments of shaly character are usually found through the entire subsoil, and bed rock occurs at depths varying from about 20 inches to 5 feet, the depth depending upon the amount of erosion which has taken place. Another characteristic of the soil is that it very often contains a marked content of coarse sand.

The Meigs clay loam occurs very irregularly in practically all parts of the area and has the largest extent of any type surveyed. Throughout the type are many areas of Upshur clay and Brooke clay loam too small to be mapped. Over some parts of it its topography is gently rolling enough to permit of cultivation and in such cases a good tilth is easily obtained. In general, however, the

surface is rough and very hilly, and a large part of it occurs as steep hillsides, on which erosion is very active if not checked. Drainage is excessive over the greater part of the soil. The underlying rocks are usually from 2 to 5 feet beneath the surface and for this reason the type is very likely to be droughty. Much damage through erosion often results in tilled fields, even though contour cultivation is practiced. It is on this type, almost wholly, that the landslides previously spoken of occur. These take place usually during rainy weather when bodies of both soil and subsoil, varying in size from a few square rods to several acres, slip down the hillside, ordinarily for a distance of about 20 feet. In many instances, however, they slide much farther than this. As a result the soils coming from the disintegration of the different underlying rock strata become very much mixed and many variations therefore occur which can not be mapped on the scale used. Many small streams and runs occur through the Meigs clay loam areas, giving good surface drainage conditions.

The Meigs clay loam is derived from the shales and soft sandstones and sandy shales of the Coal Measures, principally of the Dunkard series. A very constant feature of the type is the presence of many small shale and sandstone fragments.

The principal object in bringing this type of soil under cultivation is to obtain pasture. It is not naturally strong, but fairly good yields are obtained. Corn, wheat, and hay are the principal crops. Corn produces from 15 to 35 bushels per acre, with an average of about 20 bushels; and wheat from 6 to 20 bushels per acre with an average of about 10 bushels. Hay yields about three-fourths ton per acre. Fruits, such as apples and peaches, do well; and the same is true of small fruits, such as strawberries and raspberries.

By far the greater part of the Meigs clay loam is best adapted to pasture. Where the topography is very steep no clean tillage crops are produced, but pasture is at once obtained through the methods discussed on page 16 of this report. Bluegrass is best for pasture purposes. In some localities it occurs as a natural growth, while in others means are taken for introducing its growth. Bluegrass seed is often sown with clover on wheat ground in the spring. Hay is taken from the field the year following the wheat crop, after which it is used for pasture. The bluegrass usually takes possession of the field gradually and within three or four years a good pasture is generally obtained. One method of starting a pasture and one which has given good results in other sections is the following: In the fall, usually in September, a good seed bed is prepared in which a mixture of redtop and timothy is sown. After this small bluegrass sods are dropped over the field about 6 feet apart each way. These take root and spread, and in the following spring clover is sown. A crop of hay is

cut each succeeding season as long as the field produces a satisfactory crop and afterwards it is used as bluegrass pasture. When the bluegrass runs out, the fields are sometimes plowed again for the purpose of growing corn, wheat, and hay, and with the idea of eventually reseeding to pasture. Where there has been difficulty in obtaining a good growth of bluegrass, it is suggested that an application of lime and some form of phosphate might remedy the difficulty. The Meigs clay loam as a rule should not be cultivated to general farm crops, but should be used for pasture or for fruit. It would seem that the raising of grapes might prove profitable.

The original timber growth upon this soil was largely oak, maple, walnut, hickory, and poplar. At present it is principally locust, oak, hickory, walnut, and poplar. It is suggested that locust for posts might prove profitable upon this type. The price of this land ranges from \$10 to \$25 an acre.

The following table gives the results of mechanical analyses of fine-earth samples of the soil and subsoil of this type:

*Mechanical analyses of Meigs clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19224.....	Soil.....	1.2	2.7	0.8	1.3	13.5	60.1	20.4
19225.....	Subsoil.....	.8	3.0	1.0	2.4	5.6	51.9	35.1

DEKALB SILT LOAM.

The soil of the Dekalb silt loam, to a depth of about 9 inches, is a grayish to grayish-brown fairly compact silt loam, the particles of which feel very smooth between the fingers. The subsoil, to a depth of 36 inches, is ordinarily a yellow compact silt loam to clay loam, becoming heavier as depth increases. The latter description does not, however, apply to the subsoil in all parts of the area. In some instances the color becomes a reddish yellow to yellowish red in the lower parts of the profile. In others the subsoil to a depth of about 15 inches is a yellow compact silt loam, from which depth to about 25 inches it is of the same color but heavier. From 25 inches to 36 inches it is quite often lighter in texture and of a mottled gray and reddish-yellow color. Heavy red clay sometimes occurs in the lower subsoil and in parts of the type near areas of Upshur clay it is even found at depths varying from 15 to 20 inches. The areas last mentioned are not of large extent and were therefore not mapped as a separate type. Only a comparatively small quantity of fragments of sandstone and sandy shale are found over the surface or in the soil and subsoil.

The largest and most typical area of Dekalb silt loam is found in the western part of the survey southwest of Parkersburg. Other quite

extended areas are located south of Williamstown, Waverly, and Salama. The soil also occurs quite typically developed around Cairo, Harrisville, and Pennsboro. For the most part the type has a gently rolling topography and is easily cultivated. In some places it occurs as nearly flat or gently rolling hilltops, but in others the topography is quite sharply rolling. It is well supplied with streams, which results in good surface drainage conditions. Over some of the most gently rolling parts of this type it is thought that soil conditions could be materially improved by tiling. The areas of this soil are seldom damaged by erosion.

The Dekalb silt loam is a residual soil coming from the weathering of the shales and shaly sandstones of the Coal Measures, mainly of the Dunkard series. In road cuts the underlying rock is usually seen at depths varying from 4 to 6 feet. It is of the same character as that found at the lower depths within the areas of Meigs clay loam. The sand constituent of these rocks influences the soil considerably less than might be expected.

A very large percentage of the type is at present under cultivation. It is, however, not especially well adapted to any particular crop, but when well handled it is a good soil for the general farm crops. It is a soil responsive to good treatment and sensitive to neglect. Corn yields from 15 to 25 bushels per acre, wheat from 10 to 25 bushels, potatoes from 100 to 175 bushels, and in good years hay about 1½ tons to the acre. Oats are grown to some extent and ordinarily yield about 25 bushels per acre. In some sections near local markets tomatoes are profitably grown. Apples and peaches and also small fruits, such as strawberries and raspberries, do well.

Some commercial fertilizer is used, being usually sown with the wheat crop. As much organic matter as possible should be added to this soil and to accomplish this end the crops grown should be kept and fed to stock with a view to producing as much manure as possible. It is thought that the application of lime would increase the productivity of the soil.

The original forest growth was mainly white oak. The principal forest trees now are oak, walnut, and hickory. The type has a value ranging from \$15 to \$30 an acre.

The following table gives the results of mechanical analyses of fine-earth samples of the type:

*Mechanical analyses of Dekalb silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19208.....	Soil.....	0.1	1.7	3.3	11.1	3.5	66.7	13.3
19209.....	Subsoil.....	.3	1.1	3.0	12.3	8.4	55.1	19.6

## UPSHUR CLAY.

The soil of the Upshur clay is an Indian red or reddish-brown clay or clay loam varying in depth from 2 to 5 inches, through which small limestone fragments are occasionally found. In some parts of the type small limestone concretions are quite common in the soil. The subsoil is usually a heavy, tenacious red clay, but may sometimes be slightly mottled gray and yellow. There is generally but slight difference between the texture of the soil and subsoil.

The type is a very difficult one to handle on account of its tough and tenacious character. Both soil and subsoil often become cracked, the cracks varying in size from one-fourth to three-fourths of an inch and extending downward in many cases to a depth of over a foot. During wet weather the roads over this soil form into a deep red mud, through which it is well-nigh impossible to travel. During dry weather they are very rough until smoothed down by travel or by the use of road machines.

The Upshur clay is found mostly in the western and southwestern parts of the area. It is most typically developed in the southwestern part. Its topography is generally quite steep, but in some cases it occupies gentler slopes. In other instances it occurs as narrow bands extending along hillsides, due to the horizontal outcrops of the rocks from which the soil is derived. The surface drainage is very good, but where the soil is unprotected it is likely to erode badly.

The soil is derived from the more or less calcareous red shale of the Coal Measures. In some places small iron concretions occur. In many parts where neither limestone fragments nor concretions are to be found the soil is calcareous in character, as is proved by effervescence on applying hydrochloric acid. In quite a large number of instances land slides have mixed the type with Meigs clay loam, thus producing a phase somewhat poorer in character.

With proper handling Upshur clay produces very good crops of wheat, corn, and hay, but it is too heavy for potatoes or truck. It is best adapted to wheat and for bluegrass pasture. Oats are grown to some extent. Apples and peaches seem to do well, as do also small fruits. Wheat produces from 10 to 20 bushels, and corn from 30 to 60 bushels per acre. Hay yields  $1\frac{1}{2}$  to 2 tons and oats about 25 bushels per acre.

The most undesirable feature of the Upshur clay is the difficulty in cultivating it. During dry weather it has a tendency to bake and becomes very difficult to handle, except in areas that are somewhat loamy. When plowed in the fall winter rains have a tendency to cause the soil to run together or pack, thus making it difficult to prepare a good seed bed in the spring. This may be overcome to some extent by having the ground plowed in sod. If plowed in the spring it is likely to clod and bake badly. The best method of handling the

type seems to be to plow it late in February or early in March, after which it is subjected to alternate freezing and thawing which tends to make it loose and mellow, which condition is of material help at the time of preparing the seed bed.

The greater part of the soil has been cleared for cultivation. The principal trees found on it are hickory, locust, and walnut. The value of the land varies from \$25 to \$35 an acre.

The following table gives the results of mechanical analyses of the fine-earth samples of this soil type:

*Mechanical analyses of Upshur clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19238.....	Soil.....	0.0	2.5	0.7	4.9	3.9	48.4	40.3
19239.....	Subsoil....	.3	.8	.4	8.5	15.0	48.3	27.1

BROOKE CLAY LOAM.

The soil of Brooke clay loam is a dark-gray clay loam varying in depth from 3 to 5 inches. The subsoil under most typical conditions is a heavy yellowish-gray clay. In some cases, however, it is a heavy yellowish-brown clay to clay loam to a depth of about 16 inches, below which occurs a mottled yellowish-brown, reddish-brown, yellowish-gray, or ashy-gray material. The yellowish-gray and ashy-gray subsoils are inclined to be quite friable when dry. The red coloring is most prominent in the lower part of the profile. Scattered over the fields and disseminated through both soil and subsoil are grayish or bluish colored limestone fragments. A considerable number of limestone bowlders are also scattered over the fields and similar rounded stones are often encountered in boring. Cracks varying in width from one-fourth to three-fourths of an inch often extend downward through both soil and subsoil in practically the same way as in Upshur clay. As regards cultivation the type is very similar to Upshur clay. If plowed when too wet or too dry it becomes very difficult to handle, but if plowed in the right condition it not only turns much more easily but may be cultivated later with much less difficulty. As with Upshur clay, it is found that the best time to plow the soil is in February or March, so that it may have the beneficial effect of later alternate freezing and thawing. If plowed in the fall it is very likely to become packed by the time a seed bed is to be prepared.

The type occurs only in small, irregularly shaped bodies in the southwestern part of the area in Wood County, and is seldom found at elevations below 1,000 feet. In many instances it is so closely

associated with Upshur clay that it is difficult to draw a line of separation between the two types.

The Brooke clay loam is derived mainly from the disintegration of limestone, but to a slight extent may also come from the weathering of calcareous shales. It practically always occurs on hilltops or ridges. The drainage is good and in very few instances is it found to be eroded. The absence of eroded areas is very largely due to the fact that it is generally kept in pasture. The soil absorbs and retains moisture well and this causes the pasture to be much more permanent than upon the lighter Meigs clay loam.

The type is considered one of the best hilly upland soils. It is well adapted to the growing of general farm crops and is quite easily kept in a good state of productiveness. Bluegrass pastures upon this type are especially good. The principal crops grown are wheat, corn, hay, and oats. Apples and peaches and also small fruits, such as strawberries and raspberries, do well. Few potatoes are grown. Wheat yields about 20 bushels per acre, corn about 45 bushels, oats about 30 bushels, and hay ordinarily 2 tons to the acre. Clover nearly always makes an excellent growth upon this soil.

Practically all of the type is cleared land and is used mainly for bluegrass pasture. When cultivated as much manure as possible should be applied, since it will serve the double purpose of increasing the productiveness of the soil and improving its physical condition. The land has a value of about \$30 an acre.

The following table shows the average results of the mechanical analyses of a sample of the soil and subsoil of this type:

*Mechanical analyses of Brooke clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19226, 19228.....	Soil.....	0.1	5.3	1.9	8.3	3.8	46.3	33.9
19227, 19229.....	Subsoil.....	.0	2.1	1.7	8.9	4.9	44.3	37.6

#### HUNTINGTON SILTY CLAY.

The Huntington silty clay includes all of the areas along the Ohio and Little Kanawha rivers known as "first bottom land" and all of the bottom land along the smaller streams throughout the area. The soil is a compact brown silty loam to silty clay loam, usually having a depth of about 12 inches. The subsoil to a depth of 36 inches is a somewhat lighter brown, compact, rather heavy silty clay to clay loam. In some areas, however, the subsoil is sometimes lighter in texture in the lower depths; and along the narrow bottoms of the smaller streams it quite often happens that both soil and sub-

soil are somewhat sandy. Subangular shaly fragments are in places scattered over the surface and through the soil and subsoil, but more often occur in layers at depths varying from 1 to 3 feet. These variations have not been mapped as a separate soil, since it was found impracticable to do so on the scale used. When cultivated a good tilth is usually easily obtained, but on some parts of the type a tendency to clod was noted.

The largest areas of Huntington silty clay occur along the Ohio and Little Kanawha rivers and are usually from 10 to 15 feet above the water level. The topography throughout is level or slightly rolling, and the surface is each year likely to be flooded during the spring months, though there is ordinarily little danger of this after planting time or during the growing season. Both the surface drainage and underdrainage are fairly good. Several instances were, however, noted where tiling has been used with very beneficial results, and the extension of such drainage systems is to be recommended.

All of the soil along the Little Kanawha and Ohio rivers is made up of material deposited during times of high water. That along the smaller streams is mainly of the same origin, but to a slight extent consists of material washed from adjoining hillsides.

Although subject to overflow, the Huntington silty clay is considered valuable farming land. Along the Little Kanawha and Ohio rivers corn and hay are the principal crops. Along the smaller stream bottoms potatoes and garden vegetables are also grown very successfully. On some parts of the type slightly higher than the average alfalfa does well. The best crops of corn are procured along the river, where the yields vary from 50 to 80 bushels. On the type as a whole the yields range from 40 to 80 bushels, with an average of about 50 bushels. Hay yields from one-half ton to 2½ tons per acre, with an average of about 1½ tons. Potatoes yield about 150 bushels to the acre.

The principal tree growth found on the type is sycamore, elm, beech, and soft maple. The price of this land usually ranges from \$75 to \$150 an acre.

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

*Mechanical analyses of Huntington silty clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19218.....	Soil.....	0.0	0.1	0.0	1.3	3.1	67.2	28.0
19219.....	Subsoil.....	.0	.0	.0	.5	7.5	57.1	35.0

## WHEELING SILT LOAM.

The soil of the Wheeling silt loam is a brown mellow silt loam, having a depth of about 10 inches. The subsoil is a brownish-yellow, compact but friable silt loam, becoming somewhat lighter in texture in the lower part of the profile. In some places, however, at depths of 10 to 14 inches it consists of a grayish-yellow friable silt loam, beneath which to a depth of about 3 feet is found the usual brownish-yellow friable silt loam, the only difference being that the latter becomes somewhat lighter in texture from 30 to 36 inches. In a few cases the subsoil is also slightly mottled gray and brownish-yellow in the lower 6 inches.

Land of this character of soil occurs only along the Ohio River, occupying the second and third bottoms. The second bottom is usually from 10 to 25 feet above the first bottom and the third bottom is from 10 to 20 feet above the second. The largest body of the type is found along the river north of Parkersburg. Good sized areas also occur near Williamstown, Waverly, Salama, and Grape Island. It is everywhere easily cultivated.

The topography of the Wheeling silt loam is level to gently rolling, and the natural drainage over the greater part of the type is fairly good, although there are a few level or slightly depressed areas which need artificial drainage. This could be best accomplished by tiling or by the laying of blind ditches. As a place of outlet sink holes are sometimes dug down to the gravel strata, which in many places is found at depths varying from 10 to 20 feet. The soil is overflowed only at times of unusually high water, and then only in the lower parts.

The Wheeling silt loam is made up of material brought from the glacial regions to the northeast at a time when the volume of the river was much greater than at present.

All of the Wheeling silt loam is cleared. It is considered very valuable farming land. Wheat, corn, potatoes, and hay are the principal crops grown. Oats are produced to a slight extent. Wheat yields from 10 to 25 bushels, with an average of about 16 bushels; corn from 40 to 75 bushels, with an average of about 60 bushels; potatoes from 100 to 200 bushels, with an average of about 150 bushels; and hay from 1 ton to 2 tons per acre. Tomatoes are very profitably grown on many parts of the type. All other garden vegetables and small fruits do well.

Some instances have been noted on this type where wheat does not seem to do well. To obviate this difficulty it is suggested that the soil should be well manured and that it should be very thoroughly worked before seeding. The farmers who take these precautions and who practice systematically a rotation of corn or potatoes, wheat, and timothy and clover, seem to have no difficulty in producing

good crops. An application of lime would also very likely prove beneficial.

The farmers upon this type of soil are the most prosperous of any within the area and their holdings almost always include both first bottom land and hill land. Taken as a whole their farms are considered to be worth from \$80 to \$125 an acre. When considered separately the Wheeling silt loam is valued at \$100 to \$150 an acre.

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

*Mechanical analyses of Wheeling silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19254.....	Soil.....	0.0	0.7	0.4	6.0	17.4	61.1	14.1
19255.....	Subsoil.....	.0	.5	.3	8.6	24.7	46.0	19.2

WHEELING GRAVELLY LOAM.

The soil of Wheeling gravelly loam is a brown gravelly loam having a depth of about 10 inches. The fine-earth content is a loose, rather coarse sandy loam. A considerable quantity of gravel is found on the surface, forming probably from 30 to 60 per cent of the soil mass. The fragments, which consist of granite, quartz, quartzite, and sandstone, vary in size from one-eighth of an inch to more than an inch in diameter, and are usually well rounded. The subsoil is very similar to the soil, except that the fine-earth portion is slightly lighter in color. The gravel is of the same character and occurs in such quantities that it is almost impossible to make an auger boring. Although the gravel content of the soil is high, it offers no serious difficulty to cultivation.

The Wheeling gravelly loam is confined to the terraces along the Ohio River, and occurs in only a few small areas near Williamstown and St. Marys. It has a level to very gently rolling topography with an elevation of about 70 feet above the river. Owing to its loose open texture both the surface and underdrainage are always good.

This is a sedimentary soil made up of reworked glacial materials carried by the river from a considerable distance to the northeast, when its current was much stronger and its volume much larger than at present. During the ages since the deposition the surface has been more or less modified by weathering and the addition of organic deposits. Gravelly material of the same character as that of the Wheeling gravelly loam is often encountered in digging wells on the Wheeling silt loam, a type which occurs at nearly the same level as the Wheeling gravelly loam.

As found in the Parkersburg area the soil is used mainly for growing garden vegetables. It is especially adapted to tomatoes and water-melons. Wheat ordinarily yields from 10 to 25 bushels and corn about 45 bushels per acre. Potatoes yield about 100 bushels per acre. Barnyard manure is practically the only fertilizer used. Land of this type of soil has a valuation of from \$75 to \$100 an acre.

The following table gives the results of mechanical analyses of fine-earth samples of the Wheeling gravelly loam:

*Mechanical analyses of Wheeling gravelly loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
18932.....	Soil.....	4.9	33.4	17.2	7.2	5.7	23.6	8.1
18933.....	Subsoil.....	2.9	48.6	22.3	9.7	1.5	6.1	9.2

TYLER SILT LOAM.

The soil of Tyler silt loam is grayish to grayish-brown silt loam having a depth of about 9 inches. The subsoil to a depth of about 20 inches is a yellowish or mottled yellow and gray silt loam which is quite often rather heavy in character. From 20 to 36 inches it is ordinarily a mottled brownish-yellow and gray silt loam to clay loam, and this is sometimes slightly lighter in texture from 30 to 36 inches. In other cases the subsoil is a clay loam to clay of dark-gray and dark-yellowish mottled color.

The Tyler silt loam occurs as second bottom land along the larger tributaries of the Ohio River, at elevations varying from 15 to 100 feet above water level, and is never overflowed. Its largest areas are found along the Little Kanawha River. The topography varies from level to gently rolling, and the drainage is fairly good in the more rolling areas and deficient in those that are level or nearly so.

The type is alluvial material laid down in early ages when the streams along which it occurs were of much greater volume and, in many places, much wider than now. A little material washed from the adjoining hillsides has been incorporated in this soil.

Considered only fairly good farming land, much of the Tyler silt loam is used for pasture. Corn and hay are the principal crops, the former yielding from 35 to 50 bushels per acre and the latter about 1½ tons per acre. Wheat and oats are very little grown.

On many areas where the topography is level or slightly rolling underdrainage would undoubtedly improve the condition of the soil. Applications of lime would also prove beneficial. As much organic material as possible should be added to the soil, through the application of manure and the plowing under of cover crops, such as rye, crimson clover, or hairy vetch.

The principal tree growth on the type is oak, hickory, walnut, and poplar. The value of the land ranges from \$40 to \$65 an acre.

The following table gives the results of mechanical analyses of fine-earth samples of the Tyler silt loam:

*Mechanical analyses of Tyler silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19234.....	Soil.....	1.5	5.3	2.9	5.7	2.1	59.5	23.4
19235.....	Subsoil.....	.3	1.4	.6	1.3	.8	45.3	50.4

WHEELING FINE SAND.

The Wheeling fine sand consists of about 10 inches of loose, brown to yellowish-brown, fine to medium sand, resting on a subsoil of loose, brownish-yellow fine to medium sand which sometimes is slightly grayish yellow from 30 to 36 inches.

This soil generally occupies a position intermediate between the high river-bottom lands and the hilly upland. The largest areas occur along the Ohio River between Parkersburg and Williamstown. An important area occurs near Walkers Crossing, and smaller ones are found near Waverly and St. Marys. The topography varies from gently rolling to sharply rolling, and this in connection with the loose, open texture of the soil always induces good drainage.

The Wheeling fine sand is derived from material deposited in early ages by the Ohio River and subsequently, in part at least, modified by the action of wind. This has given rise to the sharply rolling topography occurring over a part of the areas.

As found in the Parkersburg area the soil is used mainly for the growing of truck crops. Tomatoes and watermelons are both very profitably grown. Early potatoes yield from 50 to 120 bushels, with an average of about 75 bushels. Corn and wheat are also grown to some extent. Corn yields from 30 to 50 bushels per acre, with an average of about 35 bushels, and wheat from 10 to 15 bushels per acre. Small fruits, such as strawberries and raspberries, do well.

The principal means of maintaining the productivity of the soil is through the use of barnyard manure and by the plowing under of cow-peas. Both of these methods are strongly recommended. Comparatively little commercial fertilizer is used.

The Wheeling fine sand has a value of about \$30 an acre.

The table on page 33 gives the results of mechanical analyses of samples of this type.

*Mechanical analyses of Wheeling fine sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19244.....	Soil.....	0.2	5.6	33.5	33.4	8.8	13.3	5.1
19245.....	Subsoil.....	.0	6.2	34.4	35.5	9.8	9.8	4.6

## WHEELING FINE SANDY LOAM.

The soil of the Wheeling fine sandy loam is a loose, brown, fine sandy loam with a depth of about 10 inches. The subsoil is a moderately loose yellowish or yellowish-brown fine sandy loam to a depth of about 16 inches. Beneath this to a depth of 30 inches is a fairly compact and fairly heavy yellowish-brown fine sandy loam. From 30 to 36 inches the material is usually slightly lighter in texture, but of the same coloring.

Only a few small areas of this soil are found in the Parkersburg area. They occur principally as second or third bottom land along the Ohio River, but in a few cases are found on the islands in this river. The topography of the type is usually gently rolling, which, together with the loose sandy texture, gives good drainage. The areas are usually high and, except on islands, never overflowed.

The Wheeling fine sandy loam, like other soils forming the terraces along the Ohio River, is made up of materials deposited at an early time by the river waters.

The type is well adapted to the growing of strawberries, melons, and early market potatoes. The last-named crop usually yields about 125 bushels per acre. Wheat, corn, and hay also give good yields. Wheat yields about 16 bushels per acre, corn about 50 bushels, and hay from 1 ton to 1½ tons per acre. Cowpeas are also grown both for hay and for plowing under as green manure. It is thought that the application of lime would increase the productiveness of this kind of soil. The type has a value of about \$100 an acre.

The following table gives the results of mechanical analyses of samples of this type:

*Mechanical analyses of Wheeling fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
19252.....	Soil.....	0.5	2.4	10.5	38.2	15.3	27.0	6.3
19253.....	Subsoil.....	.1	1.2	7.8	29.3	20.1	30.1	11.2

## ROUGH STONY LAND.

Rough stony land includes all of those areas which are so rough and stony as to be of very little value from an agricultural standpoint. The soil generally resembles the Meigs clay loam, but in some cases it is somewhat more sandy than that type. Rough stony land is found in nearly all parts of the area and generally occurs on the steep hillsides along stream courses. In a great many instances massive rock outcrops, which are generally those of sandstone, may be seen, and below such outcrops large, irregularly shaped bowlders often occur in large numbers. For the most part it is covered with forest. Over a large part of the type the topography is so steep as to make it impracticable to use it for either orchard or pasture.

## SUMMARY.

The Parkersburg area is located in the northwestern part of the State of West Virginia and comprises the counties of Wood, Pleasants, and Ritchie—an area of about 956 square miles. The topography of the area varies from rather gently rolling to rough and hilly, the greater part of it being of this latter character.

The country districts of the area can not be said to be very thickly populated. The largest town is Parkersburg, which has a population of about 22,000. It maintains several large manufacturing plants and is the center of a large jobbing and retail trade. St. Marys is the next town in size and has a population of about 2,000. Other smaller but thriving towns in the area are Bellville, Cairo, Harrisville, and Pennsboro.

One of the most important industries is that of obtaining petroleum. It is and has been a very material help to the farmers, but, at the same time, it has attracted attention away from agriculture.

The main line of the Baltimore and Ohio Railroad, its Ohio River division, and the Zanesville branch of the Baltimore and Ohio Railroad afford excellent means for transportation of products to all of the distant markets. In the eastern part of the area, in Ritchie County, are the Cairo and Kanawha Railroad and the Lorama Railroad, both of which are short lines connecting with the main line of the Baltimore and Ohio. Extending to the southeast along the little Kanawha River into Wirt County is also the Little Kanawha Railroad. Packet boats ply both the Ohio and Little Kanawha rivers, except at times of low water.

The most important agricultural products of the area are beef and wool. Veal and mutton are also produced to a considerable extent. The main farm crops are corn, wheat, potatoes, and hay. These with some truck and fruit about complete the list of agricultural products.

The climate is healthful and well suited to farming. The average annual temperature is about 53° F. The average for the two coldest months is about 33° F., while that for the two hottest months is about 74° F. The temperature seldom reaches 100° in summer or the zero point in winter. The rainfall has an annual average of about 43 inches, and the greatest precipitation usually takes place during June and July, when it is needed for growing field crops.

Eleven types of soil occur in the area. Six of them are of alluvial origin, while the remaining five are residual, derived from the Coal Measures of the Carboniferous period.

The Dekalb silt loam is the most valuable upland type. When well handled it produces good crops of corn, wheat, and hay. Potatoes and oats are grown to some extent. Apples and peaches and also small fruits such as strawberries and raspberries do well. The type has a value ranging from \$15 to \$30 an acre.

The Meigs clay loam is the most extensive type in the area. In general it is very rough and hilly. A large part of it occurs as steep hillsides on which erosion is very active. The type is used mainly for pasture. The main crops grown are corn, wheat, and hay. Apples and peaches and small fruits do well on this type. It has a value ranging from \$10 to \$25 an acre.

The Upshur clay is a very heavy red clay in which limestone fragments are occasionally found. It usually occurs on steep hillsides and hilltops, and because of this and its very heavy character it is quite difficult to cultivate. The crops usually grown are wheat, corn, and hay. It is a very good wheat soil. Some oats are grown. Apples and peaches both do well. The value of this type ranges from \$25 to \$35 an acre.

The Brooke clay loam is a gray limestone soil, usually occurring on ridges or hilltops. Large limestone boulders are found on the surface. The type is used mainly for bluegrass pasture. Although it is difficult to work, it is a strong soil for general farm crops. Only a small amount of this soil occurs in this area.

The Huntington silty clay is the first bottom land occurring both along the Ohio and Little Kanawha rivers and the smaller streams of the area. It is subject to overflow, but it is nevertheless considered to be valuable farming land. The crops to which it is best adapted along the rivers are corn and hay. Along the smaller stream courses potatoes and garden vegetables are also very successfully grown. The type is worth from \$75 to \$150 an acre.

The Wheeling silt loam is another valuable bottom-land type, occurring in terraces along the Ohio River. Its topography is level to gently rolling, and it is everywhere easily cultivated. Wheat, corn, potatoes, and hay are the principal crops. Garden vegetables and

small fruits do well. Tomatoes are a profitable crop on the type. It has a value ranging from \$100 to \$150 an acre.

The Wheeling gravelly loam occurs in only a few small areas near Williamstown and St. Marys as a part of the river terraces. The gravel content of both the soil and subsoil is high, but it does not seriously interfere with cultivation. It is used mainly for raising of garden vegetables. It has a value ranging from \$75 to \$100 an acre.

The Tyler silt loam is high second bottom land found mainly along the Little Kanawha River. Its topography is level to gently rolling and it is never overflowed, but over the more level parts artificial drainage is needed. The soil is considered to be only fairly good farming land. It is used quite largely for pasture, although it is also farmed to a considerable extent. The type has a value of from \$40 to \$65 an acre.

The Wheeling fine sand occurs in an intermediate position between the terraced river bottom lands and the uplands, and generally has a sharply rolling topography. The soil is material deposited by the Ohio River in early ages and subsequently subjected to the action of winds. It is best adapted to growing truck crops. Tomatoes and watermelons are both very profitably grown. The type has a value of about \$35 an acre.

The Wheeling fine sandy loam, because of limited extent, is an unimportant type. It is well adapted to the growing of strawberries, melons, and early market potatoes. Wheat, corn, and hay also give good yields. The type is valued at about \$100 an acre.

The Rough stony land includes all of those areas which are so rough and stony as to be of little or no value from an agricultural standpoint. Over a large part of this type the topography is so steep as to make it impracticable to use it for either orchard or pasture.

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