

SOIL SURVEY OF THE LEESBURG AREA, VIRGINIA.

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LOCATION AND BOUNDARIES OF THE AREA.

The area covered by the soil map accompanying this paper mainly consists of approximately the northern half of Loudoun County, Va., but includes also a small part of western Montgomery County, Md., of the southern part of Frederick and Washington counties, Md., and of the eastern part of Jefferson County, W. Va. The western boundary of the area just touches the eastern corner of Clark County, Va., and includes a few acres of it. Approximately five-sixths of the area lies within Loudoun County, Va., which is the most northern county

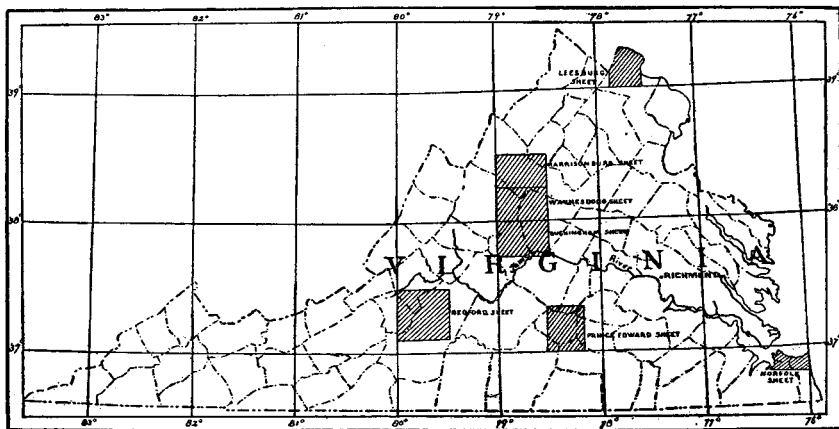


FIG. 7.—Sketch map showing location of the Leesburg area, Virginia.

of the State; about one-twelfth of the area lies within Maryland, while the remaining one-twelfth is in West Virginia.

The area lies between meridians $77^{\circ} 30'$ and $77^{\circ} 50'$ west longitude and 39° and $39^{\circ} 20'$ north latitude, and is rectangular in shape, being 23.3 miles about north and south by 18.2 miles east and west, and comprising a land surface of about 419 square miles, or 267,968 acres.

The interests of the section in which the area lies are almost entirely agricultural, and the section has long been noted for its agricultural resources and for the prosperity of the farming classes.

The area is well drained by the Shenandoah River in the northwest and the Potomac River in the north and east. In the southern part of the area Goose Creek, a tributary of the Potomac River, is the chief drainageway.

The eastern border of the area is about 40 miles northwest of Washington, D. C., and about 50 miles west of Baltimore, Md.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

That part of the area included in Loudoun County, Va., belonged to the large tract of land known as the "northern neck grant," which was granted by the King of England to Lord Fairfax early in the eighteenth century. The first permanent settlement in the county was made in 1730, when it was part of Prince William County.

The first immigrants to this country secured ninety-nine-year leases on the land from Lord Fairfax, the rate being 2 shillings sterling per 100 acres. The land along the Potomac and its tributaries was first taken up, and was much sought after. The eastern part of the area was settled by Virginians who came from the older Virginia colonies. These settlers held large tracts of land, and pursued that exhaustive system of cultivation so common in eastern Virginia by which the lands became so unproductive that they were thrown out of cultivation.

In that part of the area which lies in Maryland, West Virginia, and the northwestern part of Loudoun County, Va., the original settlers were principally Germans from Pennsylvania, and many of their descendants still remain. Here the farms are generally small and have always been well cultivated, the farmers having always been noted for their industry and thrift.

The central part of Loudoun County, Va., was originally settled by emigrants from Pennsylvania and neighboring colonies, among whom were many members of the Society of Friends, whose industrious descendants still occupy the lands. Here the farms are of moderate size and have always been cultivated by free labor. The results of careful attention and good judgment are conspicuously apparent at the present time.

In the southern part of the area the farms are larger, and before the civil war they were generally cultivated by slave labor.

The Quakers, or Friends, who early settled in this section, by their creed held it unlawful to shed human blood, and would not fight during the Revolutionary war. They could not be coerced to fight, so the legislature enacted a law to levy a tax upon their property to hire substitutes. These taxes bore heavily upon them, much of their personal property being sold under the hammer, and before the war was over many were reduced to poverty and extreme distress. Num-

bers of them migrated to the West, but a great many remained, and by their thrift and industry soon reestablished themselves in comfortable homes.

At the time of the first settlement of this region the timber was far inferior in size and quality to what it was one hundred years later. This is probably accounted for by the fact that early hunters were in the habit of setting fire to the forest in order to destroy underbrush, the more readily to secure game. When the practice was stopped a vigorous growth of timber sprang up rapidly, the trees belonging to different species of oak, hickory, black walnut, poplar, chestnut, locust, maple, sycamore, wild cherry, elm, gum, etc.

The early settlers were industrious, and engaged in growing corn, wheat, oats, and flax, at the same time paying some attention to stock raising. Tobacco has never been grown to any great extent, and at present none is produced in the area. The production of flax ceased years ago, while only a small acreage has been planted to oats in late years.

The early settlers hauled their products to Alexandria, Va., 40 to 60 miles away. When railroads were built through Alexandria this made communication with the outside markets comparatively easy. In 1832 the Chesapeake and Ohio Canal was built through part of the area, and this greatly facilitated the shipment of produce to the railroad towns. In later years two railroads were built through the area, opening up quick communication with the best markets. The value of the land advanced rapidly when the railroads were built, and the agricultural interests of the region generally made marked progress. During the civil war agriculture received a serious setback, as much of the country was devastated by the contending armies, but by hard work and intelligent management of the people the section has again been put upon a prosperous footing.

CLIMATE.

The annexed table, taken from the records of the Weather Bureau, gives the normal monthly and annual temperature and rainfall at Martinsburg, W. Va.

While not in the area, this station is near enough to give reliable data for that part of the area which lies in the Shenandoah Valley. No figures were obtainable for the Piedmont and mountain sections. However, it is well known that on the mountains it is several degrees cooler both in summer and winter than it is in the valleys or Piedmont region. Consequently vegetation is usually retarded in the spring until all danger from frost is past. This is of great advantage in fruit growing, although the fruit is sometimes killed by the freezing of the buds in winter. The winters are fairly mild, there being usually little extremely cold weather.

The rainfall is usually ample, being well distributed throughout the growing season, and is rarely insufficient or excessive. The summer rainfall comes largely in the form of local showers, scarcely ever attended by hail.

In the intermediate valley east of the Blue Ridge, and in the Piedmont, the seasons are somewhat earlier than in the Shenandoah Valley. The prevailing winds in winter are from the north and west, and the country east of the mountains is partially protected. Consequently the farmers of this part of the area can plant their ground from a week to ten days earlier than the farmers of the Shenandoah Valley. Their crops also ripen earlier by about the same period.

Normal monthly and annual temperature and precipitation.

Month.	Martinsburg.		Month.	Martinsburg.	
	Temperature.	Precipitation.		Temperature.	Precipitation.
	° F.	Inches.		° F.	Inches.
January	30.8	2.04	August	73.9	3.20
February	30.6	2.61	September	67.0	2.44
March	40.1	2.87	October	54.7	1.28
April	51.3	3.14	November	43.2	2.61
May	62.7	4.49	December	34.5	2.53
June	71.5	3.60	Year	53.1	34.45
July	75.4	3.66			

PHYSIOGRAPHY AND GEOLOGY.

The Leesburg area embraces portions of three great physiographic divisions, namely, the Piedmont Plateau, the Catoclin Belt, and the great valley of Virginia—the Shenandoah Valley.

The Catoclin Belt includes the Blue Ridge and Catoclin mountains and the intermediate valley or base-level plain between. The Blue Ridge system here consists of the Blue Ridge and Short Hill. The Short Hill is a short ridge about 4 miles east of the Blue Ridge, extending in a northeast and southwest direction, the two ridges being parallel.

The Piedmont Plateau varies in altitude from 300 to 500 feet above sea level, and occupies the eastern part of the area, including parts of Loudoun County, Va., and Frederick and Montgomery counties, Md., extending through the area in a northeast and southwest direction.

The topography is about the same as is usually found in the Piedmont region—a broad plain with rolling hills and gentle slopes. The region has a splendid drainage system, consisting of a great number of small streams, which all flow in a general easterly direction and empty into the Potomac River. The stream beds are considerably lower than the surrounding plain, which shows that the drainage system has long been in operation. The Piedmont Plateau here borders on the Catoclin

Mountain, and is composed chiefly of the Newark formation. The rocks consist of red and brown sandstone and shale, and ledges and beds of limestone conglomerate with numerous veins of quartz. There also occurs a crystalline diabase—an igneous rock which was forced into fissures in the Newark strata while in a molten condition.

The Catoctin Belt extends in a northeast and southwest direction throughout the area, and occupies the greater part of the whole area. The Catoctin Mountain is composed of the hard Lower Cambrian sandstone in the northern part of the area, and here the mountain slopes are steep and rugged; but in the southern part of the area the mountain is composed of a schist, and the summit and slopes are more rolling and gently sloping, owing to the less resistance of this rock to weathering. The mountain varies in altitude from 700 to 900 feet above sea level.

The Blue Ridge Mountain system ranges in altitude from 1,400 to 1,600 feet above sea level, and varies in configuration with the different rocks which form it. It is composed of the Lower Cambrian sandstone in the northern part of the area; and here its summits are rough, rocky, and usually sharp crested, while the slopes are steep and rocky. In the southern part of the area the mountain is a smooth, broad ridge composed of schist of Algonkian age, and here the slopes are not so steep as they are farther north. Short Hill is composed of sandstone entirely, and its physiographic features are the same as those of the sandstone areas of the Blue Ridge.

The Blue Ridge forms a natural divide, which is drained by small, swiftly flowing streams emptying into the Shenandoah River on the west and into the Potomac River on the east. Between the Blue Ridge, the Short Hill, and the Catoctin Mountain lies the intermediate valley or base-level plain, which is from 8 to 12 miles wide, and a valley only in relation to the mountain systems on each side. It ranges in topography from rolling to hilly, and its elevation is from 400 to 600 feet above sea level. This valley is well drained throughout by small streams which are tributaries of the Potomac River. In the northern part of the area the largest of these streams is Catoctin Creek, while in the southern part of the area the most important is Goose Creek. The rocks of this valley consist of a schist of Algonkian age and granite, the granite being regularly associated and bedded with the schist.

The sandstone of the mountains varies from fine-grained to coarse conglomerate, and is very siliceous and resistant to the agencies of weathering, while the resulting soils are very poor, thin, and stony, often being little but a mass of rocks on the more rugged mountain areas, and consequently little cultivated. In the schist and granite areas weathering has continued to considerable depth, and the soils are deep and strong.

The portion of the Shenandoah Valley which occupies the northwestern corner of the area ranges in elevation from 300 to 500 feet above sea level. It lies in Jefferson County, W. Va., and is a broad, gently rolling valley, with occasional high-rolling ridges which extend through it in a northeast and southwest direction. It is well drained by the Shenandoah River, whose small tributaries reach out in a northwestern direction throughout the valley.

This valley is composed of blue and gray limestones of the Silurian and Cambrian periods. The soils derived from these rocks are red in color and of great productiveness. The weathering of the limestones has gone on to a considerable depth, there being but few outcrops of the parent rock. This limestone contains a fairly high percentage of calcium carbonate, and is used extensively for agricultural, building, and manufacturing purposes, and for constructing roads.

Between the Shenandoah Valley and the Blue Ridge Mountains there is a considerable area of a uniform, slightly sandy shale, known geologically as Harpers shale. The topographic features are low foothills and rolling slopes at the foot of the Blue Ridge, extending to the Shenandoah River. Lying between the shale area and the limestone areas of the valley is a long, narrow, broken ridge of the shale formation, with beds of a uniform white sandstone. The shale soils are very porous, and while naturally fairly productive, are too leachy and loose textured to be of great value agriculturally. Often they are simply a mass of deeply weathered and broken shale fragments. The sandstone ridge west of the shale, although productive, is often so stony that cultivation is laborious and sometimes well-nigh impossible.

SOILS.

There being several different geological formations represented in the three physiographic divisions of the Leesburg area, a comparatively large number of soil types were mapped in this survey. Seventeen types are shown on the map. Their names are given below, together with the area they occupy and their proportionate extent.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Cecil loam.....	89,600	33.4	Cecil silt loam	4,928	1.8
Cecil clay.....	32,000	11.9	Hagerstown loam.....	4,864	1.8
Loudoun sandy loam.....	27,968	10.4	Cecil mica loam	4,608	1.7
De Kalb stony loam	19,072	7.1	Hagerstown clay.....	4,224	1.6
Penn loam.....	18,880	7.0	Porters clay.....	2,752	1.0
Meadow.....	18,048	6.7	Penn stony loam.....	1,280	.5
Iredell clay loam.....	18,048	6.7	Hagerstown sandy loam	1,216	.5
Penn clay.....	11,776	4.3	Penn gravelly loam.....	704	.3
Hagerstown shale loam	8,000	3.0	Total.....	267,968	.....

DE KALB STONY LOAM.

The soil of the De Kalb stony loam consists of a yellow or gray sandy loam of coarse texture, having an average depth of 12 inches. The subsoil consists of a heavy yellow sandy loam to a depth of 24 inches or more, where it rests upon a mass of sandstone fragments. These sandstone fragments and boulders occur in varying quantities throughout the soil and subsoil. Sometimes the mountain crests and slopes occupied by the type are nothing but a mass of sandstone fragments, varying in size from 1 inch in diameter to boulders several feet through, having a very little interstitial soil. Sometimes the proportion of sandstone fragments is much smaller, there being less than 15 per cent of the soil mass occupied by the stones. Where the fewer stones are found the soil is not so sandy, but a light loam, yellow or brown in color, underlain by a deep yellow loam subsoil. A phase of this type, occupying small areas, occurs closely associated with the shale formation of the Shenandoah Valley, and consists of a light sandy loam, brown in color, underlain by a yellow loam, and containing from 15 to 60 per cent of white sandstone fragments, which are usually not over 8 inches in diameter.

The De Kalb stony loam is a mountain soil, and mainly occupies the crests and slopes of the Blue Ridge Mountains and Short Hill. It also occurs in smaller areas on the crest and east slope of Catoctin Mountain. The valley phase referred to occupies a long, broken ridge, which forms a boundary between the shale areas and the limestone areas in the Shenandoah Valley.

The De Kalb stony loam, being so closely related to the mountain systems, occurs principally in the northeastern corner of the area, while the smaller Catoctin Mountain areas are in the eastern part of the area. The type occurs in long, parallel bands of varying width, extending in a general northeast and southwest direction.

On the Blue Ridge and Short Hill the De Kalb stony loam covers the whole of the mountains, and here the physiography consists of long, sharp, rock-crested ridges, with steep, rugged slopes and occasional cliffs and huge ledges. There are occasional benches on the mountain sides, and here there is an accumulation of 2 or 3 inches of a black mold, resting on the broken sandstone fragments, and covered with a growth of locust, oak, and berry vines. On the top of the Blue Ridge at one place the ridge broadens, and here there are fewer stones than elsewhere. On the Catoctin Mountain the physiography is the same, except in Loudoun County, Va., where the areas occupy small rounded ridges with steep slopes. The valley phase consists of a long broken ridge, well rounded on top, and having gentle slopes. This type varies in elevation from 500 to 1,600 feet above sea level and from 200 to 1,100 feet above the surrounding country.

Owing to the steep and rugged surface of this soil, together with its stony character, superficial drainage is rapid and thorough, the water rushing in torrents from the mountain slopes, while as a result of the loose texture and the large number of stone fragments in the soil the water passes rapidly through it, and there is never an excess of moisture in the soil or subsoil.

This soil is residual in origin, being derived from the weathering of a gray or darker colored sandstone, which varies in texture from a fine, pure sandstone to a fairly coarse conglomerate, and which is composed almost entirely of grains of quartz, with only a very little argillaceous matrix. The fragments in the sandstone are coarse and well worn. The process of formation of this soil has undoubtedly been slow on account of the resistance of the sandstone to weathering.

On account of the steep and stony nature of the De Kalb stony loam little of the type can possibly be cultivated. The soil is naturally a very thin one, and is not capable of producing fair yields except in its less stony phases. The valley phase is much more productive, while the slopes are not steep, and if the stones be partially removed it can readily be placed in cultivation.

The principal growth on the type is chestnut, oak, and some pine. Probably 95 per cent of the type is uncultivated, and is valuable only for the timber growth it supports. Where cultivated the average yields per acre are as follows: Corn, from 10 to 20 bushels; wheat, from 6 to 10 bushels. On the valley phase corn yields more than this, averaging probably 30 bushels per acre. Apples and especially peaches do fairly well on the mountain phase where not too stony. On the valley phase peaches and plums do very well, and are of fine quality.

The greater part of the De Kalb stony loam is not adapted to agricultural purposes at all, and it is not likely that the land will ever be valuable except for forestry. In one instance improved chestnut stock has been grafted on the native chestnut trees, and the result has been quite favorable to a more extended system of chestnut orcharding. On the less stony areas it is quite certain that peaches, grapes, and plums could be grown profitably, while garden truck could also be grown in such locations, the mountain climate favoring the production of vegetables of excellent quality. The land is valued at from \$1 to \$10 an acre, depending on the timber growth. The land is locally termed "mountain land," and is the poorest agricultural soil of the area.

The following table gives mechanical analyses of typical samples of fine earth of the soil and subsoil of the De Kalb stony loam:

Mechanical analyses of De Kalb stony loam.

No.	Locality.	Description.	Organic matter.	(travel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9833	1½ miles S. of Harpers Ferry, W. Va.	Yellow sandy loam, 0 to 12 inches.	3.01	11.96	14.40	5.82	8.56	2.66	25.92	29.98
9831	3 miles NW. of Bluemont, Va.	Yellow heavy loam, 0 to 12 inches.	1.15	3.90	10.26	5.38	8.58	5.08	30.34	36.10
9834	Subsoil of 9833	Brown sandy loam, 12 to 24 inches.	2.03	10.50	12.84	6.94	8.14	3.24	27.10	30.90
9832	Subsoil of 9831.....	Yellow clay, 12 to 24 inches.	.74	4.52	10.58	5.88	10.08	6.00	30.76	31.60

LOUDOUN SANDY LOAM.

The Loudoun sandy loam consists of from 8 to 12 inches of a heavy brown or gray sandy loam, underlain by a heavy yellow or red loam or clay loam. Often the subsoil contains a considerable quantity of coarse sand, making the texture much the same as that of the soil. The sand of the soil and subsoil is composed of very coarse rounded and subangular quartz particles. The surface material is not a light sandy loam, but is more like a loam containing considerable quantities of very coarse quartz fragments. It is generally quite free from stones, but small areas are occasionally covered with from 5 to 20 per cent of angular quartz fragments several inches in diameter.

The Loudoun sandy loam occurs in irregular areas of considerable size in the western part of the area, in Loudoun County, Va., and in the intermediate valley between the Blue Ridge, the Short Hill, and the Catoctin mountains. The largest area of the type is found in the vicinity of Roundhill, Va.

The topography of this soil in the valley varies from gently rolling to hilly, the slopes being long and gently undulating, while along the valley walls and in the uplands it is ridgy. Owing to the position which this type occupies, surface drainage is good. The light texture of the soil admits of the easy percolation of water through it, and except where the subsoil contains considerable sand, the soil moisture is well retained. In dry weather if the ground is cultivated a mulch is formed, which prevents the evaporation of the soil moisture and greatly assists the crops to withstand drought.

This soil type is residual in origin, being formed by the weathering of a coarse-textured schist and an eruptive crystalline granite, the two rocks being interbedded. On some of the steeper slopes the clay has been largely washed away, resulting in a phase containing a large percentage of sand, and here the subsoil also is quite sandy. On account of the large amount of feldspar which the granite contains it decays readily.

Nearly the whole of this type is in cultivation. Where the forest still stands the growth consists chiefly of oak. The soil is easy to handle, and can be worked without regard to moisture content. It is considered a good corn land, but is too light-textured for wheat, although a considerable acreage is devoted to this crop. Corn yields at the rate of 40 or 50 bushels per acre, wheat from 12 to 15 bushels and occasionally more, and grass and clover at the rate of 1 or 2 tons per acre. The productiveness of the soil depends greatly on the sand content of the subsoil. If the quantity be large, the soil is porous and requires considerable rain to produce good yields. If the clay content predominates, a moderate amount of rain suffices and good yields are obtained. Apples, pears, and small fruits do well on this soil.

The crops to which the Loudoun sandy loam is best adapted are corn, vegetables, and small fruits. Much of this type lies within convenient distances of the railroads, and many of the farms are valued at from \$30 to \$60 an acre, depending on the location. The farms are usually well improved and are kept in good condition.

The following table shows the texture of typical samples of both soil and subsoil of this type:

Mechanical analyses of Loudoun sandy loam.

No.	Locality.	Description.	Organic matter.							
				Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.06 mm.	Silt, 0.06 to 0.005 mm.	Clay, 0.005 to 0.001 mm.
9807	$\frac{1}{4}$ mile E. of Lincoln, Va.	Brown sandy loam, 0 to 12 inches.	P. ct. 0.69	P. ct. 4.06	P. ct. 13.28	P. ct. 10.12	P. ct. 16.82	P. ct. 7.96	P. ct. 29.40	P. ct. 17.62
9811	2 miles S. of Round-hill, Va.	Brown sandy loam, 0 to 10 inches.	1.50	6.70	16.56	11.56	15.88	9.80	21.50	18.20
9809	$2\frac{1}{4}$ miles NW. of Hillsboro, Va.	Brown sandy loam, 0 to 10 inches.	2.16	8.20	16.00	9.04	13.12	7.12	22.10	24.02
9812	Subsoil of 9811.....	Brown sandy loam, 10 to 36 inches.	.48	5.60	14.00	10.70	16.40	9.90	22.08	20.90
9808	Subsoil of 9807.....	Yellow sandy loam, 12 to 36 inches.	.57	3.52	10.88	7.00	11.68	4.94	29.52	31.92
9810	Subsoil of 9809.....	Red sandy loam, 10 to 36 inches.	.94	5.70	12.26	7.26	12.00	7.18	21.50	33.90

IREDELL CLAY LOAM.

The soil of the Iredell clay loam consists of from 6 to 18 inches of light loam, usually brown or gray, although sometimes of a yellowish color, with an average depth of about 12 inches. The subsoil consists of a heavy yellow to yellowish-brown waxy clay. This clay is cold and sour, almost impervious to moisture and air, and protects the underlying rock from decay to a great extent. Often the clay grades into the rotten rock at from 24 to 36 inches. In the poorly drained areas a few iron concretions occur on the surface. Numerous rounded diabase boulders, varying in size from a few inches to several feet in diameter, are also scattered over the surface of the soil. Occasional slopes of the type have had the soil covering entirely removed by erosion, and here, where the clay appears on the surface, the soil is very poor. In other places, where the soil covering is quite deep, say 12 to 18 inches, the type is fairly productive, and the productiveness of the type is generally proportional to the depth of the soil. The local name for the Iredell clay loam is "wax land," from the waxy nature of the subsoil, or "black-oak land," from the timber growth. A few small, isolated areas of this soil occur in the intermediate valley of the Catoctin belt, and here the texture is much the same as that described above; but the soil usually consists of from 6 to 10 inches of a drab or brown loam, underlain by a heavy mottled yellow and drab silty clay. This phase has few stones on the surface or in the soil. The local names for this phase are "cold, sour land" and "white clay."

The greater part of the Iredell clay loam occurs in the southeastern corner of the area and occupies one large, irregular-shaped but generally connected area extending from Leesburg, Va., in a southeasterly and southerly direction along Goose Creek to the southern boundary of the area, near Waxpool, Va., the most typical development of the soil being at that place. The phase already described occurs in small, disconnected areas, usually quite far apart, the general relative direction of these areas being northeast and southwest. They all lie in the intermediate valley of the Catoctin belt, and are usually near the foot of the Blue Ridge or Short Hill. The most typical development of this phase occurs just southeast of Bluemont, Va.

Physiographically the Iredell clay loam consists of the gently rolling Piedmont plain, with some low, flat, basin-shaped areas and some ridges along Goose Creek; but generally, where the better drained areas occur, the formation is a red clay soil of similar origin, which is mapped as Cecil clay. The small areas mapped as a phase of the type are nearly all low, basin-shaped, or flat areas.

Where rolling and sloping the surface drainage is good, the water passing rapidly from the surface into the numerous small streams flowing into Goose Creek, which is the main drainage way of this type.

In the low, flat lands the water stands or flows very slowly from the surface. Owing to the impervious nature of the clay subsoil, underdrainage is very slow, and the land is often cold and sour. A system of tile draining throughout, with ditching in the flat areas, would be of great advantage. Ditching is already practiced to some extent for removing the surplus water, but no tile drains have ever been used. A system of underdrainage practiced to some extent consists of ditching, throwing a layer of small poles into the ditch, and refilling with the earth removed. This method of drainage is quite successful where used, but is not nearly so satisfactory as tile draining would be, as it is not so permanent. However, owing to the exceedingly close texture of the subsoil, it is quite probable that an unusually large number of tile drains would have to be laid to get the best results. At present this would be relatively expensive, and such a heavy outlay would hardly be justified by the increased productiveness of the soil.

The Iredell clay loam is residual in origin, being derived from the weathering of diabase, a crystalline igneous rock, gray or greenish black in color, which was forced into fissures in the Newark strata while in a molten condition. Weathering in this rock seems to be rapid, yet numerous boulders of the solid rock are scattered over the surface. These are partly decomposed and form concentric shells, which peel off rapidly. Ledges of the rock are not often seen, except in stream cuts, but the soil covering is nowhere very deep. The close-textured clay prevents rapid decomposition of the underlying rock, and the process of formation of the soil is slow. Undoubtedly the topography contributes greatly to the process of formation of this type; for the higher and better drained diabase areas give rise to the more productive Cecil clay, while only the gentle slopes and poorly drained areas consist of the Iredell clay loam.

Corn, wheat, and grass are the principal crops grown on this soil type, the average yields per acre being as follows: Corn, from 20 to 40 bushels; wheat, from 8 to 15 bushels; and grass, from 1½ to 2½ tons. Apples do fairly well.

The greater part of the type is tilled, while the uncultivated areas are used for pasturage and wood lots, the forest growth being black oak. In dry seasons, where the soil covering is not deep, the land bakes and cracks, and in this condition it can not be cultivated. In wet seasons the soil becomes too wet and sticky to work. At such times the roads through this type become very muddy, and are well-nigh impassable for loaded teams.

Fertilizers are used quite extensively on the Iredell clay loam, and near the railroad considerable lime is used. The soil is greatly benefited by the application of lime, but the difficulty and cost of transportation prevent many from using it.

This type of soil is better adapted to the production of grass and wheat than to other crops. The more loamy phases, however, are quite well adapted to corn. Stock raising and dairying could be made profitable industries on this land. The soil is considered undesirable for general farming, but some improved farms near the railroad are valued at from \$30 to \$40 an acre. Those lands farther from the railroad sell for less, the prices ranging from \$20 to \$30 an acre.

The following table gives the results of mechanical analyses of typical samples of the Iredell clay loam:

Mechanical analyses of Iredell clay loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9837	5 miles SE. of Leesburg, Va.	Brown silty loam, 0 to 8 inches.	1.21	2.28	4.70	2.34	8.02	10.72	47.70	23.90
9835	3 miles SE. of Leesburg, Va.	Brown loam, 0 to 8 inches.	1.43	3.56	6.14	3.38	9.78	11.58	39.26	25.90
9836	Subsoil of 9835.....	Brown clay, 8 to 36 inches.	.44	3.76	8.04	3.28	7.10	8.58	28.54	40.46
9838	Subsoil of 9837.....	.....do.....	.39	1.14	2.60	2.14	8.00	11.14	31.78	43.18

PENN LOAM.

The Penn loam consists of from 8 to 12 inches of a dark, Indian-red loam, underlain by a heavier loam of the same color. This peculiar red color is distinctive of the formation wherever found, and, consequently, the type is one easily recognized. The texture of the type is very uniform throughout the area, with the exception of a few small areas where the subsoil is a clay loam. The soil is locally termed "red-rock land," on account of the numerous small red sandstone fragments which occur in the soil and subsoil in quantities varying from 5 to 20 per cent of the soil mass. The soil is free from large stones or other obstructions to cultivation.

This type occurs in several large, irregular areas on the Newark formation of the Piedmont Plateau in the eastern part of the area. The areas have a general northeast and southwest trend. A few small areas occur in close proximity to the larger areas. One of the larger areas is situated just south of Leesburg, Va., while other areas occur just east of Point of Rocks, Md., and Lucketts, Va.

The topography consists of a gently rolling to nearly level plain, and there are no steep slopes or rough areas. Drainage in this type is excellent, the easy slopes allowing a gradual flow of water from the

surface without undue erosion, except with very heavy rains on the steeper slopes. The loamy subsoil allows a ready but not too rapid percolation of surplus soil moisture, and never gets soggy or in a cold, sour condition. Numerous small streams extend throughout the area of this type, allowing a rapid removal of all surplus water into the Potomac River, the chief drainageway of the eastern part of the whole area. Along these streams, which in all cases have cut out beds some 10 to 30 feet below the surrounding plain, the slopes are gradual.

The Penn loam is residual in origin, being derived from the weathering of the Triassic red sandstone. This rock is composed of grains of sand coated with films of ferruginous clay. In the vicinity of Leesburg, Va., and northward, some wedges, or lenses, of limestone conglomerate are intercalated into the formation, which point off into the red sandstone areas like fingers, thinning out very gradually to a fine point. Where this limestone conglomerate occurs in considerable quantities with the red sandstone, it gives rise to the type of soil mapped as Penn clay. Where the conglomerate is of small extent, only very small areas of the Penn clay occur, surrounded by the Penn loam, and these were mapped as Penn loam on account of their small extent. Owing to this very irregular and peculiar contact of the two formations the contact between the Penn clay and Penn loam is not sharply marked, but consists of a slow gradation of one type into the other, which necessitated a somewhat arbitrarily drawn boundary line.

The original growth on the Penn loam was a forest of oak, hickory, and walnut, but at the present time nearly all of the type is cleared and farmed. The soil is not naturally very productive, but is prized on account of its great susceptibility to improvement, its quick responsiveness to fertilization, and its easy cultivation and management. The surface is smooth and regular, and the absence of stones, together with the loamy texture of the soil, makes it easy to maintain good tilth. Any addition of fertilizers or lime is immediately effective, and by judicious management the type may be kept in a high state of productivity. Many fine farms with good buildings are to be seen on this type. The crops grown are corn, wheat, grass, clover, apples, and small fruits. Grazing, stock raising, and dairying are practiced to some extent. The land yields from 40 to 60 bushels of corn, from 10 to 15 or more bushels of wheat, and from 1 to 2 tons of hay per acre. Nearly every farm has a small herd of beef cattle fattening for the market, as well as a small flock of sheep.

Where managed judiciously, the soil is well adapted to growing wheat, corn, oats, vegetables, apples, and small fruits. Liming is very beneficial, and a small amount of lime frequently added is said to give better results than a large amount added at longer intervals.

This type of soil is located within easy reach of the railroads, and is one of the most desirable soils of the area. The price of this land varies from \$25 to \$50 an acre, depending largely on the character of the improvements and the location, the farms nearer the railroads bringing the higher prices.

The following table shows the texture of typical samples of the fine earth of the soil and subsoil of this type:

Mechanical analyses of Penn loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9853	5 miles S. of Leesburg, Va.	Red loam, 0 to 12 inches.	1.70	2.34	4.80	2.82	7.76	20.82	36.72	24.30
9851	3 miles S. of Leesburg, Va.	Red loam, 0 to 12 inches.	1.44	2.40	4.50	2.56	7.40	22.74	35.60	24.48
9849	3 miles NE. of Point of Rocks, Md.	Red loam, 0 to 10 inches.	1.48	2.70	10.94	8.92	13.44	10.68	27.62	24.96
9852	Subsoil of 9851.....	Red loam, 12 to 36 inches.	.32	2.30	5.26	3.40	10.06	20.04	29.30	29.30
9850	Subsoil of 9849.....	Red loam, 10 to 36 inches.	.52	2.30	8.44	6.48	12.70	12.28	27.94	30.00
9854	Subsoil of 9853.....	Red loam, 12 to 36 inches.	.59	3.54	6.04	2.64	7.42	16.20	32.00	31.90

PENN CLAY.

The Penn clay consists of from 6 to 12 inches of a red or reddish-brown loam, resting upon a subsoil of heavy red clay. The soil and subsoil generally have the Indian-red color characteristic of the Triassic red sandstone from which the soil is in part derived. From 1 to 10 per cent of the soil mass is usually made up of small sandstone fragments, while throughout the greater part of the type numerous limestone conglomerate ledges, interbedded with Triassic red sandstone, come to the surface. In other areas of the type numerous limestone conglomerate bowlders, often of great size, cover from 10 to 25 per cent of the surface.

This latter phase occurs in the vicinity of the Potomac River near Point of Rocks, Md., and near the Potomac River 3 miles north of Leesburg, Va., and in these places the heavier phase of the type occurs, the clay often being very near the surface. In other parts of the area, where the limestone conglomerate is not so preponderant, or where it lies deeper and is mostly unexposed, the surface soil is deeper, often consisting of 18 inches of loam. The land is locally termed "limestone

land," and if it were not for the fact that it is derived in part from the red sandstone, it would probably be classed with the Hagerstown series. Near Catoctin Mountain the rocks seem to have weathered to considerable depth, there being no exposures or outcrops. Here the soil has been washed away from some of the more elevated small areas, and the heavy red clay subsoil is exposed.

In a great many places along the base of the mountain the formation of this type is somewhat complicated by the wash from the mountain, which consists principally of subangular quartz fragments, from 1 to 4 inches in diameter. This rock sometimes forms as much as 30 or 40 per cent of the soil mass. This phase is called "gravelly land," and is hard to cultivate on account of its heavy texture and stony condition, although it is inherently productive.

This type occurs in one irregular-shaped area, about 15 miles long, varying from less than 1 mile to 3 or 4 miles in width, being cut by the Potomac River just east of Point of Rocks, Md. It thus lies in the eastern part of the area, in the Piedmont Plateau. It occurs only in Loudoun County, Va., and Frederick County, Md., extending from immediately north of Leesburg, Va., to the northeastern corner of the area, skirting the eastern foot of Catoctin Mountain.

The surface configuration varies from valleylike to gently undulating and high rolling land, with occasional ridges extending through the higher lying lands. The area of Penn clay lies between the Catoctin Mountain and the Triassic sandstone areas, and the limestone conglomerate rock from which it is partly derived weathers more rapidly than the formations on each side. Consequently much of the type lies as a broad, shallow valley.

The general surface drainage is good, there being many small streams flowing through the type and emptying into the Potomac River. The stream beds are but little lower than the surface of the surrounding land, while the slopes are long and gentle. Excessive erosion scarcely ever occurs. The heavier phase of the type would undoubtedly be improved by tile draining, as it is usually lower lying than the lighter phase. The heavier phase bakes and cracks in dry weather much the same as the heavy limestone soils of the Shenandoah Valley, but with the lighter phases, where the soil covering is deeper, good tilth is easily maintained throughout the growing season.

This soil is residual in origin, being derived partly from red sandstone of the Jura-Trias period and partly from limestone conglomerate. The latter is made up of worn pebbles of limestone, averaging 2 or 3 inches in diameter, and of bluish color, embedded in a reddish calcareous matrix. The result of weathering upon the conglomerate is a very uneven and rugged series of outcrops projecting above the rolling surface of the soil. The weathering of the conglomerate has

progressed more rapidly than that of any of the other formations; consequently the surface of this soil type approaches nearer to the level of the present drainage than any other type of the area, excepting Meadow. Where the drainage streams have approached their base level, scarcely an outcrop of conglomerate is seen, but nearer the faster-flowing streams the irregular masses of unweathered rocks frequently appear.

On this type a well-diversified system of general farming is carried on. Corn, wheat, clover, and grass are the crops grown, of which the yields are as follows: Corn, from 40 to 60 bushels per acre; wheat, from 15 to 25 bushels per acre, and clover and grass, from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons of hay per acre. Apples do well on this type, and many small orchards are to be seen. Many of the farmers have small herds of steers, which are raised and fattened for the eastern markets.

The Penn clay is the most highly prized soil of the Piedmont region in the Leesburg area, and brings the highest prices. Improved farms near the railroad have been sold for as much as \$75 an acre. The more remote lands sell for about \$50 an acre. However, it is generally considered that the land is hardly worth the higher prices for agricultural purposes, but is more often sold at that rate to persons of means who desire to establish country homes. Many fine residences and substantial farm buildings are located on the farms of the Penn clay.

The Penn clay partakes of the characteristics of an important soil type of another series, namely, Hagerstown clay. The color and texture indicate clearly its relationship to the soils of the Penn series, but the limestone conglomerate adds much to the productiveness of the soil and undoubtedly greatly influences its texture and condition. Lime and fertilizers are used extensively on this type, and the land responds readily to such treatment. Without liming, the land would produce much less than it is really capable of doing.

The soil is judiciously managed and, on the whole, is kept in a high state of cultivation. The system of getting a good stand of clover by liming, and turning the crop under to be followed by corn and wheat, is much in vogue and is greatly to be commended. The lands are kept much more productive through the practice of stock feeding and the application of the manure to the soil.

This soil type is well adapted to the system of agriculture which is practiced—namely, general farming and stock fattening. Nearly all of the type is cultivated. The only trees growing on the Penn clay are confined to very small areas and consist of locust and oak.

The following table gives the results of mechanical analyses of typical samples of fine earth of the Penn clay:

Mechanical analyses of Penn clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9845	2½ miles NE. of Point of Rocks, Md.	Red heavy loam, 0 to 6 inches.	1.13	2.64	4.02	3.00	11.32	13.52	34.50	30.32
9843	5 miles N. of Leesburg, Va.	Dark-red loam, 0 to 12 inches.	.88	3.04	4.48	2.14	7.62	16.34	34.26	32.16
9847	3 miles N. of Leesburg, Va.	Dark-red loam, 0 to 18 inches.	1.49	1.92	3.02	1.62	2.92	16.46	39.70	34.40
9844	Subsoil of 9843.....	Red clay, 12 to 36 inches.	.17	3.10	4.90	2.60	5.58	14.88	27.90	41.00
9848	Subsoil of 9847.....	Red clay, 18 to 36 inches.	.32	.52	2.28	1.20	2.58	13.70	35.32	44.30
9846	Subsoil of 9845.....	Red clay, 6 to 36 inches.	.55	3.48	3.56	2.26	7.06	9.26	27.80	46.48

PENN STONY LOAM.

The Penn stony loam consists of from 8 to 12 inches of a red or grayish heavy loam, somewhat silty, underlain by a heavier red loam. From 10 to 60 per cent of gray and brown fragments of Triassic sandstone, ranging from 1 to 6 inches in thickness, cover the surface of the soil. The color is in general the dark Indian-red of the other soils derived from Triassic sandstone, being particularly marked in the subsoil.

This type occurs in the southeastern part of the area, on the Piedmont Plateau. It occupies three small areas whose total extent probably does not exceed 2½ square miles. It is closely associated with the Penn loam and grades gradually into that type. The only great difference between the two is the presence of sandstone fragments in the Penn stony loam.

The topography varies from gently rolling to hilly and ridgy, with slopes that are sometimes rather steep. However, the surface is not so broken as to interfere with cultivation, and the slopes are usually gentle.

The type is well drained, the slopes allowing a rapid flow of water from the surface, while the soil water passes readily through the soil and subsoil. On the other hand, the texture is sufficiently heavy to prevent undue leaching and drought.

The soil is residual in origin, being formed by the weathering of red and brown sandstones of the Newark formation. This brown

sandstone is much harder than the red sandstone and is very siliceous. It is on account of the slow weathering of this sandstone that the fragments occupy so large a proportion of the soil mass.

Little of the land is in cultivation, on account of its stony character, which makes cultivation difficult. Where unimproved it is covered with a heavy growth of chestnut, oak, and pine. The land is locally called "chestnut land." In a few small areas the larger stones have been removed and the land is cultivated, corn and wheat being the principal crops. The yield of corn ranges from 20 to 35 bushels and of wheat from 8 to 15 bushels per acre. Apples and small fruits and vegetables do well.

The Penn stony loam is well adapted to the growing of small fruits and vegetables. A system of chestnut orcharding would doubtless prove successful. The land responds well to lime and fertilizers. On account of the distance from the railroad and the thinness of the soil, the land is not valued highly. There are no complete farms on the type, and when sold it is in connection with the adjacent lands composed of the Penn loam. On this basis it is valued at probably \$15 or \$20 an acre. On account of its small extent, also, the type is not an important one in this area.

The following table gives the results of mechanical analyses of typical samples of the fine earth of the Penn stony loam:

Mechanical analyses of Penn stony loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
9859	1½ miles SW. of Evergreen, Va.	Red heavy loam, 0 to 8 inches.	P. ct. 1.49	P. ct. 1.40	P. ct. 5.28	P. ct. 3.44	P. ct. 8.64	P. ct. 17.44	P. ct. 34.36	P. ct. 29.30
9861	1½ miles NE. of Oatlands, Va.	Red heavy loam, 0 to 10 inches.	1.35	2.12	4.04	2.72	9.94	14.22	32.80	33.58
9862	Subsoil of 9861.....	Red clay, 10 to 36 inches.	.47	1.24	2.96	2.22	9.62	20.48	32.80	30.60
9860	Subsoil of 9859.....	Red clay, 8 to 36 inches.	.52	1.04	2.88	2.04	6.80	12.40	30.90	43.20

PENN GRAVELLY LOAM.

This type of soil consists of from 1 to 12 inches of a red or brown sandy loam, medium in texture, underlain by a red loam or clay loam. From 10 to 60 per cent of the soil mass consists of small, rounded sandstone gravel.

The type occupies only a very small proportion of the area, and consists of two small tracts, one about 2 miles east of Point of Rocks, Md.,

and the other just east of Whites Ferry, Montgomery County, Md. The surface is very rolling or hilly, the characteristic topography of the Piedmont Plateau upland near the Potomac River. The areas lie about 200 feet above the river bed. The slopes vary from gentle to steep, and the latter wash badly.

As a result of the topography, the type has adequate surface drainage, while the presence of gravel allows a quick distribution of moisture throughout the soil mass.

The Penn gravelly loam is partly residual and partly sedimentary in origin. It is derived mostly from the Triassic red sandstone, and has the characteristic Indian-red color common to the Penn soils. The sandy nature of the soil is undoubtedly due to sedimentation from the river, which at one time overflowed these areas. The gravel was probably derived from the same source.

The Penn gravelly loam produces fair yields, but cultivation is greatly hindered wherever the gravel is plentiful. Corn yields from 20 to 40 bushels and wheat from 8 to 15 bushels per acre. Vegetables and small fruits do well.

In the matter of adaptation the type is probably best suited to vegetables and fruits, such as peaches, plums, grapes, and berries. It responds well to fertilization. Owing to its small extent it is a very unimportant type in this area. Its value ranges from \$20 to \$30 an acre.

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

Mechanical analyses of Penn gravelly loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
9857	2 miles E. of Point of Rocks, Md.	Red sandy loam, 0 to 12 inches.	1.49	1.82	7.70	6.70	19.54	18.12	26.72	18.78
9855	.....do.....	.....do.....	1.43	2.16	7.20	6.70	18.74	18.12	26.92	19.92
9858	Subsoil of 9857.....	Red loam, 12 to 36 inches.	.62	5.54	7.56	3.72	7.96	18.20	37.32	19.70
9856	Subsoil of 9855.....	.....do.....	.64	3.60	7.34	4.44	11.26	15.16	32.20	25.70

HAGERSTOWN CLAY.

The soil of the Hagerstown clay consists of a heavy red or brown loam, having an average depth of 8 inches. The subsoil consists of a heavy red clay. Occasional outcrops of massive blue limestone occur

throughout the type, and near these outcrops the soil is much heavier, the clay often being on the surface. With the exception of the limestone outcrops, which are relatively few, there are no stones on the surface.

The Hagerstown clay occurs in one broad area in the northwestern corner of the area, which lies within the Shenandoah Valley. It extends through this corner of the area in a northeast and southwest direction. Several narrow ridges of Hagerstown shale loam occur in the Hagerstown clay areas. For several miles the western boundary of the type is formed by the meadow land along the Shenandoah River.

The topography of the type consists of the high, rolling uplands of the Shenandoah Valley. The rolling character of the surface makes it naturally well drained, although the passage of soil moisture is greatly retarded by the heavy texture of the clay subsoil, and tile draining would undoubtedly prove of great benefit on the heavier phase of this soil. A number of small streams tributary to the Shenandoah extend throughout the type, making it well watered, and removing rapidly all surplus surface water. Occasional slopes have been denuded of the soil covering by erosion, but excessive washing rarely occurs.

The soil is of residual origin, being derived from the weathering of pure, massive blue limestone. It is derived through the removal by water of the soluble constituents which constitute a large proportion of the rock, the insoluble matter remaining to form the soil. Weathering has gone on to a great depth, and but few outcrops of the harder, more resistant ledges still protrude from the surface. Small areas of the type near the Shenandoah River contain considerable sandstone gravel, which has been deposited there by the river when it flowed at a higher level than at present.

The Hagerstown clay is the best soil in the Shenandoah Valley, being naturally very productive. It is easy to work when it contains a moderate amount of moisture, but when dry the heavier phase bakes and cracks and, while in this condition, is extremely difficult to cultivate. Corn yields from 40 to 60 bushels per acre on the loamy phases, but on the heavier phase the yields are not so high or so certain. Wheat yields from 18 to 25 bushels per acre, with occasional yields of 30 or 35 bushels. Large yields of timothy and clover hay are obtained, ranging from 1 to 2½ tons per acre. Blue grass grows well and makes fine pastures. Little lime is used, the majority of the farmers believing that it is of doubtful benefit to soil of this type. Others insist that it is beneficial, and judging from the experience in other sections where lime was applied extensively on this soil, it would seem that judicious liming should prove profitable. Considerable quantities of commercial fertilizer are used. Fall plowing is also thought beneficial to the

soil, on the theory that it is thereby more freely exposed to the weathering influences of the winter rain and frost.

The farms on this type are quite large, containing usually from 200 to 300 acres. They are valued at from \$60 to \$100 an acre, and are all well located with respect to transportation facilities.

The Hagerstown clay is especially adapted to wheat, and, indeed, is probably the best wheat soil of the area. Grass and clover are also well suited to this soil, and produce large yields. Apples do well and are a profitable crop, the principal varieties grown being Paragon, Ben Davis, Newtown Pippin, and Baldwin. A few large orchards are now being set out, but as a rule the orchards are small.

The following table gives the results of mechanical analyses of typical samples of the Hagerstown clay:

Mechanical analyses of Hagerstown clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9815	3 miles SW. of Harpers Ferry, W. Va.	Brown loam, 0 to 8 inches.	1.51	0.70	2.18	1.72	3.86	10.86	45.84	33.96
9817	1 mile SW. of Milldale, W. Va.	Red clay, 0 to 6 inches.	1.19	.30	1.80	2.04	7.10	9.68	40.12	38.92
9816	Subsoil of 9815.....	Red clay, 8 to 36 inches.	.37	.30	1.32	1.14	2.88	6.78	35.98	50.60
9818	Subsoil of 9817.....	Red clay, 6 to 36 inches.	.40	.28	1.04	.92	2.94	4.12	27.42	63.08

HAGERSTOWN LOAM.

The Hagerstown loam consists of about 10 inches of a brown silt loam, underlain by a yellow or yellowish-red clay loam, which grades into a heavy reddish clay at a depth of from 20 to 30 inches. The soil is light and easy to work, and is highly esteemed on this account. It can be cultivated within a wide range of moisture content, rarely getting too dry or too wet. The surface soil is free from stones, although some few limestone outcrops occur, and shale fragments are occasionally found in the subsoil.

This type occurs in the Shenandoah Valley in one body, occupying the extreme northwestern corner of the area and having a total extent of several square miles. The eastern boundary of the type consists of a long, broken ridge of Hagerstown shale loam, which extends throughout the section, separating the Hagerstown clay from the Hagerstown loam.

The topographic features of the type consist of broad, rolling uplands. The slopes are gentle, being rarely steep enough for excessive erosion, although the land is inclined to wash with heavy rains on the steeper slopes.

The drainage is good throughout the type. Many small streams traverse the area, and springs are abundant and flow perpetually. The subsoil, while not heavy for a considerable depth, is sufficiently close-textured to hold enough moisture for growing vegetation when there is anything like an adequate rainfall.

Like the Hagerstown clay, the Hagerstown loam is residual in origin, being derived from the weathering of limestone. This limestone is a gray variety, not so pure as the blue, but it has weathered to great depth, there being very few outcrops on the surface. In places the formation of the soil seems to have been slightly influenced by a yellow shale.

The Hagerstown loam is much better adapted to general farming than the Hagerstown clay, having a more loamy soil covering and being much easier to cultivate. However, it is not as strong land as the clay, and is not capable of producing such large yields of wheat or grass, though it gives much better yields of corn. It produces from 15 to 20 or more bushels of wheat and from 50 to 70 bushels of corn per acre. The yields of clover and timothy hay range from 1 to 2 tons per acre, and sometimes more. Bluegrass grows well and makes fine pastures. Apples yield good crops, and there are many orchards of a few acres on this type.

The Hagerstown loam is finely adapted to its present use—general farming—and, with the exception of some of the meadow land, is the best corn land of the area. The soil is well adapted to the production of apples, although they are grown only in a small way. The type is all under cultivation and is held at a high price, few farmers caring to sell. It would bring an average of \$60 an acre, and well-improved farms near the railroad could not be bought for less than \$100 an acre.

But little lime is used on the soil, although some hold that its use is beneficial. Much commercial fertilizer is used. Rotation of clover, corn, and wheat, and the addition of barnyard manure keep the soil in a high state of productiveness. The roads throughout the type are good. The farms are usually large, some containing 400 acres or more.

The following table gives mechanical analyses of typical samples of the Hagerstown loam:

Mechanical analyses of Hagerstown loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
9829	1½ miles SW. of Halltown, W. Va.	Brown silty loam, 0 to 10 inches.	1.56	1.94	3.86	1.86	5.08	9.04	48.70	29.18
9827	¼ mile SW. of Halltown, W. Va.	Brown silty loam, 0 to 12 inches.	2.05	.44	1.20	.70	1.96	6.06	52.70	36.82
9828	Subsoil of 9827.....	Brown clay loam, 12 to 36 inches.	.46	.46	1.54	.90	3.60	7.20	43.50	42.80
9830	Subsoil of 9829.....	Clay loam to clay, 10 to 36 inches.	.56	1.24	2.68	1.58	3.82	6.78	38.64	45.40

HAGERSTOWN SANDY LOAM.

The soil of the Hagerstown sandy loam consists of from 6 to 12 inches of brown or yellowish sandy loam. This is underlain by a red clay, which, though quite heavy, often contains considerable quantities of sand. The soil is normally free from stones, but near the Shenandoah River some areas are covered with from 30 to 50 per cent of smooth, rounded, sandstone gravel from 1 to 8 inches in diameter, which were deposited there by the river when its bed was higher than it is now. The sand of the soil is medium to fine in texture. The subsoil is usually heavy and quite retentive of moisture, while the sandy covering acts as a mulch, protecting the soil moisture from evaporation.

The type occupies three or four small areas in the Shenandoah Valley, in the northwestern part of the area. It occurs along the Shenandoah River, and usually occupies the necks of land formed by the river bends. The largest of these areas is scarcely more than 1 square mile in extent. In topography the land is a gently rolling upland, lying from 50 to 150 feet above the river bed.

The Hagerstown sandy loam is both residual and sedimentary in origin, the subsoil being derived principally from the weathering of the Shenandoah limestone, while the sandy-loam covering has been formed by sedimentation from the river, occurring during overflows.

The greater part of this area is cultivated, but where uncultivated is covered by a growth of scrub oak.

Where the subsoil is quite heavy the soil is good corn land, yielding 40 or 50 bushels per acre. Wheat does not do well, on account of the light nature of the soil, though it produces from 8 to 15 bushels per

acre in good seasons. Vegetables and small fruits are the crops which thrive best on this type. Owing to the small extent of the type, it is not an important soil in this area. It is valued at from \$15 to \$25 an acre. The price would be higher if the areas of this type were located more conveniently as regards railroad facilities.

The following table gives the results of mechanical analyses of typical samples of the Hagerstown sandy loam:

Mechanical analyses of Hagerstown sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	R. ct.	P. ct.
9819	2½ miles SW. of Harpers Ferry, W. Va.	Brown sandy loam, 0 to 12 inches.	1.23	2.70	10.68	5.82	13.18	21.74	31.74	14.12
9821	5 miles SW. of Milldale, W. Va.	Brown sandy loam, 0 to 10 inches.	1.33	1.24	4.90	5.90	20.80	20.82	28.00	18.28
9822	Subsoil of 9821.....	Red sandy clay, 10 to 36 inches.	.37	.48	3.40	4.70	16.80	14.02	30.90	29.62
9820	Subsoil of 9819.....	Red heavy loam, 12 to 36 inches.	.31	1.20	5.20	3.30	7.50	12.20	25.80	44.68

HAGERSTOWN SHALE LOAM.

The Hagerstown shale loam consists of 8 inches of a gray or brown loam, underlain by a subsoil of somewhat heavier yellow loam, which often rests upon a bed of broken shale at a depth of from 24 to 30 inches. On the surface and throughout the soil and subsoil varying quantities of small broken shale fragments occur, sometimes forming not more than 15 per cent of the soil mass, while at other times making up practically the whole soil mass. At Harpers Ferry a small area of the shale formation seems to have been partially metamorphosed, and here the subsoil consists of a reddish clay loam. Along the gorges of the Potomac and Shenandoah rivers are some fine exposures of the massive shale.

A valley phase of the type occurs in the Shenandoah Valley west of Harpers Ferry, the texture being quite typical, except that the proportion of shale fragments is lower. Beds of slate also occur in this phase, and the whole is probably underlain at a considerable depth by limestone.

This type occurs in the northwestern corner of the area, and the greater portion of it occupies one long, continuous belt, extending from Harpers Ferry in a southwesterly direction along the west flank of the Blue Ridge. The belt varies from 1 to 3 miles in width, and is

divided at Harpers Ferry by the Shenandoah and Potomac rivers. The valley phase occupies long narrow strips, extending in a north-east and southwest direction, and is surrounded on all sides by the Shenandoah limestone soils. The whole of this phase occurs in Jefferson County, W. Va.

The topographic features consist of low foothills and rolling slopes. Where the Shenandoah and Potomac rivers cut through the areas the banks are very steep and rise from 100 to 200 feet above the river bed. The valley phase of the type consists of long, narrow ridges with rounded crests and steep slopes, having an altitude of about 100 feet above the surrounding valley.

The surface configuration and loose texture of the soil make it not only well drained, but even leachy, and what water falls on the surface either flows rapidly away or passes quickly through the soil and subsoil. On the steeper slopes erosion is active, and deep gullies and ditches are quickly formed. The crops often suffer from drought, because the porous subsoil does not retain sufficient moisture to supply growing vegetation in dry weather, and to secure the best yields this soil requires a series of light rains not far apart throughout the growing season. The areas of this type are drained by numerous deep-bedded and steep-walled small streams which empty into the Shenandoah River.

The Hagerstown shale loam is residual in origin, and is formed by the weathering of a uniform argillaceous and slightly sandy shale of the Cambrian era. When fresh this shale is of a dull bluish gray color, but on weathering the color changes to a light greenish gray. The weathering of this rock has advanced to considerable depth, but complete decomposition is very slow, as evidenced by the numerous fragments which cover the surface of the areas.

The Hagerstown shale loam is locally termed "slate land," and is not highly valued for agricultural purposes. A considerable portion of the type is farmed, however, the farms being small and generally owned by those farming them. Where uncultivated a natural growth of oak and pine is found, the trees being rather small. Much of this pine is now being sawed into lumber. The crops are corn, wheat, clover, and grass, with some few vegetables and small fruits. The average yields per acre are: Corn, from 20 to 30 bushels; wheat, from 8 to 12 bushels; clover, from 1 to 2 tons. On the valley phase the yields of corn and wheat are considerably higher. Peaches do fairly well, but the trees are short lived. Grapes, apples, pears, plums, and quinces thrive. This soil warms up rapidly in the spring and responds very quickly to good cultivation and fertilization.

This type is not especially adapted to corn and wheat, but is well suited to clover, which grows luxuriantly. On account of its light, warm nature the soil is well suited to the production of small fruits.

Little lime is used on this type, and its use seems unnecessary, so far as the correction of any acid condition of the soil is concerned.

Improved land is valued at from \$8 to \$20 an acre. Good roads extend throughout this section, and railroad transportation is easily available, giving a ready outlet to good markets.

The following table shows the texture of typical samples of fine earth of the soil and subsoil of the Hagerstown shale loam:

Mechanical analyses of Hagerstown shale loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9825	4 miles S. of Harpers Ferry, W. Va.	Brown loam, 0 to 8 inches.	1.61	2.80	4.70	3.80	18.30	13.76	34.04	22.50
9823	2 miles SW. of Harpers Ferry, W. Va.	Brown loam, 0 to 6 inches.	2.18	1.80	2.74	3.40	4.70	11.12	44.88	31.14
9826	Subsoil of 9825.....	Yellow loam, 8 to 24 inches.	.37	3.10	5.60	3.90	16.30	10.70	36.02	24.18
9824	Subsoil of 9823.....	Yellow loam, 6 to 28 inches.	1.43	3.40	4.96	2.60	8.20	14.54	41.12	25.20

CECIL LOAM.

The soil of the Cecil loam consists of from 8 to 12 inches of a brown or yellow loam. The subsoil consists of a heavy yellow or red loam, or occasionally clay loam. The soil and subsoil are usually free from stones, but occasional areas have from 5 to 30 per cent of angular quartz or schist fragments on the surface. Often a mica-schist enters into the composition of the subsoil, giving it a soft and greasy feel.

The greater part of the intermediate valley or base-level plain of the Catoctin belt consists of the Cecil loam, and it occurs here as one large, connected area, inside of which are small areas of Cecil clay, Loudoun sandy loam, and Iredell clay loam. This plain or valley, several miles in width, lies between the Blue Ridge and Catoctin Mountain, and extends through the central part of the area in a northeast and southwest direction. A considerable portion of the Catoctin Mountain also consists of the Cecil loam. In extent this is the most important soil type in the survey, covering about 33 per cent of the total area.

The topographic features consist of a broad, rolling to hilly plain lying between two mountains and forming, with reference to these mountains, a valley. Many of the slopes are fairly steep, especially in the area on Catoctin Mountain, although as a rule they are long and gradual.

The Cecil loam, owing to its rolling character, is well drained throughout. Many small streams traverse it, affording ample outlets for surface water. The gently rolling areas are not generally subject to excessive erosion, but the steeper slopes wash badly, deep gullies and ditches being formed on the hillsides. Especially subject to erosion are the areas in which the subsoil contains a relatively large proportion of mica fragments. The soil and subsoil, though quite loamy, retain enough moisture in seasons of moderate rainfall to supply all growing crops.

The Cecil loam is residual in origin, being derived from the weathering of the igneous rocks of the Catoctin belt. These rocks consist of schist and granite, the schist sometimes occurring alone in large areas, but the granite always occurring in close relation to the schist as an interbedded formation. This schist is a light bluish-green rock which varies from coarse to fine in texture and weathers into a grayish-yellow color. It is rich in epidote and feldspar. The granite is of eruptive nature and was forced into fissures in the schist while fluid. This rock is light gray in color and is rich in feldspar. These rocks decompose rapidly, on account of the large amount of feldspar which they contain.

The Cecil loam is devoted entirely to general farming. The crops grown are corn, wheat, grass, clover, vegetables, apples, and pears. The agricultural interests are further diversified by the practice of dairying and stock raising. The land is one of the best corn soils of the area, being loamy and easily cultivated throughout the growing season. The average yield per acre ranges from 40 to 60 bushels. Wheat does very well, producing from 12 to 20 bushels per acre, and more in favorable seasons. Grass and clover yield at the rate of from 1 to 2 tons of hay per acre and form good grazing during a considerable part of the year. Apples and pears are grown everywhere on the type, usually in small orchards, and good yields of these fruits are obtained. Oats were at one time grown, and can be produced at the rate of from 35 to 50 bushels per acre, but the present acreage is small, the farmers claiming that this crop rapidly reduces the productiveness of the soil. A considerable number of beef cattle are fattened on the farms of the Cecil loam. The mature steers are brought from the surrounding States or from the western markets and grazed and fed on corn until fat, when they are shipped to the eastern markets. Bluegrass makes a fine, lasting pasture, and dairying is a prominent feature of the agriculture in the southern and central part of the area, along the Washington, Ohio and Western Railroad. The industry is confined chiefly to the production of milk and cream, which are shipped every morning to Washington. Dairying is also an important industry on this type along the Baltimore and Ohio Railroad in the northern part of the area. The milk is shipped to

Baltimore and Washington. Little butter is produced, on account of the generally smaller profit as compared with the profit on milk.

Much commercial fertilizer is used on the soil and the land tends to become sour, perhaps from the acid phosphate used. Often the land becomes so sour that a stand of grass or clover can not be secured without first giving it an application of lime, and large quantities of this mineral are used on the farms throughout the area. Several years ago, before the use of lime had become general, much of the land of this soil type was in such a condition that many farms were worked at a loss. But through liming, although it is an expensive practice, the farms have again been brought into a high state of cultivation, and it is believed that the prosperity of the section is largely due to this. The lime costs from 10 to 12 cents a bushel by the time the farmer gets it on his land, and it is probable that its high price and the difficulty of transportation prevent many from using a sufficient amount. The quantity applied is usually about 25 bushels to the acre. The good results obtained from the use of lime on the Cecil loam are also secured in the case of the Cecil clay and Loudoun sandy loam; in fact, it seems that all the granite soils of the area require lime, more to correct the acidity of the soil than to remedy any textural deficiencies. In addition to the use of lime and commercial fertilizers, the skillful manipulation of the soils and the practice of a good rotation, generally of clover, corn, and wheat, keep the farms of this type in a highly productive condition, making this section one of the most prosperous farming regions of Virginia.

The farmhouses on this type are good, while the barns and other farm buildings are substantial. Many silos are seen in the dairy communities. Little of the Cecil loam land is for sale, but improved farms bring from \$40 to \$80 an acre, depending largely on the distance from railroads.

The soil of this type is well adapted to the purpose for which it is used—namely, a system of diversified farming. It is probably better for corn than for any other crop, but is well adapted to wheat, clover, and grass. Apples can be grown profitably on the type, although little attention is paid to their production. Fair yields of pears and peaches can also be obtained. Great care has to be exercised in plowing the Cecil loam in the spring, for if plowed when too wet the soil forms into hard clods, which hinder cultivation greatly until succeeding rains break them down.

Nearly all of the type is in cultivated crops or pasture. The original timber growth was oak, hickory, and walnut; but little of this stands now, except on occasional woodlots. The Cecil loam is a soil which with careful treatment makes a fine farming land; but carelessly managed it very quickly deteriorates.

The following table gives the results of mechanical analyses of typical samples of fine earth of the Cecil loam:

Mechanical analyses of Cecil loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9795	1½ miles E. of Lovettsville, Va.	Brown loam, 0 to 8 inches.	1.07	4.00	6.92	4.82	10.06	18.44	34.40	20.64
9797	3 miles W. of Woodburn, Va.	Brown silty loam, 0 to 8 inches.	.43	3.76	5.04	3.02	8.14	8.64	49.58	20.84
9799	2½ miles S. of Union, Va.	Brown loam, 0 to 10 inches.	1.37	2.68	4.20	3.00	9.00	9.12	41.14	30.84
9798	Subsoil of 9797.....	Brown loam, 8 to 36 inches.	.24	1.00	3.82	2.78	10.98	14.90	45.20	21.26
9796	Subsoil of 9795.....	Brown loam, 8 to 36 inches.	.32	2.12	6.58	4.22	10.12	15.42	38.50	22.50
9800	Subsoil of 9799.....	Red heavy loam, 10 to 36 inches.	.53	.70	2.38	2.16	8.16	9.00	47.26	29.58

CECIL CLAY.

The soil of the Cecil clay consists of a heavy loam, red or brown in color, and having an average depth of 8 inches. The subsoil generally consists of a red clay, although it is sometimes a heavy clay loam. The surface is generally free from stones, though occasional small areas have a few quartz and granite or schist fragments. In the Piedmont areas small rounded diabase fragments, or "niggerheads," occur on the surface. Occasionally on steep slopes or high knobs the soil covering has been washed away, leaving the heavy red clay exposed on the surface. These areas, however, are small.

The type occurs in this area principally in the intermediate valley of the Catoclin Belt, between the Blue Ridge and the Catoclin Mountain, and on the west slopes of the Catoclin Mountain. In the valley it occupies several small, disconnected areas scattered throughout this region, while on the west slope of the mountain it is found in one or two long, broad areas, extending in a northeast and southwest direction. Three small areas occur in the Piedmont, in the southeastern corner of the area, and the type is here closely related to the Iredell clay loam.

The most typical areas of this soil occur in the Piedmont Plateau and on the gentle slopes at the foot of the Blue Ridge in the vicinity of Bluemont, Va. The physiographic features consist of very rolling to ridgy land, or long, gentle slopes. At the foot of the Blue Ridge this type occurs as a long, gentle slope. On the Catoclin Mountain it

is hilly and gently sloping, the steeper slopes being Cecil loam. In the Piedmont it is very rolling and ridgy.

This soil type has excellent surface drainage and is well watered and drained throughout by small streams. Few of the slopes are so steep as to wash badly. The heavy clay subsoil retains ample moisture for plant growth and the soil is rarely so wet as to necessitate tile draining, although this would undoubtedly be very beneficial in the case of the heavier phases.

The soil is of residual origin, being derived from the weathering of igneous rocks. In the Catoclin Belt these rocks consist of a fine-grained, bluish-green schist, rich in epidote and chlorite, which has weathered to considerable depth, little of the parent rock being seen at the surface, except in deep cuts. In the Piedmont the soil is derived from a diabase, which, although it weathers rapidly, leaves numerous small bowlders, or "niggerheads," scattered over the surface. In these diabase areas the higher and better-drained lands are composed of Cecil clay, while the lower and more poorly drained lands consist of the Iredell clay loam.

This soil is all under cultivation and is highly esteemed wherever found, being naturally a strong soil and susceptible of improvement. The original forest growth consisted of oak, hickory, and walnut. The land is easily improved, retentive of moisture and manure, and with careful management makes an excellent soil for general farming. Owing to its tendency to bake, crops are liable to suffer during drought.

The land produces wheat, corn, grass, clover, apples, and pears. It is a strong wheat soil, and yields from 15 to 25 bushels per acre and occasionally more. Grass and clover hay yield at the rate of $1\frac{1}{2}$ to $2\frac{1}{2}$ tons per acre, while from 40 to 60 bushels of corn per acre are usually produced in good seasons.

The soil responds readily to applications of lime, and is much benefited by its use. Much commercial fertilizer, as well as lime and barnyard manure, is used on this soil. In fact, so much acid phosphate has been added of late years that the land has become quite sour, and it is hardly possible to obtain a stand of grass or clover without the use of lime.

All things considered, the Cecil clay is best adapted to the production of wheat and grass. The more loamy phases are adapted to corn, but the type as a whole is a much better wheat land than corn land. The soil is also well adapted to apples and pears. Bluegrass grows well and makes fine pasturage, and stock raising and dairy farming are other industries to which the Cecil clay is well suited. Care has to be used in the cultivation of this soil, for if worked when too wet it dries in large, hard clods that give trouble throughout the season and interfere with cultivation for a long time afterwards.

The land is well located, and has as high a value as any other in the area, from \$40 to \$60 an acre being the usual price. Little land of this type is on the market at the present time.

The following table shows the texture of typical samples of fine earth of the soil and subsoil of this type:

Mechanical analyses of Cecil clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9789	3 miles NE. of Blue- mont, Va.	Red clay loam, 0 to 8 inches.	1.34	3.64	6.54	3.60	7.36	10.36	40.22	28.26
9791	2 miles E. of Ever- green, Va.	Red heavy loam, 0 to 8 inches.	1.63	3.22	10.66	4.40	13.16	12.66	23.70	31.60
9787	$\frac{1}{2}$ mile NE. of Blue- mont, Va.	Red clay loam, 0 to 10 inches.	1.72	3.58	3.90	1.98	4.24	4.46	42.30	39.10
9790	Subsoil of 9789.....	Red clay, 8 to 36 inches.	.87	1.80	3.66	2.62	5.20	7.78	39.94	39.00
9788	Subsoil of 9787.....	Red clay, 10 to 36 inches.	.97	2.96	4.14	2.48	4.42	4.20	36.58	45.04
9792	Subsoil of 9791.....	Red, heavy clay, 8 to 36 inches.	.68	1.20	5.80	2.80	9.30	9.72	22.26	48.40

CECIL SILT LOAM.

The surface soil of the Cecil silt loam consists of 12 inches of a light gray or white silt loam. This material is underlain by a subsoil of yellow silt loam slightly heavier than the soil. The type is locally termed "white land," and is closely related to the Penn loam and the Iredell clay loam, these types surrounding and grading gradually into it. In some areas the soil is quite free from stones, while in others from 10 to 30 per cent of the soil mass is composed of small rock fragments.

The type occupies several small areas in the Piedmont region, in the southeastern corner of the area. The largest of these areas lies about 2 miles east of Leesburg, Va., and a considerable part of the type is adjacent to the Potomac River. It occupies high, rolling, ridgy, or hilly lands, and has some rather steep slopes, though in general the surface is only gently sloping.

The drainage is good, but wherever the slopes are steep erosion proceeds rapidly, making gullies and washed-out places that hinder or entirely prevent cultivation. The type is well watered by small streams, which flow the year round.

The Cecil silt loam is a residual soil, derived through the weathering of the rocks of the Newark formation, which have been partially

altered by the heat of adjacent intrusive diabase. These rocks consist of Triassic red sandstone and red shale. The sandstones near the diabase lost their ferruginous matter and were slightly silicified, with a change of color to a dull white. The shale was somewhat hardened and silicified. These rocks have weathered slowly, and in some places their small fragments are quite numerous on the surface and throughout the soil and subsoil.

Probably one-half of this type is cultivated. The remainder is covered with a growth of scrub oak, pine, and some cedar. The soil is thin and only fairly productive, and consequently is not greatly desired for agriculture. It is very easy to work, but has to be cultivated carefully to avoid washing. The crops raised are corn, wheat, grass, and some apples. Corn yields from 25 to 35 bushels, wheat from 12 to 15 bushels, and clover and timothy hay from 1 to 2 tons per acre. Small fruits and vegetables do well.

Although naturally a thin soil, the Cecil silt loam is fairly well adapted to the production of the crops just named. Of the small fruits peaches, plums, and berries do best. On the whole the type is considered much better adapted to wheat than to corn. It is limed and fertilized to a considerable extent, and responds well to such applications. The farms of the type are usually small and poorly kept. The dwellings and farm buildings are small, and the section occupied by this type does not have that general air of prosperity that is to be seen on the better Piedmont soils.

The location of the Cecil silt loam is good. The roads are fair, and the railroad is near at hand. The better improved farms are valued at from \$15 to \$30 an acre.

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

Mechanical analyses of Cecil silt loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
9839	3 miles E. of Leesburg, Va.	Gray silty loam, 0 to 12 inches.	1.13	0.76	1.04	0.56	1.80	12.00	60.06	22.80
9841	4½ miles SE. of Leesburg, Va.	Gray silty loam, 0 to 12 inches.	1.26	1.58	2.36	.78	1.80	9.62	58.94	23.98
9842	Subsoil of 9841.....	Yellow silty loam, 12 to 36 inches.	.23	.98	1.36	.54	1.72	11.12	57.24	26.32
9840	Subsoil of 9839.....	Gray silty loam, 12 to 36 inches.	.32	.76	1.56	.90	3.64	11.26	53.36	27.98

CECIL MICA LOAM.

The Cecil mica loam consists of 12 inches of a friable, micaceous yellow or yellowish red loam, underlain by a yellow or yellowish-red loam, whose mica content increases with the depth until at 24 to 30 inches the subsoil is little more than a mass of small mica flakes. Occasionally the subsoil is a clay loam for several inches before grading into the unweathered mica particles.

The mica flakes in the soil and subsoil cause a loose texture, and when wet the soil has a greasy feel, due to the mica flakes. On the surface there is from 5 to 40 per cent of angular quartz fragments, ranging from 1 to 6 inches in diameter, some being much larger.

The roads through this formation are usually cut several feet beneath the surface, the road cuts having vertical sides. This is a characteristic feature in this soil. A few small areas of a loose loam, derived from a bluish slate, occurring within the mica loam areas, were mapped as this type.

The Cecil mica loam occurs as one long, narrow strip, occupying the lower, gentle eastern slopes of the Catoctin Mountain. The southern end of the strip begins a short distance north of Leesburg, Va., and extends in a northeasterly direction, leaving the area at its northern boundary a few miles north of Point of Rocks, Md.

The topographic features of the Cecil mica loam consist of gentle and occasionally steep rolling slopes. The surface is well drained and on the steeper slopes the soil washes badly and deep gullies are formed. In a season of moderate rainfall the soil and subsoil retain considerable moisture, but in dry weather crops suffer from drought.

The Cecil mica loam is a residual soil, and is formed by the weathering of a mica schist. The rock decomposes slowly, as is shown by the gradation of the soil into the soft, unweathered mica at a depth of not more than 24 or 30 inches. For this reason and because of erosion it is a thin soil. The areas are usually covered with a thick growth of chestnut, scrub oak, pine, and mountain ivy. The type is locally termed "chestnut soil," and is not considered a desirable one for agriculture. However, the soil is warm and responds very quickly to fertilization.

No farms are found entirely on the Cecil mica loam, but those farms of the Piedmont, extending up the mountain slopes, generally include some of this soil. Such areas are often farmed, but more generally used as woodlots. Where cultivated the yields are scant, except where the soil is heavily fertilized. Corn yields from 10 to 30 bushels per acre and sometimes more, and wheat from 6 to 12 bushels per acre. Small fruits, especially grapes, which seem well adapted to the soil, do very well. The type is best adapted to forestry, chestnut orcharding, and grape growing. Vegetables and berries would undoubtedly

do well if carefully cultivated. It is valued at from \$10 to \$20 an acre, and is located within easy reach of the railroads.

The following table gives the results of mechanical analyses of typical samples of the fine earth of the Cecil mica loam:

Mechanical analyses of Cecil mica loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
9803	2 miles N. of Point of Rocks, Md.	Brown mica loam, 0 to 12 inches.	P. ct. 0.71	P. ct. 1.60	P. ct. 2.56	P. ct. 1.76	P. ct. 21.56	P. ct. 14.12	P. ct. 32.80	P. ct. 24.98
9805	1½ miles NW. of Luckets, Va.	Yellow mica loam, 0 to 12 inches.	1.45	.88	1.82	2.22	22.44	18.34	27.36	26.50
9804	Subsoil of 9803.....	Brown loam, 12 to 36 inches.	.62	.82	2.88	2.72	33.20	16.42	32.40	11.42
9806	Subsoil or 9805.....	Yellow mica loam, 12 to 36 inches.	.44	.70	2.08	3.36	28.56	15.32	31.80	18.10

PORTERS CLAY.

The Porters clay consists of from 6 to 12 inches of a brown or reddish-brown loam, underlain by a heavy red loam or clay loam. The type consists of fairly rough mountain land, and is very stony, having from 15 to 60 per cent of small and large schist fragments on the surface, some of which are several feet in diameter. The soil is light and easy to work wherever it is not so stony as to interfere with cultivation.

This soil is a strictly mountain type, and in this area is not of great extent. It occurs in one small strip entering the area at Bluemont, Va. It follows the crest and part of the east slope of the Blue Ridge Mountain for several miles, extending in a northeasterly direction and ending at the areas of sandstone formation.

The topography of this type consists of a broad, rounded mountain ridge and part of the steep slopes of the mountain. Its altitude in the area is from 1,000 to 1,500 feet above sea level.

The type is well drained throughout, while the texture of the subsoil is sufficiently heavy to retain considerable moisture through quite extended dry spells. The steeper slopes are uncultivated and hence are not subject to erosion.

The Porters clay is a residual soil, derived from the weathering of the mountain areas of Catoctin schist. This schist is a fine-grained rock, with lenses and veins of epidote and quartz. The rock has weathered to considerable depth, although, as already noted, many unweathered fragments of great size cover the surface.

A considerable proportion of this soil type is under cultivation, especially on the broad mountain top. Those areas not cultivated are covered with a heavy growth of oak, hickory, locust, and walnut. Corn and wheat can be grown on the type with fair yields, but little of the latter is grown on account of the stony nature of the land. Corn yields from 20 to 35 bushels, wheat from 8 to 15 bushels, and grass and clover from 1 to 2 tons per acre. Irish and sweet potatoes give good yields, and fine apples and peaches are produced. Peaches are apt to winterkill, and the crop is uncertain for this reason.

This type is peculiarly adapted to fruit growing, and especially to the production of apples. On account of the relatively small area of the type in this survey it has not been developed to such an extent as in some other parts of Virginia, and only one or two apple orchards are found. However, it is quite likely that the Porters clay is the best apple soil of the area. The soil is also well adapted to the production of Irish potatoes.

The price of the Porters clay varies from \$15 to \$30 or more an acre, some of it being valued at a higher rate than would ordinarily be the case, on account of its proximity to the railroad and the fact that in the vicinity of Bluemont city people are buying it for sites for summer cottages. This tends to advance the value of the land considerably.

The following table gives the results of mechanical analyses of typical samples of the fine earth of the Porters clay:

Mechanical analyses of Porters clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
9865	2 miles NE. of Bluemont, Va.	Brown loam, 0 to 10 inches.	P. ct. 1.69	P. ct. 3.40	P. ct. 4.64	P. ct. 2.66	P. ct. 5.18	P. ct. 10.26	P. ct. 41.70	P. ct. 32.10
9863	.....do	Brown loam, 0 to 6 inches.	P. ct. 3.11	P. ct. 1.88	P. ct. 2.50	P. ct. 1.64	P. ct. 5.46	P. ct. 10.12	P. ct. 38.82	P. ct. 39.54
9866	Subsoil of 9865	Red clay loam, 10 to 36 inches.	P. ct. .82	P. ct. 3.60	P. ct. 5.80	P. ct. 3.00	P. ct. 5.90	P. ct. 7.80	P. ct. 38.20	P. ct. 35.02
9864	Subsoil of 9863	Red clay loam, 6 to 36 inches.	P. ct. 1.06	P. ct. 1.02	P. ct. 2.56	P. ct. 1.88	P. ct. 5.48	P. ct. 8.06	P. ct. 39.20	P. ct. 41.78

MEADOW.

The Meadow of the Leesburg area is usually a brown silty or sandy loam, with a depth of several feet. The type occurs in narrow bands along the larger streams, forming a bottom or low terrace a few feet above the mean water level, or as islands in the Potomac. The nature of the soil depends greatly on the surrounding soils, as it is formed

from sediment of the wash from these types, and partakes of their textural characteristics to some extent.

The type, while low and flat, is generally well enough drained for cultivation, although this is somewhat hindered by overflows; consequently the land is chiefly used for grazing. The soil is alluvial in origin, being built up by successive overflows of the streams. Little of the type is forested. Where cultivated it is generally used for corn, which yields from 50 to 75 bushels an acre. Little wheat is grown, although the soil is capable of producing fair yields of this crop. It also produces from 2 to 3 tons of hay per acre, and affords excellent pasturage. The crops are somewhat uncertain, however, on account of overflows which sometimes occur after the planting season, though in the case of the rivers the danger from flood is usually past before the time for corn planting. Where the areas are in grass the floods usually do little damage. Productiveness is in a great measure maintained by the addition of the sediments left by the overflow waters.

AGRICULTURAL METHODS.

The agricultural methods in use throughout the Leesburg area are very uniform, notwithstanding the fact that there are a comparatively large number of soil types in the area.

A system of general farming, with few variations, is practiced, although some of the soils are much better adapted to the purpose than are other soils of the area. The system of rotation practiced consists of drilling in wheat and timothy seed together on the corn stubble in the fall, and sowing clover in the following spring. The wheat is harvested in the early summer, leaving the timothy and clover, which, after obtaining a good growth, is grazed, or cut the next year for hay. This land is then plowed, and the following spring corn is planted, to be followed by wheat again the next fall, thus completing the rotation.

Commercial fertilizers are used extensively throughout the area. These consist chiefly of phosphatic fertilizers, although some nitrogenous mixtures are used. Barnyard and green manures are employed to a considerable extent. Lime is applied freely on the soils of the Piedmont region and the Catoclin belt. In the Shenandoah Valley little lime is used. The lime is brought into the area in cars, hauled from there to the farms by wagon, and thrown in small piles over the land, the usual application, as stated, being 25 or 30 bushels to the acre. It is almost always put on the land in the fall, and after it has become thoroughly slaked by air and rain, is spread over the land as evenly as possible. Applications are made every fifth or sixth year. Where farms are situated at considerable distances from the railroads but little lime is used on account of the difficulty of transportation.

AGRICULTURAL CONDITIONS.

Throughout the area the farming class is, as a rule, in a very prosperous condition. Loudoun County, Va., which constitutes the greater part of the area, is the second county in the State in wealth, and this rank is due to agriculture, which is the paramount industry and the occupation of a large proportion of the inhabitants of the county.

The farmhouses are substantial, and many fine old mansions are to be seen. The barns are large, modern, well-built structures. The cost of the houses and farm buildings varies generally from \$1,000 to \$5,000, but some much more expensive improvements are seen. A few persons of means are building fine country homes in this section, which adds much to the prosperous appearance of the country and to the value of the adjacent lands. The farm fences are usually quite substantial, and the farm buildings are painted and well kept.

The machinery used on the farms is improved and up-to-date, while the work stock are mostly strong draft animals and are kept in good condition.

A good public school system for both white and colored pupils is maintained, and many schoolhouses and churches are conveniently located throughout the country.

In that part of the area which lies in Virginia and Maryland the farmers, as a general rule, own the land which they cultivate. There are a few farms, however, which are worked by tenants on shares, the usual rental being one-third or one-half of the crops produced. In the Shenandoah Valley large tracts of land may be owned by a single individual, who divides it into farms for leasing, and here the tenant system is more common. The tenants are nearly all competent farmers and usually take good care of the farms, remaining on the same farm for many years.

In that part of the area which lies in the northern part of Loudoun County, Va., and in Maryland, most of the farms contain from 160 to 300 acres. Here the people are of German descent. They have never owned slaves and have always cultivated the farms themselves, using white labor almost entirely. In the southern part of the area, in Loudoun County, and in the Shenandoah Valley in West Virginia, the farms are larger, on the average, some containing 600 acres or more. Slaves were used here before the civil war, and the land was exhaustively cropped. However, in the vicinity of Hamilton and Lincoln, Va., in the south central part of the area, the farms are not so large, containing from 160 to 400 acres. They are owned by people of Quaker descent, who have always kept the land in a high state of cultivation.

The scarcity of efficient labor is one of the most serious troubles with which the farmers of this area have to cope. In the northern

part of the area the labor is principally white, while in the southern part there is a greater proportion of the negro race.

Some farmers employ men by the month, paying from \$15 to \$18 and board; or in other cases a laborer and his family are allowed to live on the farm, and he is paid by the day for such work as is required of him, the usual wage being 75 cents or \$1, with the opportunity of working throughout a considerable part of the year. The laborer usually pays a small rent for his cottage, but is allowed a piece of ground free for a garden. Where the farms are small the greater part of the work is done by the farmer and his family, and the situation is less difficult; but with the large farms it is often impossible to secure sufficient labor, especially during harvesting.

The principal agricultural products of the area are corn, wheat, clover, and timothy hay, the minor products being fruit and vegetables. Beef production and dairying are quite important features of the agriculture of the section, and many sheep are raised, the latter especially in the Shenandoah Valley. The good prices obtained for apples during recent years have led some to plant this fruit on a larger scale than heretofore, and the result is so far quite gratifying. Apples do well on most of the soils in the area. The favorite varieties are the Ben Davis, Newtown Pippin, and Paragon. The best apples are sold to buyers who ship to large markets. The poorer qualities are used for cider or fed to hogs. Pears are grown in a small way throughout the area. Peaches do well on most of the soils, but yield irregularly, on account of frosts.

The wheat grown in the area is sold for shipment, or is ground into flour by the many small water mills situated throughout the country, which mainly supply the home demand. The surplus is shipped chiefly to Washington and Baltimore. A considerable part of the corn produced in the area is also used locally for feeding beef cattle, dairy stock, and work animals. The fodder derived from this crop constitutes an important item in the ration of the farm stock and is carefully gathered and used for this purpose. Besides that gathered from the fields where it is grown for grain, a considerable quantity is produced for ensilage, which is used for dairy stock where milk is desired. Hay is shipped in large quantities to markets outside the area. In the production of beef the mature steers are brought in from the adjoining States, or from the western markets, and kept on the pastures and fed corn and fodder until fat, when they are shipped to the eastern markets. These steers are kept from several months to two years, depending on their condition and the rapidity with which they fatten. This practice is general throughout the area, and the manure obtained in this way adds greatly to the productiveness of the land.

Sheep are to be found on every large farm. These are kept for both wool and mutton. An important trade in spring lambs is carried on

by a few buyers, who go through the country early in the winter and contract to take the lambs at a certain time in the spring, paying a certain price based on their live weight. When these lambs are ready for the market, they are gathered up by the buyers and shipped to the eastern markets.

Quite a number of horses, chiefly of the draft type, are raised in the area. In the southern part of Loudoun County also some very fine blooded hackney and running horses are raised and trained. Loudoun County is also quite famous for its hunters and saddle horses. Cattle and hogs are raised on every farm in a small way, although little attention is paid to the question of blooded stock. However, a few very fine herds of Jersey cattle were seen in the dairy section of the area. On the whole, Loudoun County probably markets more stock than any other county in the State.

The heavy clay soils of the area are recognized as being the strongest wheat and grass soils. The more loamy soils are better for corn on account of the possibility of more thorough cultivation. However, the lands all have to be fertilized or limed to obtain the best results, and with this added expense the profit in wheat growing is extremely uncertain on any but the clay soils. The loamy soils are especially adapted to corn, stock raising, and dairying, and they are largely used for these purposes. The mountain sandstone soils, which are rough and stony, are not adapted to any form of agriculture; but for some lines of horticulture—as, for instance, the production of grapes, peaches, apples, and chestnuts—or forestry they seem to offer excellent opportunities. The schist soil of the mountains, although rough and stony, is productive, easily worked, and especially adapted to apples, peaches, and potatoes. The shale and mica soils, although thin and leachy, are especially adapted to grapes, vegetables, and berries and other small fruits. These soils should be managed very carefully to obtain the best results. They are easily worked and very quickly respond to fertilization and thorough cultivation. It is very probable that market gardening and fruit raising on these types would prove profitable. It seems, however, that peach trees are short lived on these soils. The meadow lands are low and subject to overflow, although otherwise well drained. They are best adapted to the production of corn, grass, and vegetables.

Throughout the section there is a splendid system of public roads, which are kept up by taxation and are in good condition the year round. A few of these roads are well graded and ballasted with limestone, being kept up by private corporations, which take a toll of those who use them.

There are no large cities in the area, but the railroad communication with Washington, Baltimore, and Philadelphia is rapid and convenient. There are several towns of good size in the area and many small

villages. The largest of these towns are Leesburg, the county seat of Loudoun County, Va., with a population of 1,800; Harpers Ferry, W. Va., an historic old place with about the same number of inhabitants, and Brunswick, Md., a new railroad town of 2,000 inhabitants. These towns are located on the railroads and are reached from Washington and Baltimore in two or three hours' time.

Two railroads extend through the area from east to west. One, the Washington, Ohio and Western, is a branch of the Southern system and runs from Washington, D. C., to Bluemont, Va., just on the western boundary of the area. This road extends through the south central part of the area and makes railroad connection with Washington and other cities easy. The other railroad is the main line of the Baltimore and Ohio system, which runs along the north shore of the Potomac River and connects the northern part of the area with Baltimore and Washington. These railroads have played an important part in the agricultural development of the section by bringing it in touch with these and other large markets farther north.

The Chesapeake and Ohio Canal, extending from Washington, D. C., to Cumberland, Md., runs along the north shore of the Potomac River.

The Potomac and Shenandoah rivers are crossed by bridges and ferries. There are large wagon bridges in the area at Harpers Ferry, W. Va., Brunswick, Md., and Point of Rocks, Md. High rates of toll are charged on these bridges and ferries, and those farmers living across the river from the railroad find these tolls a heavy tax on any produce they have to take to the railroad for shipment.

Many summer boarders come into the Leesburg area from Washington and Baltimore. Loudoun County in particular receives a large transient population from this source, and numbers of hotels and boarding houses are operated to accommodate it. This trade brings considerable money into the area and is a factor in its prosperity not to be ignored.

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