

SOIL SURVEY OF BEDFORD COUNTY, PENNSYLVANIA.

By CHARLES J. MANN, of the U. S. Department of Agriculture, and W. E. GROSS, of the Pennsylvania State College.

DESCRIPTION OF THE AREA.

Bedford County is situated in the southwestern part of Pennsylvania, forming one of the lower tier of counties bordering the State of Maryland. It has an area of approximately 1,067 square miles, or 682,880 acres. It is bounded on the north by the counties of Blair

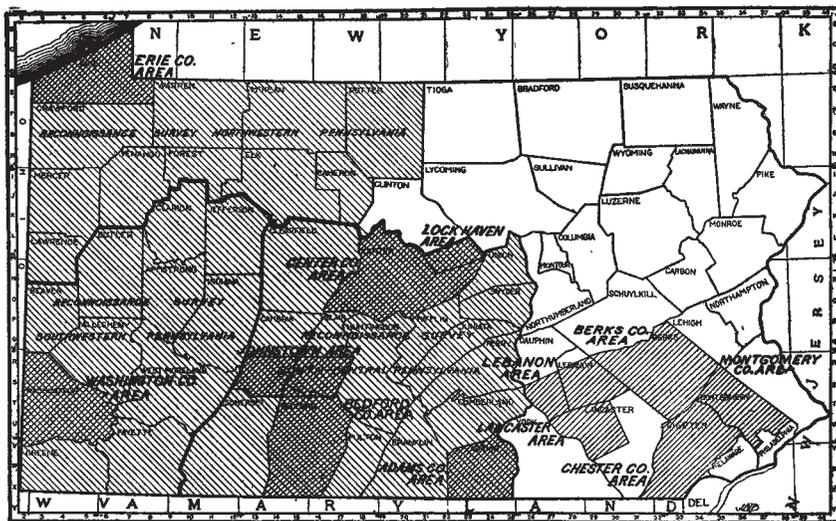


FIG. 4.—Sketch map showing areas surveyed in Pennsylvania.

and Huntingdon, on the east by Huntingdon and Fulton, on the south by Allegany County (Md.), and on the west by Somerset and Cambria Counties.

Practically all of Bedford County lies in the Appalachian Valley region, its topography consisting of alternating mountainous ridges and valleys running from northeast to southwest. The principal ridges from east to west are Rays Hill, Broadtop, Tussey, Dunning, Wills, Buffalo, and Allegheny. These mountains owe their existence to the hardness of the sandstones from which they are formed. Their

upper slopes are steep and rocky, their crests usually narrow, and, with the exception of Allegheny Mountain, they are very slightly serrated when seen from a distance. Their lower slopes are usually longer and more gradual than the upper. No gap occurs in Wills or Dunning Mountains, but two streams cut through Tussey Mountain, the Raystown Branch of the Juniata near Bedford and Yellow Creek near Loysburg. Brush Creek cuts through Rays Hill at Gapsville and Sideling Hill Creek cuts it at Barnes Gap. The average height of these mountains is about 2,300 feet, though many higher altitudes occur.

As a whole Bedford County is rolling to mountainous, with very hilly topography predominating. The stream bottoms are usually narrow, though they are developed somewhat extensively west of Osterburg. Outside of the bottoms and a few places where the mountain tops broaden out there are hardly 10 acres of level land in the county. Natural drainage is therefore well developed and in many sections excessive.

The drainage of the county is accomplished by two main systems, the Susquehanna and the Potomac. Fully four-fifths of the area drains into the Susquehanna. The southern or Potomac system receives the waters from only about one-fifth of the county.

The larger streams are apparently not influenced in their courses by the geological formations or topographical features, as they flow directly across them, but the smaller runs and draws follow the formations quite closely and are often the dividing line between soil types.

Bedford County was established in 1771, but portions of its original territory were taken in forming the counties of Westmoreland in 1773, Huntingdon in 1787, Somerset in 1795, Blair in 1846, and Fulton in 1850. The first recorded settlement was made in 1750 near the present site of Bedford, known earlier as Raystown. After the close of the Revolutionary War a slow but steady increase in settlement took place, the majority of the settlers being Scotch-Irish, Welsh, Huguenots, and Germans. The Germans settled around Morrisons and Friends Coves; the other nationalities, including both those coming from farther east and from Europe direct, settled on lands other than the limestone soils.

In 1850 the population of the county was 23,077, in 1880 it had increased to 32,463, in 1900 to 39,468, and in 1910 it was 38,879. During the last decade there was thus a slight loss. This is believed to be due to the drift of population to the cities.

Bedford, the county seat, is situated in the center of the county and has a population of 2,235. It has good railroad facilities, being

a junction point for all the railway lines in the county. Everett is the second town of importance, with a population of 1,725. It is well located and the business center of a large surrounding territory. Saxton ranks third and Hyndman, at the junction of the Pennsylvania and Baltimore & Ohio Railroads, is fourth. Hopewell draws considerable business from the coal-mining section. Manns Choice and Osterburg are other small towns on the Pennsylvania Railroad. Mount Dallas, Everett, Hopewell, and Saxton are on the Huntingdon & Broad Top Mountain Railroad. Schellburg, New Paris, Pleasantville, Pavia, and New Buena Vista are small agricultural towns in the western part of the county, while Rainsburg and Woodbury are the largest towns of Friends Cove and Morrisons Cove within Bedford County.

There are three railroad lines in the county. The Pennsylvania line nearly parallels the Baltimore & Ohio to Hyndman, then turns north through Bedford, at which point it is joined by the Huntingdon & Broad Top Mountain, passing out of the county near Queen Station on the northern boundary. The Huntingdon & Broad Top Mountain leaves the area north of Saxton and connects with the main line of the Pennsylvania at Huntingdon. Spurs from this line tap the coal-mining region. Trains now run on the Bedford line direct between Altoona and Cumberland and between Bedford and Huntingdon. The Baltimore & Ohio road enters the county at State line and follows Wills Creek through the county, with Hyndman and Cooks Mills the only stations in the area. This road gives direct communication to Pittsburg and the West and eastern points. Bedford, Yount, Cessna, Fishertown, Reynoldsdale, Osterburg, Imler, and Queen are stations and shipping points on the Pennsylvania.

The country roads are numerous enough and in the shale regions are usually in good condition, but in the country underlain by sandstone they are quite rough and rocky. Wherever possible they follow ridges or stream courses. It has cost much money to make many of the roads over the mountains and most of them have been made with even grades and are well kept. The roads over the smaller ridges and hills are usually more difficult to travel than the mountain roads, as the steeper slopes tend to wash more readily. There are several miles of excellent State road in the county, with much more under construction. The southeastern section of the county depends entirely upon its public highways for transportation. Timber and tan bark from this region are now brought to Everett by traction engines and wagons, which carry lime on the return trips.

Good material for road making is available in nearly all sections. Telephones are in general use throughout the county. The county

is fairly well supplied with schoolhouses and churches. Rural free delivery routes have been established over the county.

CLIMATE.

The climate of the county is equable and healthful. The summers are particularly delightful. There are only a few days when the temperature rises above 90° F., and the nights are almost always cool. The winters are long and rather severe. There are probably about 90 days of the year with a temperature below freezing and periods of several days with the thermometer below zero are not uncommon.

The appended table, compiled from the Weather Bureau stations at Huntingdon and Everett, shows the mean monthly, annual, and seasonal temperatures and precipitation, the absolute maximum and minimum temperatures for each month, and the rainfall during the years of greatest and least precipitation at both of these stations, also the normal snowfall, the greatest precipitation in 24 hours, and the average number of rainy days (precipitation of 0.01 inch or more) at Everett. Huntingdon is situated about 15 miles northeast of the county at an elevation of 650 feet and Everett about 7 miles east of the center of Bedford County in the valley of the Juniata River at an elevation of 1,080 feet. The records at Huntingdon cover the period from 1888 to 1910, while the data at Everett cover only 11 years from 1897 to 1908. The mean temperature at Johnstown, Pa., is almost identical with that of Huntingdon, but the normal precipitation is 5 inches greater at Johnstown. Similarly the temperatures for Altoona would almost be duplicated by those at Everett, but the rainfall at the latter place is 10 inches more. The great range of elevation in Bedford County causes considerable variation in temperatures and probably in precipitation also, and it is likely that the fall and winter temperatures at Everett are subnormal, and the spring and summer temperatures are above normal for the most of the county. There is certainly considerable variation in the dates of first and last frosts between Allegheny Mountain and the lowlands at Everett. This fact is of vast importance in choosing orchard sites for protection from frost.

The average date of the first killing frost at Everett is October 8 and the earliest date given is September 19, 1901. The average date of latest killing frost is May 5, and May 23, 1905, is the latest date recorded. From the records it appears that the normal growing season is about 150 days, which is ample for all crops grown. There are, of course, varieties of corn which will not mature under such

conditions, and these should be avoided. Unless there is a sufficient covering of snow for protection, wheat, clover, and alfalfa are frequently injured by freezing.

It will be observed from the table that the season of greatest normal precipitation is in the summer, when it is most needed by the crops. There are, however, exceptions to this, as was the case in the year 1911, when very little rain fell in July and August, but many rainy days occurred in the fall. The drought of 1911 was exceptional, though a period of three weeks without rain is not unusual. The Weather Bureau records unfortunately do not show the normal number of consecutive days without rain.

TEMPERATURE.

Month.	Mean.		Absolute maximum.		Absolute minimum.	
	Huntingdon.	Everett.	Huntingdon.	Everett.	Huntingdon.	Everett.
	° F.	° F.	° F.	° F.	° F.	° F.
December.....	33	29.7	68	64	-4	-8
January.....	29	27.5	72	72	-17	-21
February.....	29	24.2	68	63	-23	-20
Winter.....	30	27.2				
March.....	38	39.3	82	92	-7	-3
April.....	49	47.4	93	91	16	16
May.....	60	59.7	98	92	22	26
Spring.....	49	48.8				
June.....	69	66.9	99	94	36	33
July.....	72	72.2	104	100	33	41
August.....	71	69.5	101	94	38	40
Summer.....	71	69.5				
September.....	64	63.3	99	94	31	28
October.....	52	51.6	92	88	17	18
November.....	42	39.3	78	75	10	1
Fall.....	53	51.4				
Annual.....	51	49.2	104	100	-23	-21

PRECIPITATION.

Month.	Mean.		Total amount for the driest year.		Total amount for the wettest year.		Average snow-fall unmelted, Ever-ett.	Average number of rainy days, Ever-ett.	Greatest precipitation in 24 hours, Ever-ett.
	Hunt- ing- don.	Ever- ett.	Hunt- ing- don.	Ever- ett.	Hunt- ing- don.	Ever- ett.			
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
December.....	3.2	3.19	3.0	2.45	3.4	5.54	5.8	6	2.96
January.....	3.1	2.94	5.2	3.08	3.0	1.51	11.2	8	2.10
February.....	3.0	2.38	.5	1.90	5.2	.78	9.4	6	1.75
Winter.....	9.3	8.51	8.7	7.43	11.6	7.83	8.8	20	.....
March.....	3.6	4.29	1.4	2.97	3.6	4.55	7.5	10	1.40
April.....	3.1	2.87	2.0	3.55	4.9	5.16	1.4	9	1.65
May.....	5.3	3.73	3.0	4.08	6.4	5.80	T.	10	1.60
Spring.....	12.0	10.89	6.4	10.60	14.9	15.51	3	29	.....
June.....	4.2	5.00	4.8	4.43	4.2	5.21	0	11	3.19
July.....	3.8	4.32	3.2	5.69	4.6	5.22	0	10	2.55
August.....	3.6	4.85	1.5	1.66	4.4	10.35	0	10	2.60
Summer.....	11.6	14.17	9.5	11.78	13.2	20.78	0	31	.....
September.....	3.4	1.88	1.3	3.47	3.6	2.33	0	7	1.90
October.....	3.1	2.69	1.1	1.67	5.0	.35	T.	7	2.07
November.....	2.8	1.88	1.1	.43	1.4	2.50	2.4	7	1.90
Fall.....	9.3	6.45	3.5	5.57	10.0	5.18	.....	21	.....
Annual.....	42.2	40.85	28.1	35.38	49.7	49.3	37.7	101	.....

AGRICULTURE.

The agricultural development of Bedford County began in 1755, but settlement and development were necessarily slow, because of the heavy forest covering.

Corn was the principal crop of the early settlers, though some wheat and rye were also grown. Grist mills were built some time prior to 1780. Much of the rye was made into whisky, which found a ready market. Some wool for home use was also produced.

By 1800 the county contained many settlements, the same crops being grown at this time as earlier, but wheat had become the important money crop, especially in Morrisons Cove, where it was transported to market down the Juniata River. Winchester, Va., Hagerstown, Md., and Carlisle and Chambersburg, Pa., were the principal markets.

The yields of these crops were undoubtedly greater in the early days than at present, owing to the large amount of new land in cultivation. When one piece of ground began to fail it was possible to clear new fields, thus keeping a large proportion of virgin land

in cultivation every year. The more level country, such as the limestone valleys and the flats near Schellburg and southwest of Everett, were among the first farmed. The superior productiveness of the limestone soils was early recognized by the Germans. Chestnut Ridge, which is now valuable property, was long neglected, and but little utilized until after the Civil War. The opening of the Huntingdon & Broad Top Mountain Railroad from Huntingdon to Saxton in 1855 and to Mount Dallas in 1862 gave an impetus to agriculture as well as an outlet for the coal from the Saxton and Hopewell region.

From 1814 to 1821 a number of main roads were built. These are still in existence. The main pike follows the course of Budds Road from Fulton County through Breezewood, Everett, Bedford, and Schellburg. This road is now being rebuilt under State supervision. Another pike forks from this one between Bedford and Manns Choice and follows Dry Ridge into Somerset County. These roads were main lines of travel between the east and the west, particularly for the stock, primarily sheep, driven to eastern markets. All of these pikes, which were owned by corporations, have now been acquired by the State and the tolls abolished.

The following table gives the production of the principal crops of the county as reported by the censuses of 1870 to 1910, inclusive:

Production of the principal crops in Bedford County, 1869 to 1909, inclusive.

	Year.				
	1869	1879	1889	1899	1909
	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>
Corn.....	405,201	876,451	770,594	931,510	855,100
Wheat.....	338,074	304,108	378,088	461,520	338,871
Oats.....	376,296	228,708	417,181	351,510	388,061
Rye.....	118,000	95,277	94,506	104,130	101,158
Buckwheat.....	33,491	67,627	46,467	84,280	156,207
Potatoes.....	104,667	170,424	110,059	183,369	263,790
Barley.....	1,177	3,064	5,075	8,420	.....

The principal crops of the area, in the order of their present importance, are corn, oats, wheat, potatoes, and buckwheat. The relative positions of orchard, clover, alfalfa, soy beans, and truck crops are about equal.

Winter wheat is the staple money crop of the county. It is grown on all the soils and by practically all farmers. The limestone and bottom soils give the highest yields, averaging about 20 bushels to the acre, while the Upshur shale loam and Upshur stony loam are next, with 15 to 18 bushels. Other types yield from 10 to 15 bushels.

While the yields are not so high on the Dekalb shale loam, the quality of flour made from wheat grown on this type is considered by many to be the best milled in the area.

The general practice is to plow up the oat stubble in August or September and drill in the wheat about the first of October. The original custom was to broadcast the seed, but with the introduction of the drill about 1866 its use became general and is now universal. About 200 pounds of phosphatic fertilizer is drilled in with the seed, which, it is claimed, strengthens the straw and fills the heads. The Fulcaster is the most common variety, though Fultz is also grown to some extent by farmers in Morrisons Cove. Other varieties have been tried, but the results have in most cases been less satisfactory than with the varieties mentioned.

Corn is usually grown on sod ground, which is broken in the spring, harrowed, and sometimes dragged and rolled. No fertilizer is ordinarily used on this crop, though manure is spread on the grassland before plowing. The best yields under ordinary conditions run as high as 50 bushels per acre, and yields of 85 bushels have been reported. The best farmers frequently obtain 50 bushels per acre from the limestone and bottom-land soils and from the Frankstown stony loam; 35 to 40 bushels on the Upshur soils, Murrill silt loam, and Dekalb loam; and from 25 to 35 bushels on the other soils. Higher yields on each soil are frequently reported.

The varieties most in favor seem to be the Whitecap, Collier's Excelsior, and Funk's Yellow Dent. Cutworms work great injury to the corn in the early plantings and frequently make replanting necessary. Soaking the seed in tobacco water just before planting has been of some service in combating the pest. Fall plowing will do much to rid the land of this worm.

The acreage in oats is more than one half that of corn, and with but few exceptions this crop follows corn in the rotation. Fertilizer is seldom used on this crop, which probably accounts to a large extent for the general complaint that the heads do not fill well. The crop is cut in July. By far the larger part of this crop is fed on the farm and none is shipped from the county. Yields as high as 70 bushels per acre have been reported. The Big Four variety gives the largest yields. The Danish Isle is also becoming quite popular in Morrisons Cove, giving larger yields than the local varieties. The Lincoln also gives better than ordinary yields within the county. So far as known no tests have been made of the Kher-son or Sixty Day oat, notwithstanding the fact that they have been tried with success at the State experiment station.

Rust and smut frequently cause considerable loss to the crop. By using strong, carefully selected seed, treated for smut, and fertilizing the land, there is no reason why the yield of oats should not be at

least doubled and in many cases trebled, making it a remunerative crop. On ground properly supplied with phosphorus and organic matter no trouble should be experienced in getting the grain to fill.

Rye occupies only about one-third of the acreage given to wheat and corn. It is commonly sown on buckwheat or potato land. It is drilled in in the fall, and occasionally is pastured off. It is frequently planted on steep hillsides, where the growth prevents serious erosion. The crop is handled in much the same way as wheat and oats. The local distilleries consume the bulk of this grain and none is shipped from the county. Although the average yield seems to be less than 10 bushels per acre, yields of 30 bushels were reported from the Upshur shale loam. There is probably more rye grown on Dekalb shale loam than on any other type, the yields in many sections averaging 10 bushels per acre. It is very seldom grown on the limestone soils. This crop responds readily to fertilization, and with proper care profitable yields may be secured.

The acreage in buckwheat varies considerably with the season. When corn can not be planted or late replanting of land is necessary, buckwheat is used as a catch crop. It may be sown in July and harvested early in October. The crop makes a very rapid growth and does fairly well on the poorer land, on which it is usually grown. The seed is usually drilled, though it is sometimes sown broadcast. The straw is utilized for feed and bedding. The local mills consume practically all the product. Buckwheat middlings are proving of considerable value as a feed ration. The average yield is about 11 bushels per acre, though as much as 25 bushels is frequently secured on the better soils.

The acreage in potatoes is composed of small patches, hardly any of which can be called a field. The quality of the product is usually good, but the yields at present are rather low, ranging from 100 to 150 bushels per acre. With good seed, care, and fertilization these yields could be greatly increased. The shale soils seem to be well adapted to potatoes, the Dekalb silt loam, Dekalb shale loam, Upshur shale loam, and Frankstown stony loam all being good. The Dekalb loam, Murrill silt loam, Dekalb fine sandy loam, and the lighter Hagerstown soils also give good yields of this crop. The varieties usually grown are Smith's Blight Proof, Gold Coin, Factor, Up-to-Date, Million Dollar, and Rose of Sharon, all of which have given good results.

Very little barley is grown, but the acreage is apparently increasing. At present, however, it can hardly be considered an important crop or an increased acreage advised. The yields average about 20 bushels and could be largely increased.

Only one patch of flax was seen in the county.

Timothy for hay constitutes an important product of the county, and there is usually a surplus for shipment to outside points. Practically all the soils of the county produce good grass, and the poorer-drained types are adapted to little else. The stand of timothy depends largely on the weed growth which is permitted. Wild carrots and daisies are the principal pests, but these can be controlled by clipping at the proper time. When they become very numerous, the meadow should be plowed up and cultivated, as a hay crop will no longer be profitable. The seed is sown in the fall with the wheat and allowed to occupy the ground as long as a stand is maintained. One instance on the Frankstown stony loam was noted where phosphate fertilizer had greatly increased the stand of this crop.

A few patches of dwarf broom corn were seen in the county on various soils. Acreage yields of 1,500 pounds of fair-quality straw are obtained. At present prices this could be made a profitable crop. The yields could be greatly increased by proper handling. Rape is grown for forage with excellent results. Pumpkins are commonly planted in the corn and fed to the stock.

Clover is quite generally grown throughout the county, particularly on the Hagerstown soils, but most of the fields seen had a poor stand and were weedy. The seed is sown usually with timothy in the oats and wheat and rarely lasts longer than the second year, when the timothy predominates. To secure the best results inoculation must be resorted to, and applications of lime are sometimes made in order to correct soil acidity. Phosphoric acid in judicious quantities also makes for increased yields. Clover should be grown regularly on all the soils, for without it no plan of permanent agriculture for this county can be readily devised. One of the best forms of soil improvement is to plow under the entire crop, although most of it can be returned by feeding and hauling the fresh manure to the land. Medium red varieties are best suited to general conditions, though the Mammoth is grown to some extent. Alsike clover would be better than either on much of the bottom lands and the Lickdale clay loam. White clover is widely distributed and makes excellent pasture grass. Sweet clover is not as common in this county, though a few patches of it are found. Crimson clover makes a good orchard crop, but is little grown here.

Some very excellent stands of soy beans were seen in the county on different soils, but particularly on the Dekalb shale loam. They yield about 20 bushels of seed to the acre and compare favorably with cotton seed in feeding value. The seed is worth about \$2 a bushel.

At present alfalfa is grown successfully on the Dekalb silt loam, the Dekalb shale loam, Dekalb loam, Murrill silt loam, Hagerstown silt loam, Hagerstown clay loam, Upshur shale loam, Lickdale clay

loam, and Westmoreland silt loam. Three cuttings are normally secured and with good stands yields run to 4 or 5 tons per acre. One successful farmer near Rainsburg grows alfalfa on both Dekalb silt loam and Murrill silt loam, having met drainage difficulties by laying tile, and has no trouble now in securing and maintaining good stands. In planning a seeding of alfalfa the first difficulty to be met in these soils is acidity. Where acid no less than 1 ton of burnt lime or 2 tons of ground limestone rock per acre should be applied. Unless the soil is already inoculated, this should be done immediately before seeding by broadcasting 200 pounds of earth from a well-inoculated alfalfa field, or inoculating material can be secured from the Department of Agriculture and the seed itself treated before seeding. Either method will be satisfactory provided soil acidity has been corrected. Care should be taken in the selection of seed. Artificial drainage will be necessary on some of the Dekalb silt loam, Murrill silt loam, Dekalb shale loam, on practically all the Lickdale clay loam, and on much of the bottom land. Springy places should either be carefully avoided or drained.

The Hagerstown silt loam is naturally well adapted to this crop, as less lime is required to correct acidity, natural drainage is usually sufficient, the soil has sufficient depth, and there are not enough stones on the surface to interfere with cultivation. The slopes of the Murrill silt loam make admirable locations for alfalfa, though in some places the stones should be removed. It could also be grown on most of the Dekalb loam. With sufficient liming it could be grown on any of the Dekalb soils, though stones would have to be removed in many places. There would, no doubt, be difficulty in securing a stand on the Dekalb shale loam, where the bedrock comes near the surface. The Westmoreland silt loam is also well suited to this crop and there are admirable locations for it on the Upshur shale loam. Care must be taken on the Hagerstown clay loam to secure a mellow seed bed. This type has an advantage over the other soils in that it rarely requires lime. The bottom-land types will grow alfalfa provided adequate drainage can be obtained.

The timber in the area consists mainly of oak, walnut, chestnut, beech, maple, hickory, and locust. The local tanneries consume quantities of hemlock, chestnut, and oak bark. The State has a forest reserve of over 20,000 acres surrounding Beans Cove and is practicing scientific forestry, but with this exception little effort is made to protect these resources. Areas are cut over and left with an impenetrable growth of underbrush, which sooner or later catches fire and destroys great quantities of valuable timber. Most of the Dekalb stony loam, much of the Upshur stony loam, and Dekalb shale loam, Morrison sand, Morrison stony sandy loam, Dekalb stony sandy loam, as well as

Rough stony land, could be utilized for forestry. Locust appears to do especially well on the steep hillsides of Dekalb shale loam.

Truck growing is not carried on extensively, though there are a few small farmers who devote most of their time and land to truck and small fruits. Not enough is raised, however, to supply the local markets and nearly all kinds of garden truck are brought into the county. Little attention is paid to soil and the different crops do sufficiently well for home use when the land is well manured. Light trucking soils are rather scarce in Bedford County, the Dekalb fine sandy loam being the best, with the Morrison series ranking next. Where the Frankstown stony loam is not too stony it is a good trucking soil, as is also the Dekalb loam. The more loamy spots of the Murrill silt loam and Upshur shale loam could be utilized and the Dunning clay loam would be good for heavier crops, such as onions, celery, and cabbage. Where well drained the bottom-land types are excellent truck soils, but are likely to be rather slow in warming up in the spring. The most profitable truck crops for Bedford County are asparagus, rhubarb, tomatoes, cabbage, onions, and onion sets, of which 50 bushels to the acre can be grown. There are no canning factories in the county, and a small plant for this purpose, the output to be sold in local or near-by markets, might prove profitable.

Fruit growing as an industry dates back to the early days of the county, when it was not attended with so many difficulties as at present. Fungus diseases and insect pests have done much to discourage orchardists, despite the fact that the existence of old, untended orchards in the county testifies that some trees at least were able to resist these enemies. Though these old trees are now commencing to decline, their fruit is highly colored, and they bear prolifically. When properly situated orchard fruits suffer little injury from frost.

The best apple soils of the county are the Frankstown stony loam, the Upshur shale loam, Upshur stony loam, Dekalb shale loam, Dekalb stony silt loam, Chemung shale loam, Dekalb silt loam, and Dekalb loam. A large percentage of the Frankstown stony loam is well situated and is rapidly proving itself one of the very best apple soils of the county. The natural ridge occurrence of the Dekalb stony silt loam and Upshur stony sandy loam makes them particularly desirable. Many good slopes for fruit occur in the Dekalb loam and Murrill silt loam. The Morrison soils have not yet proved their fruit-producing capacity. The Hagerstown soils are better suited to the general farm crops. There is much land of other types, with the exception of the Frankstown stony loam, which is not paying good returns in general farming, but which is well located and could be used advantageously for fruit. Some of the best prospective orchard sites are in the vicinity of Dry Ridge, Pigeon Hills, on the

Frankstown stony loam of Dunning Cove and Cumberland Valley, in Sherman Valley, on Warrior Ridge, Clear Ridge, Polish and Ragged Mountains, and Addison Ridge. Much of this land can now be bought at prices ranging from \$10 to \$35 an acre, and in good orchards should in 10 years' time be worth \$200 or more an acre.

The following are a few of the apple varieties grown: Red Astrachan, Early Harvest, Maiden Blush, Rambo, Gravenstein, Stayman Winesap, Ben Davis, York Imperial, Rome Beauty, Baldwin, Rhode Island Greening, and Newtown Pippin. Orchards planted during the last 10 years are made up almost entirely of winter varieties. The Baldwin should be planted on north slopes, as it tends to drop early this far South, though it colors up splendidly and makes a good market apple. No exact variety adaptations to soil types could be determined.¹

The best peach soil in the county is the Dekalb shale loam, but good orchards were seen on nearly all the Dekalb and Upshur soils, as well as on the Murrill silt loam and Chemung shale loam. The Morrison soils and Hagerstown loam have not been sufficiently tried, but it is probable that they will prove excellent peach soils. Drainage is especially important for peach trees, and care should be taken to avoid springy places. The most common varieties are Elberta, Crawford, Belle of Georgia, October, and Fox Seedling. Much improvement in peach orchards of the county could be effected by clean cultivation.

Pears are grown principally on the Dekalb shale loam, Murrill silt loam, Upshur shale loam, and Dekalb stony silt loam, though other types could be utilized. The most common varieties are Kieffer, Bartlett, Lincoln, and Clapp Favorite. Most of the orchards are still young and have borne but a few crops, but there is every indication that they will prove highly profitable.

Plums are but little grown, except for home use, but they do well and may be planted commercially. Cherries are grown for home consumption.

Grapes do particularly well on Frankstown stony loam, Upshur shale loam, Dekalb shale loam, Dekalb stony silt loam, and Murrill silt loam. The most commonly grown varieties are Catawba, Concord, Delaware, Niagara, Worden, and Martha Washington.

Some improved chestnut trees have been planted in a commercial way, but these are too young to give any indications of their worth. The wild chestnut grows abundantly and there is no apparent reason why the cultivated varieties should not be profitable provided they are properly cared for and protected from disease.

¹ For a discussion of adaptation of fruits to soils, see Wilder, Pennsylvania Fruit Soils and Soil Variety Adaptations, Ann. Rept. Pa. State College, 1910-1911.

Small fruits have not received the attention they deserve, considering the demand for them and the convenience to local markets. Raspberries, both black and red, do well. Blackberries are cultivated to some extent, but grow wild, particularly on the limestone soils, in great quantities. Wild huckleberries abound on the mountains and great quantities are gathered and shipped to Johnstown, Altoona, Cumberland, and local markets. Gooseberries and currants are not generally grown. Strawberries are grown for the markets already mentioned and are very profitable. The Frankstown stony loam, the Morrison soils, Hagerstown loam, and Dekalb loam are excellent small-fruit soils. Practically all the small fruits, as well as grapes, make excellent fillers for orchards and will, no doubt, be used for that purpose in the future, though at present they are mostly mere garden products.

Lime is essential to practically all these soils for fruit production and should be applied in sufficient quantities to correct all soil acidity.

The general rotation practiced in the county is corn, oats, wheat, and grass. The mowing or grass land is usually plowed in the spring and corn planted. The land is then plowed again in the fall or spring and drilled to oats, which are harvested and the land plowed again and sown in wheat and timothy in the fall. The following spring clover is sown and after the wheat is harvested the land is occupied by clover and timothy. The next year a mixture of good timothy and clover hay is cut. The fifth year there is less clover and more timothy and the following years the proportion of timothy to clover is greater and weeds are more plentiful. The length of time the land is devoted to grass depends on the condition of the sod. It is usually left too long. There are many modifications of this rotation. Instead of corn, potatoes, or sometimes oats, are planted on the broken grass land. Not all the corn land always is put into oats, as part of it may be fallowed for wheat. This is frequently done when only enough oats for home feeding is desired. Wheat may be put in on corn land, providing the corn can be harvested early, but this is seldom done. Sometimes only clover is sown in the wheat and too frequently only timothy. Where buckwheat is grown it is nearly always followed by rye.

The main objection to this rotation is that there is not sufficient legume growth to supply nitrogen for the grain crops. If clover were sown in the oats and all the growth which could possibly be secured plowed under for wheat the effect would be marked. Instead of fallowing, the land could much better be planted in soy beans. These could even be substituted for oats or only enough oats grown for feed. Cowpeas could be planted in the corn at the last cultivation and plowed under. It is evident that some such method must be resorted to in order to maintain the supply of nitrogen and organic matter in the soils.

Nearly every farm, in addition to the work animals, has a few head of milch cows, sheep, and hogs. Cattle are mostly of the dairy type and are frequently purebred. Jerseys are the most common type of cow, with a few Holsteins. Some farmers make a practice of feeding beef cattle. The local supply of calves is usually sold as veal and commands a good price, probably bringing more profit than if held for feeding. Good beef breeds, as Shorthorns, Herefords, or Angus, are scarce.

Poland China, Berkshire, Chester White, and Duroc-Jersey, or their various crosses, are the prevailing breeds of hogs. There are but few purebred flocks of sheep, but mixed Southdowns and Hampshiredowns and other breeds are common.

Much of the Dekalb shale loam and Upshur shale loam, Dekalb stony silt loam, Dekalb stony loam, and Dekalb stony sandy loam offers excellent opportunities for grazing sheep. They are all good grass soils and would probably produce as much profit from sheep as when under cultivation.

Lime can be procured from practically all the areas of Hagerstown and Frankstown soils and from places in the Westmoreland and Murrill soils. There is frequently a limestone stratum at the base of the Mauch Chunk red shale. The limestone ordinarily used here contains about 92 per cent CaCO_3 , 2 per cent MgCO_3 , and 0.008 per cent phosphorus. Magnesium carbonate has more power to correct soil acidity than does calcium carbonate, so that there is no objection to its presence in these small quantities.

There are a few public limekilns in the county, which sell burned lime for 8 cents a bushel, or \$2 a ton. Some kilns near Everett and Manns Choice sell burned lime which is afterwards ground at from \$4 to \$5.75 per ton. A great many farmers burn their own lime, securing it on their own land or buying the stone, quarrying it themselves, for 10 cents a perch. The lime is then distributed from the piles with a shovel or put on a sled, from which it is distributed. It is unfortunate that no unburned ground limestone can be obtained in the county, though a mill of this kind is contemplated in Friends Cove. The advantages of ground limestone are that it is more easily spread, becomes available more slowly, does not leach rapidly from the soil, and can be applied in very large quantities without the least danger of injuring the soil, there being no caustic and destructive action on the organic matter, as there is with the burned lime. On the other hand, about twice as much of it must be used to obtain the same results.

There is a general scarcity of farm labor, which in many cases limits agricultural development. The ordinary wage is from \$20 to \$30 per month.

The total acreage in farms has not changed materially (a slight decrease is indicated) in the last 30 years, being about 480,000 acres, or two third the county area, but the acreage improved in farms has increased from 252,659 in 1880 to 286,514 in 1900. The average size of farms decreased from 149 acres in 1880 to 132.8 acres in 1900. There are many farms which far exceed this acreage, but a farm of 300 acres is considered a very large one in this region. Land held for lumber or mineral resources frequently runs into tracts of thousands of acres, but these are divided into numerous farms. The number of farms increased from 3,240 in 1880 to 3,600 in 1900. The farms operated by the owners in 1880 numbered 2,493, or 77 per cent, while in 1900 the ratio dropped to 71.6 per cent. Farms are leased almost always on a share basis, the owner receiving from one-third to three-fifths of all crops.

Land values vary considerably, ranging from \$5 to \$100 per acre. The better class of farms may probably be bought for \$60 to \$75, while ordinary farms will bring from \$20 to \$35 an acre. Farms not in good condition and distant from markets can be bought very cheaply.

SOILS.

Most of the soil of Bedford County is residual—that is, has been formed by the weathering of the underlying rock—though some is classed as alluvial. The residual soils are by far the most extensive, covering practically all of the upland. A knowledge of the many different geological formations which occur in the county will assist in understanding the variations which are found in this group.

The rocks of the area are all sedimentary and were laid down in Paleozoic time. They belong in four of the periods of geologic time, the most recent being the Carboniferous, which includes the rocks of the Allegheny Mountain crest and westward and the Alleghippa Mountains east of Saxton; the Devonian, comprising the rocks which form the eastern foothills of the Allegheny Mountain and the wide valley between Warrior Ridge and Rays Hill; the Upper Silurian, including the mountainous ridges to the east of the Allegheny Front, and the Ordovician or Lower Silurian, to which the rocks of Morrisons and Friends Coves belong.

These rocks are sandstones, shales, and limestones. The sandstone and shale rocks lie in a distinct soil province known as the Appalachian Mountains and Plateaus Province. Variation in color is one of the peculiar characteristics of the rocks of this province. Most of them range from gray to brown and give rise to gray and yellow soils. Others have a peculiar red color, which is usually intensified in the overlying soil. The size of the particles forming

these rocks also varies considerably. The shales are composed largely of silt and clay, while the sand grains in the sandstone may be fine, medium, coarse, or mixed. When the rocks disintegrate through the various agencies of weathering the soil texture is influenced mainly by the texture of the parent rock, except that there may be a concentration of the coarser particles, due to the washing away of the finer ones. The size of the particles and the proportions of the different sizes found determine the texture of the resulting soil.

For convenience in classification soils of similar derivation or origin and with the same general characteristics of color and, to some extent, of drainage, are grouped into series. Separation of the series into soil types is made mainly upon the basis of texture.

The Dekalb series, derived from sandstones and shales, is distinguished by its gray and yellow soils. Seven members of this series were mapped in the county, namely, the silt loam, shale loam, loam, fine sandy loam, stony loam, stony silt loam, and stony sandy loam.

The red soils embraced in the Upshur series are represented by three types, the shale loam, stony loam, and stony sandy loam.

There is but one chocolate-colored soil, the Chemung shale loam.

The limestone rocks are so radically different from the sandstone and shales in chemical and physical composition and manner of weathering that they constitute a separate soil province, the Limestone Valleys and Uplands. These rocks give rise to the Hagerstown series. Morrisons Cove, Friends Cove, and the various ridges of limestone, notably those running north and south through Bedford and Everett and in Beans Cove, represent this province in Bedford County.

Limestone weathers principally through chemical agencies, the soluble part of the rock being dissolved away and the relatively insoluble residue forming the soil. It has been estimated that it requires the solution of from 75 to 100 feet of limestone rock to form 1 foot of soil, and upon the relative purity of the rock and the character of the residue depends the type of resulting Hagerstown soil. Chert or flint occurring as strata embedded in the massive rock is the most common impurity in limestone. The pure rock yields a red soil with a high clay content and no chert, which is classified as Hagerstown clay loam. The moderately pure limestone leaves a residue of small chert fragments and fine material of lighter texture and color, giving the Hagerstown silt loam. The soil derived from very impure rock contains many large chert fragments and is classified as Hagerstown stony loam. In places where considerable sand, even though it is derived from a sandstone or sandy limestone, has been incorporated with limestone material the resulting soil is included in the Hagerstown series as Hagerstown loam and Hagerstown sandy loam.

The Murrill series includes soils derived from intimate mixtures of sandstone, shale, and limestone origin. Such conditions are encountered on the outer rim of Morrison and Friends Coves, where material from sandstones of the mountains and from the shale at the foot of the mountains has crept down over the lower-lying limestone, which outcrops frequently. The Murrill silt loam is the only member of this series mapped in the county.

The so-called Barrens of Morrisons Cove and Middle Ridge of Friends Cove are occupied by soils derived from rocks of the Trenton formation, which range from pure to siliceous limestone to calcareous sandstone, though there is some sandstone which does not appear to be calcareous. These soils are not unlike the Dekalb series, but their association with the limestone and the frequent calcareous nature of the sandstone found in them, and the color of the subsoil, which is in many places similar to that of the Hagerstown soils, warrants their separate classification in a distinct series—the Morrison. Two types, the Morrison sand and the Morrison stony sandy loam, occur in Bedford County.

The Frankstown stony loam is derived from the calcareous, siliceous, shaly member of the lower Helderburg formation.

The alluvial soils, as the name implies, are found in the stream bottoms. All the streams have a decided fall and swift currents, and consequently are deepening rather than widening their stream beds, and a very large proportion of the soil particles which are washed from the uplands into the streams is carried to lower levels outside the area. In times of very high water the streams overflow and narrow bottom lands have been formed by the accumulation of particles too large to be borne away by the currents. This process results in assorting the soil particles according to size, the coarser particles being deposited near the stream channels, where the current in time of overflow is swiftest, while the finer particles are carried farther from the stream and deposited in slowly moving water. The soils thus formed range from fine sandy loam to silt loam. Where the material is principally the wash of the Dekalb series the soils are typically brownish in color and form the Huntington series, of which in this county there are the Huntington silt loam, Huntington loam, and Huntington fine sandy loam. Where wash from the Upshur soils constitutes most of the alluvium the soils have a red color and are grouped in the Moshannon series. Of this series only one type is found in the county—the Moshannon loam. Where the bottoms become wide there are, back from the stream and adjacent to the upland, areas of black clay loam. This type has been named the Dunning clay loam.

Colluvial soils consist of material accumulated at the base of slopes as the result of surface wash or creeping. This material forms the

Lickdale clay loam. Although derived from soils of the Dekalb series and retaining some of the characteristics of those soils, the radical difference in formation and in drainage conditions justifies establishing a distinct series to include the derivative soil.

The terms Rough stony land and Meadow are self-explanatory.

All of these soil types have been previously encountered in this and other States through which the Appalachian Mountain system extends.

The following scheme shows the geological formations and the soils derived therefrom:

Age.	Formation.	Soil type.
Carboniferous...	(Allegheny River (Coal Measures).....	{ Dekalb silt loam. Dekalb stony loam.
	Pottsville conglomerate.....	{ Dekalb stony loam. Dekalb stony sandy loam.
	Mauch Chunk red shale.....	{ Upshur shale loam. Upshur stony loam.
		{ Dekalb stony loam. Dekalb stony sandy loam.
	Pocono sandstone.....	{ Upshur shale loam. Upshur stony loam. Dekalb shale loam. Dekalb stony loam. Dekalb stony silt loam. Dekalb loam. Chemung shale loam. Dekalb shale loam.
Devonian.....	{ Catskill red sandstone.....	{ Dekalb loam. Dekalb fine sandy loam. Dekalb stony loam. Dekalb stony sandy loam.
	Chemung shales and Portage flags...	{ Hagerstown clay loam. Hagerstown stony loam. Frankstown stony loam.
		{ Dekalb silt loam. Dekalb shale loam. Westmoreland silt loam. Dekalb stony silt loam. Upshur shale loam. Upshur stony loam. Upshur stony sandy loam. Rough stony land.
Upper Silurian..	{ Oriskany sandstone.....	{ Dekalb silt loam. Dekalb shale loam. Dekalb stony loam. Dekalb stony loam.
	Lower Helderburg limestone.....	{ Murrill silt loam. Hagerstown silt loam. Hagerstown loam. Hagerstown clay loam. Hagerstown stony loam. Hagerstown sandy loam. Morrison sand. Morrison stony sandy loam. Huntington silt loam. Huntington loam.
		{ Salina, Niagara, and Clinton shales..	{ Huntington fine sandy loam. Moshannon loam. Dunning clay loam.
	Medina and Oneida.....	
Lower Silurian..	{ Hudson River and Utica slates.....	
	{ Trenton and Calciferous limestones..	
Recent.....	Alluvium.....	

The names and extent of the various soils mapped are shown in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dekalb shale loam.....	124,800	18.3	Murrill silt loam.....	8,704	1.3
Dekalb stony loam.....	92,416	13.5	Hagerstown loam.....	8,384	1.2
Upshur shale loam.....	64,768	10.3	Dekalb fine sandy loam.....	7,744	1.1
Mixed phase.....	5,888		Lickdale clay loam.....	7,552	1.1
Upshur stony loam.....	66,368	9.7	Meadow.....	5,888	.9
Rough stony land.....	54,720	8.0	Dekalb loam.....	5,312	.8
Dekalb stony silt loam.....	45,376	6.6	Westmoreland silt loam.....	3,840	.6
Dekalb silt loam.....	41,024	6.0	Morrison stony sandy loam ...	3,520	.5
Frankstown stony loam.....	29,120	4.3	Hagerstown stony loam.....	3,136	.5
Hagerstown silt loam.....	26,944	3.9	Chemung shale loam.....	2,688	.4
Dekalb stony sandy loam....	16,064	2.4	Morrison sand.....	896	.1
Hagerstown clay loam.....	13,824	2.0	Dunning clay loam.....	768	.1
Huntington loam.....	13,312	1.9	Hagerstown sandy loam.....	576	.1
Upshur stony sandy loam....	9,920	1.5	Huntington fine sandy loam..	256	.1
Huntington silt loam.....	9,536	1.4			
Moshannon loam.....	9,536	1.4	Total.....	682,880	.....

DEKALB SHALE LOAM.

The Dekalb shale loam consists of 6 to 8 inches of a gray, yellowish, or brownish-gray silty loam, underlain by a somewhat heavier textured light-yellow subsoil, which extends to depths rarely exceeding 24 inches. From 10 to 60 per cent of the surface soil consists of shale and shaly sandstone fragments varying in size from mere chips to large flat pieces from one-half to 1 inch in thickness and 12 inches in circumference. The shale usually predominates and the content increases with depth until the subsoil gives way to the solid bedrock. The presence of this shale has a great influence upon the physical condition of the soil, giving it an open structure and making it workable at almost any time. The surface seldom bakes to any extent, though in places where the content of organic matter is unusually low the fine earth tends to run together and become hard and lumpy if plowed. Ordinarily it is a soil easily kept in good tilth. It is commonly spoken of as "shale land" or "slate land."

This type occurs as continuous or broken belts across the county from northeast to southwest. The largest area occupies the lower foothills of the Allegheny Mountain in a belt about 2 miles wide. It completely surrounds Chestnut Ridge, being 4 miles wide on its east side. Another belt occurs immediately to the east of Warrior Ridge, with an average width of about 1 mile. Several smaller areas are found in the southeastern part of the county.

A phase of the type has been indicated on the map by stone symbols. It has an unusually large number of flat, sandy shale fragments 1 inch thick and varying from 8 to 10 inches in circum-

ference. They do not actually prevent cultivation, as do the large sandstone fragments of the Dekalb stony silt loam, but are more or less a hindrance. This phase usually occurs as a continuous ridge or series of knobs adjacent to the Dekalb stony silt loam areas. The type also occurs in Cumberland Valley, Dunning Cove, and at the foot of Wills, Dunning, and Evitts Mountains, in which position it carries but few of the larger sandy shale fragments, most of the rock fragments present being small, thin pieces of argillaceous shale. Other small areas occur on the lower slopes of the mountains surrounding Millikens, Friends, and Morrisons Coves. These areas frequently carry a small proportion of sandstone fragments and the usual content of shale fragments.

The characteristic topography of the type is a succession of steep-sided, irregular ridges, from the top of which frequently rise the rounded knobs so universally found in shale formations. In the foothills area the ridges and knobs rapidly rise in height to the westward and meet in a high knob of Dekalb stony silt loam. Elevations range from 1,100 to 1,700 feet, sometimes within a distance of 2 miles, so that the surface is usually hilly and rough. The tops of the ridges are rarely over an eighth of a mile in width and always somewhat rounded, so that there is no strictly level land in the type. Ordinarily the content of rock fragments is lower on the ridges and more pronounced on the slopes. Throughout the type are small areas which have received a shallow covering of silt, but these were too small to show on a map of the scale used. The drainage is thorough, or even excessive in places, and unless protected the soil is likely to erode and gully badly. The open structure caused by the shale fragments permits rapid absorption of rain water, which reappears in spots as seepage, forming many "spouty" places, in which the soil is kept wet, making it cold and soggy much of the year. These places can be drained by means of tile, tapping the source of seepage. If all such places were thus treated, much land could be reclaimed for cultivation. Sufficient fall to secure good drainage can always be secured. The shallow depth of soil tends to make the type droughty, as there is but a small reservoir in which to store moisture.

The larger areas of the Dekalb shale loam have been derived by disintegration of slates and shales, making up the Chemung, Nunda, Genesee, Hamilton, and Marcellus formations of Devonian age. The cove areas are derived from the Hudson River and Utica shales, while the other areas are derived from the Clinton shales. These formations are composed of black to reddish-gray shales, with included lentils of sandstone. The shales are comparatively soft and readily disintegrate under weathering influences, while the sandstone, being harder, has accumulated on the surface. For this reason the Chemung formation, which contains considerable sandstone, has given

rise to the stony phase of this type. The Clinton, Hudson River, and Utica shales have weathered more completely than the others, and consequently the content of shale fragments is somewhat lower in the soils derived from these formations. The soil particles have been removed almost as fast as made from some of the higher elevations and escarpments by washing, leaving only a mass of shale, while the accumulation of the wash on lower and more protected slopes gives a deeper soil.

This type is largely under cultivation, except over the stony phase and where the surface is too rough to be farmed. Occasionally an abandoned farm is seen. All the general crops of the area are grown. According to estimates given by farmers, corn yields from 15 to 25 bushels per acre, wheat averages about 12 bushels, oats 25 to 30 bushels, rye about 10 bushels, and buckwheat about 15 bushels. The use of lime and fertilizers is becoming more general. Phosphatic fertilizers carrying some nitrogen and potash are preferred.

This soil is capable of marked improvement. The use of lime to correct soil acidity, the incorporation of organic matter through the use of leguminous crops, such as clover, soy beans, or alfalfa to be plowed under, and the application of phosphoric acid as a fertilizer are all recommended.

DEKALB STONY LOAM.

The Dekalb stony loam consists on an average of 10 inches of light yellowish-brown or gray fine-textured loam, underlain to a depth of 36 inches by a compact yellow loam, becoming heavier with depth and frequently grading into a distinct clay loam in the lower portion. Sandstone fragments of all sizes and varying from fine-grained to coarse conglomerate are strewn over the surface and scattered throughout the soil and subsoil in such quantities as to make cultivation impossible unless they are removed. The virgin areas have a rather compact and close structure, but when cultivated the soil becomes more open, friable, and easily worked. Penetration of the surface soil with an auger to a depth of more than a few inches is very difficult.

The Dekalb stony loam is well distributed throughout the county. It occupies the crests of the Allegheny Mountain, the west side of Wills, Dunning, and Evitts Mountains, and the east side of Tussey Mountain. It is also found on the slopes of Chestnut Ridge and in the northeastern and southwestern corners of the county.

The Dekalb stony loam owes its origin to the disintegration of sandstones and shales of various formations. The Coal Measures, Pottsville conglomerate, and Pocono sandstone give rise to the areas of the type found on Allegheny Mountain and to those in the northeastern and southwestern corners of the county, while the white

Medina sandstones give the areas on the sides of Wills, Dunning, Evitts, and Tussey Mountains. These areas are not altogether residual, but represent the accumulation of talus from the upper slopes of the mountains which have fallen over and become incorporated with the residual material derived from the underlying Clinton or Hudson River shales. In some cases this talus covers and obliterates the lower Helderburg formation, which normally gives rise to Hagerstown clay loam and Frankstown stony loam. In the formation of the areas in the Coal Measures, which consist of alternate beds of sandstone and shale, it is evident that in the more eroded sections the shale has been rather completely disintegrated and largely washed away, while the sandstone fragments have accumulated on the surface and through the profile. The Oriskany sandstone has also given rise to this type, not only on Chestnut Ridge, but in Cumberland Valley and on Warrior Ridge, and in other localities. As the type is confined principally to mountain sides, which vary from gentle to steep slopes, the topography of the type is generally rough and hilly to mountainous, though along the small water courses which rise in the the mountains there is very little relief. Except in these areas natural drainage is well established, and while run-off is rapid the stones protect the land from serious damage by erosion.

Owing to its rough topography and the excess of stones only a small proportion of this type, usually adjacent to other types, is under cultivation. Such areas are used for home gardens and general farming. A number of farms were seen in this type which have apparently been abandoned, as the houses are in bad condition and the old fields are used only for pasture. Farming on this type is difficult and unremunerative. The greatest value of the land lies in its utilization for forestry. Chestnut, oak, hickory, and pine constitute the principal tree growth, and there are some very excellent forests of these trees in the county.

Bluegrass grows abundantly wherever the conditions are favorable, and the land is used as pastures for sheep and cattle. In view of the low yields usually obtained the cost of clearing is prohibitive, removing the stones and thick bushy growth being expensive. For forestry the type will be found valuable, as trees make good growth. In its present condition the land which has been recently cut over is left to reforest itself and becomes so encumbered with brush as to be nearly useless for pasture.

The value of this type depends almost entirely upon the standing timber.

DEKALB LOAM.

The Dekalb loam consists of 8 inches of brownish or yellowish-gray, fine-textured loam, underlain by a yellow to slightly reddish loam, grading rapidly with depth into a heavier silt loam and at 36

inches often into a clay loam. When dry the surface soil is very light colored, owing to lack of organic matter. The areas are not very uniform, and spots of silt loam and very coarse loam or fine sandy loam occur within the type. On the surface and throughout the soil profile are found varying quantities of small sandstone fragments, but rarely in sufficient quantity to make their removal necessary. Bedrock is sometimes encountered at a depth of 2 feet or less.

The profile of the type bears a close resemblance to that of the Murrill silt loam, and except for the influence of the limestone in the latter type would probably have been included with it.

The type is not very extensively developed in Bedford County, and usually occurs in rather small areas. These are most common in the Cumberland Valley, in Black Valley, and south and north of Osterburg. The type invariably occupies gentle slopes at the foot of much steeper rises. Some of the areas resemble second bottoms, and some of the stones are rounded, but the soil profile is unquestionably Dekalb, and the evidence pointing to second bottom formation is not conclusive. Surface inequalities are only moderate, and the topography can be described as gently undulating. There is sufficient relief in most areas to provide natural drainage, though under-drainage would prove beneficial in many instances. The type apparently withstands drought well.

Most of the Dekalb loam is derived from the Oriskany sandstone. These areas contain much fine rounded quartz gravel derived from a conglomerate, fragments of which are also numerous throughout the profile. In a few areas the material apparently comes from a horizon of the Chemung formation, in which sandstone predominates. In other sections much of the material is, no doubt, wash from the higher lying sandstone formations, and, therefore, colluvial; but these areas are small and the profile typical, so that no separation was attempted.

A large proportion of the type is under cultivation to the general farm crops. It is considered a fairly good soil, and yields of 35 to 50 bushels of corn and 15 bushels of wheat per acre are obtained. Buckwheat, oats, rye, and clover are also grown, giving yields slightly above the average. Commercial fertilizers are almost universally applied to the wheat. Lime and manure are also used.

Several tests showed that much of this soil is highly acid and should be treated with lime. Manure, clover, and phosphoric acid are the best fertilizers for the type and are fairly lasting in their effects, as the heavy subsoil prevents serious leaching.

Some good fruit trees were seen on this soil, and where sufficient air drainage can be secured the type makes a good fruit soil and could well be utilized, particularly for peaches. Alfalfa should also do well where drainage is good and bedrock not too close to the surface, provided, of course, that lime is applied.

DEKALB STONY SANDY LOAM.

The Dekalb stony sandy loam consists of a loose-structured, dark-gray to gray sandy loam, 6 to 10 inches deep, underlain by a dark-yellow, slightly sticky sandy loam, becoming little if any heavier to a depth of 36 inches. The line of demarcation between soil and subsoil is quite pronounced, being determined by the depth to which organic matter has been incorporated. This frequently exists as a mass of leaf mold containing white quartz sand grains and a small quantity of small quartz pebbles. The sand grains are usually about equally divided between fine, medium, and coarse, though some areas occur in which the finer grades predominate. No effort was made to separate them on the map. At least 20 per cent of the surface of most of this type is occupied by large fragments of medium to coarse-grained sandstone or conglomerate, the removal of which is necessary before cultivation is possible. Some small stoneless areas occur, but these were not separated on the map.

The largest area of this type occurs on the broad tops of Tussey and Evitts Mountains east and west of Beans Cove. Other smaller areas occur on Allegheny Mountain, Blue Knob, and on ridges adjoining the Frankstown stony loam. There are, no doubt, other areas on the tops of mountains which are not shown on the map because of their inaccessibility.

This type of soil has been formed by the disintegration through weathering of the White Medina, Pocono, and Oriskany sandstones and Pottsville conglomerate. The largest areas are derived from the Medina, while those near the Frankstown stony loam are derived from the Oriskany sandstones, and the others from the Pocono and Pottsville, though these two formations give rise to Dekalb stony loam more frequently than might be expected. The type reaches its best development on the nearly flat tops of the mountains, where there has been ample opportunity for the accumulation of the weathered material. On the mountain slopes the sand grains have been washed away as fast as freed from the parent rock, so that no accumulation could occur. Incomplete disintegration has caused the stony character of the soil.

This type is covered by timber growth, consisting of chestnut, chestnut oak, and scrub pine. The timber is rapidly being cut off, the bark of the chestnut oak being particularly in demand for tanning purposes. Huckleberries and blackberries grow wild in abundance. The accumulation of leaves from the forest trees and the green moss that frequently covers the ground account for the relatively large quantity of organic matter found in the soil.

Very little of the type is under cultivation, being confined to small patches used by lumbermen. Probably some of the stoneless areas

or areas where the surface stones can be readily removed may be cultivated to advantage, but the yields would certainly be too low after the third year to be remunerative, unless much organic matter is added. The land would need to be heavily limed; as limestone is not readily accessible, this would be expensive. In addition, the soil does not stand prolonged drought. Slowly soluble fertilizers should be used, as leaching is quite rapid. Either green or barnyard manures would have to be used in abundance to maintain the fertility of this soil. In view of these facts the type should be left in forest. Most of it is at present included in the State forest and game reserve.

DEKALB FINE SANDY LOAM.

The surface soil of the Dekalb fine sandy loam, which is seldom over 6 inches in depth, consists of a grayish fine sandy loam or loamy fine sand, moderately loose and incoherent in structure. The subsoil from 6 to 36 inches in depth is a light-yellow fine sandy loam, usually slightly heavier than the surface soil. Occasionally the subsoil is a nearly white loamy fine sand, and in places the yellow subsoil may be tinged with red. Small rounded quartz gravel are usually found on the surface and throughout the soil profile, but seldom in such quantities as to warrant the classification of the type as gravelly. There are also some small sandstone and conglomerate fragments scattered over the surface, but not in quantities sufficient to make their removal necessary. Very stony areas found in conjunction with this type have been mapped as either the Dekalb stony sandy loam or the Dekalb stony loam.

The Dekalb fine sandy loam occurs in very narrow bands on Warrior Ridge, Shriver Ridge, and in Dunning Cove and Cumberland Valley. It occupies slopes which may be either gentle or steep and is bounded on the lower side by Dekalb shale loam or Dekalb loam and on the upper side by Frankstown stony loam. Occasionally, however, it runs clear to the top of the ridge, in which case Frankstown stony loam occupies the other slope. Its topography and texture give this soil thorough drainage and it is not subject to severe erosion.

The Dekalb fine sandy loam is derived from a loosely cemented strata in the Oriskany sandstone. As this formation lies above the Lower Helderburg limestone, but below the Genesee shales, the relation of this type to the other soils mentioned above is easily explained. In places where these strata have been exposed large pieces of the parent rock can be readily crushed in the hand. The Oriskany sandstone is described as being slightly calcareous, but no reaction for lime could be obtained from the rocks forming this soil.

Much of this type is under cultivation, but most of it still supports a timber growth of chestnut and oak. As cultivated fields on the slopes usually contain some Dekalb shale loam, Dekalb loam, and

Frankstown stony loam, as well as Dekalb fine sandy loam, and as little effort is made to grow special crops, it is difficult to estimate yields accurately. Observations on growing crops during the survey indicated that the type ranks between the Dekalb shale loam and Frankstown stony loam. In many places corn stands the drought remarkably well, making a good growth and having a good color. In other fields, evidently not well cared for, the crop was stunted and yellow.

This is naturally the best trucking soil of the county. It is easily worked, is well drained, warms up rapidly, and responds quickly to fertilizers. Owners of this type would do well to devote it exclusively to truck or garden crops. Peach trees apparently do better than apples, though where the soil is not exceedingly sandy the latter do well. Farm manure and lime give good results, but the soil is apt to leach rapidly. On this account ground limestone would be preferable on this soil to burned lime, as it is less readily soluble. Applications of potassium and other fertilizer salts give good results. Nitrogen should be supplied by green manuring.

DEKALB SILT LOAM.

The Dekalb silt loam consists of about 8 inches of a yellowish or brownish-gray, smooth, and friable silt loam, underlain by a yellow silt loam, which becomes heavier with depth and frequently grades into a clay loam or silty clay loam. Slight mottlings of red occur in the subsoil. Small shale chips are abundant in the surface soil, increasing in size and quantity with depth until bedrock is encountered at depths varying from 20 to 40 inches. The quantity of shale fragments in the soil is the characteristic distinguishing this type from the Dekalb shale loam. Small spots of the latter type occur within this type. Small sandstone fragments are also found, but not in sufficient quantities to interfere with farming operations.

The largest area of the type is found in the northeastern corner of the county; another large area in Yellow Creek Valley, and smaller tracts in Cumberland Valley, along the borders of Friends, Morrisons, Beans, Millikens, and Slaters Coves. Small areas are also found in the vicinity of Schellburg and Osterburg.

The type owes its origin to the disintegration of soft shale formations. The largest area is derived from the Coal Measure shales, while the Yellow Creek, Cumberland Valley, and Beans Cove areas come from the Clinton shales. The Millikens, Slaters, Friends, and Morrisons Cove areas are formed from Hudson River and Utica shales and slates. There is considerable difference in the colors of these shales. The Coal Measures are yellowish-gray and the Clinton is slightly pink or reddish, while the Hudson and Utica are more

commonly dark colored or nearly black. These variations, however, are not imparted to the resulting soil to any marked degree, for it is almost universally yellowish, especially in the subsoil. All of these formations have thin lenses of sandy shale or sandstone. They do not commonly influence the soil, but as a consequence of their presence there are throughout the area small spots of a few acres which are very stony. It was impossible to show all these on the map as Dekalb stony silt loam, but their occurrence has been indicated in some instances by the use of the stone symbol. The areas near Schellburg and Osterburg occupy what might be termed flats and resemble in some respects second bottoms. The soil profile is typical, however, except that the proportion of shale chips is not so great. Drainage would in many places improve these areas, and this could easily be accomplished.

The topography is characteristic of shale formations, knobs, and irregular ridges, usually quite prominent, and with fairly steep sides, giving a surface configuration varying from rolling to undulating. The Coal Measures area is dissected and rough, the knolls and ridges being fewer but prominent. The Hudson and Utica shale areas are characterized by steep slopes and some small knobs, with few ridges.

Natural drainage is well established over the type. The run-off is rapid, and unless means are taken to prevent it serious erosion is likely to occur. Seepage causes many springy places, but these can be easily drained.

Most of the type is under cultivation, being used for the general farm crops. Yields are moderate; corn about 25 bushels, wheat 15 bushels, oats 20 bushels, buckwheat 25 bushels, and rye 15 bushels per acre. This soil can readily be improved, as the subsoil does not permit as much leaching as occurs on many of the lighter types. Stable manure and legumes, supplemented with phosphoric acid are used to advantage in the cultivation of this soil. Potatoes could be made a profitable money crop on this type, and alfalfa could be grown in many localities.

DEKALB STONY SILT LOAM.

The Dekalb stony silt loam consists of a light-gray, floury silt loam having a high content of fine silt and clay, underlain by a yellow silt loam, becoming somewhat heavier with depth, until at 24 inches it frequently grades into a clay loam or silty clay loam. The soil is somewhat sticky when wet and very powdery when dry. Small shale chips are commonly found in the surface soil, increasing in quantity and size with depth until at 15 to 30 inches a solid or broken mass of shale fragments occurs. Sandstone fragments of varying sizes are

also found throughout the soil profile. Those on the surface are usually removed before the land is cultivated.

The principal areas of the Dekalb stony silt loam occur in the southeastern and western parts of the county. The southeastern areas occupy the upper slopes and crests of Clear Ridge, Polish, and Ragged Mountains, and Addison Ridge, which are long, narrow anticlines. The western area is also a long, rather narrow, and somewhat broken belt occupying the higher range of knolls forming the foothills of the Allegheny Mountain. Other smaller areas form narrow, broken lands at the foot of Wills, Buffalo, Dunning, Evitts, and Tussey Mountains.

The surface varies from the slightly rounded or nearly flat on the tops of ridges to steep slopes along the sides of the ridges and mountains. The southeastern areas have much smoother topography than the western areas, which are frequently quite rough. Except on the flat tops of the ridges, where pools of water may collect and remain for some time, drainage is thorough and sometimes excessive. Care must be taken where the land is in intertilled crops to prevent erosion. The soil has a texture and depth giving a good reservoir for the storage of moisture, and if properly handled it withstands drought fairly well.

Most of the Dekalb stony silt loam is derived from the upper conglomerate horizon of the Chemung formation, which consists of alternate strata of shale and sandstone. The hardness of this upper conglomerate sandstone accounts for the ridge and knob topography of the type and also for its stony character. The areas at the foot of the mountains are formed principally by the disintegration of the Clinton, Hudson River, and Utica shales and slates, over which fragments of sandstone have fallen from the adjacent mountain slopes. Some fragments of sandstone from strata which occur in the shales also are found. The basic material of all the type is shale, the sandstone being accidental and having contributed but little to the actual soil material.

The steeper slopes and more stony areas of the type are forested with chestnut, chestnut oak, oak, and some beech and pine. Some very valuable standing timber is still to be seen, and the rougher areas are best left in forest. Much of the type has been cleared and the stones picked off and used for building fences. The agricultural value of this type is higher than most of the other stony soil in the county. It is locally rated as being much better than the Dekalb shale loam, though not quite so good as the Upshur shale loam or Upshur stony loam. The stones found in the last-named type are not as large and difficult to remove as those in the stony silt loam.

All the general farm crops of the area are grown. The position occupied by most of the type makes it well adapted to orchards, and much of it will no doubt be thus used at some future time. The plowing under of leguminous green manuring crops or manure and the application of some form of phosphorus are the important steps needed to improve this type.

CHEMUNG SHALE LOAM.

The Chemung shale loam consists of about 8 inches of chocolate-colored fine loam to silt loam, resting upon a subsoil slightly lighter in color and texture. On the surface and throughout the soil and subsoil occur large quantities of chocolate-colored shale and sandstone fragments, ranging in size from mere chips to flat stones 2 inches thick and over 2 feet in circumference. In places the stones are sufficiently numerous to make their removal necessary before cultivation is practicable. The color of this soil is its distinctive feature and is the main reason for its being separated from the Dekalb shale loam, which has a yellow subsoil. The type was mapped in the Johnstown area as the Chemung stony loam, but later observations indicate that Chemung shale loam is the better name for it.

The principal area of this type occupies a broken belt in the foothills of the Allegheny Mountain in the western part of the county. Other small areas occur east of Chestnut Ridge in the Pigeon Hills. The type is closely associated with the Dekalb shale loam and the Dekalb stony silt loam in that vicinity, small areas being included in those types. As shown on the map, it also includes some small areas of each of the other types.

The type is characterized by rough or rolling topography, the county being made up of steep sloping ravines and narrow, steep-sided ridges. Elevations in the type range from 1,200 to 1,700 feet. Natural drainage is well established and in places is excessive. Gullies frequently cause serious damage, unless provision is made for protecting the cultivated areas. The type withstands drought better than the Dekalb shale loam, as the soil is usually deeper.

This soil is locally known as "black slate land" and is derived from a horizon close to the upper conglomerate in the Chemung formation. It may be the division known as Portage flags, though these are described as being olive in color, while the rock fragments on this soil are nearly the same color as the soil—a pronounced chocolate. The formation consists of alternate layers of shale and very fine-grained sandstone. The fine earth of the type is largely derived from the shales, while the sandstone being harder has weathered less completely and the fragments from the stone occur on the surface and scattered through the profile. None of this type was found over

the country occupied by the Chemung formation in the eastern part of the county, and the particular stratum giving the type evidently does not exist there.

The agricultural value of this type is slightly higher than that of the Dekalb shale loam, but not quite equal to that of the Upshur shale loam. The areas under cultivation are very small and usually embrace more than this one type; hence no accurate crop yields were obtainable. It might be utilized for fruit, as air and water drainage are nearly always good. Several tests showed high acidity, and lime, while difficult to get over much of its area, should be applied and clover grown and incorporated in the soil. While the soil is dark colored, the organic matter content is not greater than in case of the Dekalb shale loam.

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

Mechanical analyses of Chemung shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
181221.....	Soil.....	1.8	3.5	1.0	1.4	10.4	70.0	11.5
181223.....	Subsoil.....	4.3	5.2	1.0	2.0	11.7	61.0	14.2

LICKDALE CLAY LOAM.

The Lickdale clay loam consists of 6 to 10 inches of light-gray to dark-gray silty clay loam to clay loam, underlain by a yellowish, heavy silty clay loam to clay, which quickly grades into a heavy silty clay, mottled with blue, drab, yellow, brown, and gray. The blue and drab colors usually become more pronounced with depth and the yellow less conspicuous. The surface soil when freshly plowed also shows mottlings of yellow and dark gray. Freshly disintegrated brown shale rock is usually found at depths varying from 24 to 36 inches. Small sandstone fragments occur on the surface and throughout the soil profile, but rarely in quantities sufficient to necessitate their removal for cultivation. Included in the type are areas of Lickdale silt loam too small to map separately.

This type is not confined to any one locality, but occurs in isolated areas all over the county. It is generally associated with the yellow shale soils—Dekalb shale loam or Dekalb silt loam. It occupies the gentle slopes between these types and the watercourses. The line of demarcation between this type and the Dekalb soils is usually distinct and marked by a sharp escarpment, but its contact with the Huntington soils of the bottoms is frequently less definite. There are some small areas occurring as depressions within the Dekalb

shale loam. A very narrow band of this type is nearly always present along each side of watercourses which drain these two Dekalb soils, but only the larger areas could be shown on the map. Other unmapped areas occur in the small depressions and flats of the true uplands.

The topography is level to very gently undulating, the type occupying flats and gentle slopes. This characteristic surface causes very poor drainage conditions, which accounts for the dark color of the soil and the subsoil mottlings. The subsoil is nearly impervious to water and the surface configuration prevents rapid run-off, with the result that the surface soil is frequently waterlogged, while the subsoil is comparatively dry. The result, of course, is a wet, cold, and in many cases an untillable soil. Seepage from the adjacent soils materially increases the wet condition and causes the many "spouty" places nearly always found in this type. Sufficient fall to the adjacent watercourses nearly always exists and areas of some size could be profitably drained by means of tile. Care must be taken in doing this that every source of seepage is completely tapped or the results of tiling are sure to be unsatisfactory.

This soil is largely derived from material that has slipped or been washed from the adjacent shale hills and accumulated on the slopes or in depressions. The poor drainage prevents the rapid decomposition of organic matter and retards oxidation of the subsoil. As a result the soil is somewhat darker than the soils caused by the disintegration of shales and the subsoil is mottled. That part of the type next to the bottoms undoubtedly contains considerable alluvial material and some small areas are apparently wholly of alluvium, but with profiles typical of this soil they have been so mapped.

Most of the type has been cleared but is rarely cultivated because of its cold, wet nature. It is extensively used for pasture and mowings, to which it is admirably adapted. The lack of drainage alone prevents much of the type from producing good yields of the general crops. The larger areas might be drained profitably even if the land were to be left in grass. Alsike clover should be more extensively grown, as it stands the wet conditions better than red clover. Applications of lime and fertilizer are lasting on this soil, as leaching is practically negligible. If drained and otherwise improved yields of the general farm crops above the average could be secured. Only with exceptionally good drainage could alfalfa be expected to do well.

WESTMORELAND SILT LOAM.

The Westmoreland silt loam, as mapped in Bedford County, comprises considerable variations in the color, depth, and texture of the material. The color ranges from red to light gray, the texture from

a rather floury silt loam to clay, and the depth from only a few inches to over 3 feet. Predominantly the surface soil is about 8 inches and composed of a brownish, friable silt loam with a reddish tint. The subsoil, to a depth of 20 inches, is slightly lighter colored than the soil, but otherwise the same, grading below that depth into bedrock, which may be either gray calcareous shale, shaly limestone, or gray shale with a decided greenish cast. A scattering of highly fossiliferous blue limestone fragments occurs over the surface of nearly all areas. On a large-scale map on which areas of an acre or less could be shown this type could be separated into Dekalb silt loam, Dekalb shale loam, Upshur shale loam, Hagerstown silt loam, Hagerstown clay loam, Dekalb clay, and possibly one or two other types, but the areas of each are so small that no separation could be attempted on the map used in this survey. Cultivated fields appear spotted with small areas of Hagerstown red, Upshur red, and Dekalb yellow and gray material. The clay spots consist of very heavy and tenacious yellow clay, difficult to work, but usually capable of producing good yields. In the Johnstown area this clay predominated in this same formation and the entire area was mapped as Dekalb clay. The spots or streaks of Upshur soil are very small and unimportant.

This type is confined to the region lying between Wills and Dunning Mountains, where it forms a large, irregular area. The topography is undulating to rolling, the surface consisting of knolls and ridges, which frequently have quite steeply sloping sides. Drainage is everywhere thorough, except where clay spots occur on the lower levels, in which case artificial drainage is advisable. Injury by washing is sometimes experienced and care must be taken to avoid this.

The Westmoreland silt loam owes its origin to the disintegration of the varied rocks which make up the Clinton shale and Marcellus slate formations. These consist of interbedded shale and limestone. The shale may or may not be calcareous and the limestone may be shaly or it may be practically massive. The strata are both very thin. The limestone is rarely thick enough to use for burning, especially when the more massive Lower Helderburg limestone is in close proximity.

That this type occurs only in the one locality and not wherever these formations occur is evidently because the rocks are usually tilted at such a great angle that their exposure is very small and insignificant. A few square feet of limestone and red shale soil can usually be found within the Dekalb silt loam and Dekalb shale from these formations, but not enough to map. In this one area the rocks are more nearly horizontal and consequently strata but a few feet thick will be sufficiently exposed at the surface to allow considerable soil formation, though still not enough to allow separate mapping.

Nearly all of the type is at present under cultivation, but its merits vary. This is unquestionably due to the character of the predominating soil. Farms on which the shaly limestone or calcareous shales predominate are highly prized and considered the equal of Hagerstown silt loam, but where the argillaceous shales predominate the farms are considered inferior and difficult to work. Yields of 15 to 20 bushels of wheat, 15 to 50 bushels of corn, and 20 to 35 bushels of oats per acre are ordinarily obtained. The land is valued at \$30 to \$100 an acre.

Nearly all of the limestone areas are badly in need of lime, the soil giving decided tests for acidity. Clover should be grown to supply nitrogen and organic matter. Fertilizers are universally used and there is no question that phosphorus carriers are the most efficient fertilizer salts. Nitrates should not be necessary, provided plenty of decaying organic matter is supplied the soil by plowing under leguminous crops.

UPSHUR STONY LOAM.

The soil of the Upshur stony loam to an average depth of 6 to 8 inches consists of a fine-textured Indian-red loam, containing an appreciable quantity of fine sand and silt. This is underlain by a rather compact loam, the same color as the surface soil, becoming slightly heavier with depth. The surface soil is open in structure and easily tilled. The depth to bedrock varies from a few inches to several feet. Where the depth is only a few inches the subsoil is entirely lacking. The average depth of soil and subsoil is about 2 feet. Sandstone fragments are disseminated through soil and subsoil in quantities ranging from 10 to 35 per cent of the soil mass. These vary in size from small pebbles to pieces 2 feet in circumference. Many soft red shale fragments also occur in the soil and subsoil.

Two kinds of stones on the surface virtually make two phases of this type. The most characteristic are flat, red, shaly sandstone fragments derived from the parent rock. On the immediate slopes of mountains it frequently happens that large gray or white sandstone fragments have accumulated on the type from higher lying formations. In these locations the soil, too, is likely to contain considerable extraneous material and to be purplish-gray in color, though the red is constant in the subsoil. As a rule the flat reddish fragments can exist in large numbers and not be very detrimental to cultivation, but the gray stones are larger, not flat, and many must be removed before successful tillage is practicable. Little of the phase carrying gray sandstone fragments is under cultivation. Except in color, this phase is more similar to the Dekalb stony loam than the more extensive less stony division of the type.

The largest area of this type lies in the foothills of the Allegheny Mountain, and occupies a belt varying from $4\frac{1}{2}$ miles wide at the northwest corner of the county to less than 1 mile in width at the southern boundary. Another separate area occurs in the southwest corner of the county. It is also found as narrow strips at the foot of Millikens Cove. Small isolated areas occur within or adjacent to the Upshur shale loam in the eastern part of the county.

The surface of the type is made up of steep slopes and hogback ridges and knolls, so that the topography can be classified as broken to very rough. Elevations range from about 1,500 to 2,400 feet above sea level. Natural drainage is rapid and thorough, but as the texture of the soil normally permits very rapid absorption of the rainfall erosion is not a serious problem. Except in areas where the underlying rock comes close to the surface, the type stands drought fairly well.

The larger proportion of the Upshur stony loam has been formed through the disintegration of soft red shales and fine-grained reddish sandstones, alternate layers of which compose the Catskill formation. The sandstone strata weather more slowly than the shale, and consequently fragments of this rock accumulate on the surface, giving the soil its stony character. The two large areas in opposite corners of the county are derived from the Mauch Chunk formation, but the stones are not as likely to be the red sandstone fragments as the large blue fragments which have tumbled down from the higher lying Pottsville conglomerate. These are sometimes immense boulders, the removal of which is impossible.

The cove areas are found at elevations of 1,600 to 2,000 feet and occupy mainly shallow valleys or table-lands, which are sometimes cultivated. These areas are derived from the red Medina shale and sandstone, sandstone predominating and being responsible for a slightly higher sand content in many places. The inaccessibility of these areas, their low content of moisture in many places, and their tendency to be droughty will probably retard their development except for forest culture, for which they are well adapted. Much of the type is in forests of chestnut and oak, with some beech, tulip, and maple. Possibly half of it is under cultivation, but the farms are small, though fairly well improved. General farming is carried on, but crops must usually be harvested by hand, as the slopes are too steep for machinery. Sleds are in common use on these hillsides, where wagons are impracticable. In fact, the type has the distinction of having steeper slopes in cultivation than any other soil, with the possible exception of certain areas of the Frankstown stony loam. This is probably due to the fact that it is considered a strong soil, or, at least, better than the Dekalb soils. The average yield of wheat is about 16 bushels per acre; of oats, 25 bushels, with a range of from

20 to 35; of corn, between 30 and 40 bushels; and of buckwheat, about 18 bushels. Clover can be grown where the land is limed. Potatoes do fairly well in areas in which the rock fragments are not too abundant. There are many good orchard sites of this soil and fruit does well. The addition of organic matter, supplemented with phosphatic fertilizers, is the prime requisite to the permanent improvement of this type.

UPSHUR STONY SANDY LOAM.

The soil of the Upshur stony sandy loam consists of an Indian-red to reddish-gray or gray sandy loam, 6 to 10 inches deep. The subsoil, at first a sandy loam, becomes sandier and redder with depth, until at 36 inches a rather loose structured Indian-red sandy loam is encountered. In some of the larger areas the color of the subsoil may have a distinct yellowish tinge and it is sometimes difficult to determine whether the type belongs to the Dekalb or Upshur series, but because of frequent spots of true Upshur soil in all these areas they have all been mapped with that series. Occasional spots of loose, incoherent sand occur throughout the type. Except in local patches this soil is not as stony as either the Upshur stony loam or the Dekalb stony sandy loam, but the sandstone fragments and bowlders are sufficient to make clearing and cultivation arduous. Boring is frequently difficult and bedrock is often found within less than 2 feet of the surface.

The type is not extensive and occurs as narrow, usually broken belts around Morrisons, Friends, Millikens, and Slaters Coves. It is practically confined to a series of terraces or benches and ridges which occur about half way up the sides of the mountains which surround these coves. These are continuous from Friends into Morrisons Cove and from Morrisons Cove into Slaters Cove. They lie about 400 feet above the valley at an altitude of 1,500 to 1,900 feet above sea level. They are not level, but slope gently upward to the foot of the upper slopes of the mountains and steeply down to the valleys below. Occasionally there is a shallow valley between the ridges and the mountains, but this type is always separated from the Rough stony land of the mountains by areas of Upshur stony loam. Drainage is thorough to excessive. The soil apparently does not stand drought well.

In origin the type may be traced to the red Medina and gray Oneida sandstones from which it has been derived through the various processes of weathering. To the Oneida, which is apparently thin but hard, is attributed the formation of the terraces, and various mixtures of material from both the gray and red sandstone account for the various shades and colors.

The type is mostly left to forest, for it is difficult of access, inclined to be droughty, and tillable areas are small. A few cultivated fields were seen, but several others were apparently abandoned after a few

years' use. Chestnut and oak of fair quality represent the tree growth and it is evident that over much of the type forestry is the best use to which the land can be put. Peaches would no doubt do well in favorably situated areas where readily accessible. Apples would probably not do as well as peaches. The soil itself is an admirable truck soil for early crops, and where irrigation can be practiced such crops could no doubt be profitably grown. Heavy applications of lime, phosphate, and possibly potash and the incorporation of organic matter in liberal quantities would be necessary.

UPSHUR SHALE LOAM.

The Upshur shale loam consists of 6 to 8 inches of Indian-red, fine-textured, but fairly loose structured loam, resting on a subsoil of somewhat heavier material and usually of a more intense red color. The surface soil closely approaches a silt loam or fine sandy loam in small areas. Both soil and subsoil are, however, rendered fairly open in structure by a large quantity of small red shale and sandstone fragments. These frequently make the surface appear rather gravelly, but are never of sufficient size to impede cultivation. Their number increases with depth, until at approximately 18 inches the solid rock is encountered.

Mixed phase.—In many places where this type is bounded by the Dekalb stony silt loam the intermediate region is spotted with red and yellow, representing a mixture of Dekalb and Upshur material. In some cases a pinkish cast prevails, as though the red color had largely leached out. These areas have been indicated by symbol on the map, as separation into types was impracticable. Their agricultural value is somewhat less than that of the typical Upshur shale loam.

The Upshur shale loam is the predominating soil type in the southeastern quarter of the county. It occurs as a broad, irregular belt running the entire length of the county, narrowing to less than 1 mile in width in the northeastern part. Other smaller and more or less isolated areas occur in the western part of the county, in the foothills of Allegheny Mountain and near the upper slopes of the mountains bordering Friends and Morrisons Coves. Another area occurs on the north side of Sherman Valley.

The surface of the type is characteristic of eroded shale formations, successive irregular ridges from which rise rounded knolls, cut by water courses with steep or often precipitous sides. In this type the ridges are possibly somewhat wider and the slopes normally steeper than in the Dekalb shale loam. In general the topography is hilly and along some of the larger stream courses, such as Brush Creek, almost rugged. In the vicinity of the main divides, west of Chapmans Run, there are large areas of gently undulating land which has

more the appearance of a plateau than an eroded valley. In the eastern part of the county the type is found over rough topography, the western areas being confined to the tops of ridges. The steep sides are quite stony and have been mapped as Upshur stony loam.

Drainage is good to excessive, and while erosion may cause some damage unless care is taken in cultivating hillsides, the soil is porous and absorbs the rainfall readily, and the danger from this source is not so great as on the Dekalb shale loam. Springy places due to seepage are not nearly so common as in the Dekalb shale loam. Artificial drainage would probably prove advantageous in some of the broad, nearly level areas. Underdrains may prove difficult of installation, however, because of the proximity of the rock to the surface.

The larger part of the type is formed, through weathering, from the Catskill formation, which is composed of alternate strata of red shale and sandstone. The area in Sherman Valley is derived from the red shale of the Mauch Chunk formation, while the few areas in the coves are from the red Medina sandstone. Red strata of shale and sandstone in the Clinton formation also give rise to this type, but in only a few cases is it sufficiently wide to be separated on the map, and it has usually been included with the Dekalb silt loam. Disintegration of the parent rock has in all cases been quite complete, so that few large fragments occur on the surface.

By far the greater part of the type is under cultivation, and many well-improved farms are seen. The type is rated locally as next to the limestone soils in productiveness. Those areas derived from Mauch Chunk formation are regarded as the best of the type. All the general crops of the area are grown. On the better class of farms corn yields about 40 bushels, wheat 18 bushels, oats 35 bushels, buckwheat 25 bushels, and rye 30 bushels per acre.

Besides the general crops mentioned the type is well adapted to alfalfa and fruit. There are many excellent orchard sites in the type, which sooner or later will be used in the production of apples, peaches, and pears.

Land values range from \$10 to \$50 an acre, depending on location.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Upshur shale loam :

Mechanical analyses of Upshur shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
181203.....	Soil.....	1.4	3.5	1.9	6.0	18.8	54.3	13.8
181204.....	Subsoil.....	4.4	7.2	2.7	8.0	16.0	38.3	23.5

HAGERSTOWN LOAM.

The surface soil of the Hagerstown loam is a brownish loam with a depth of 8 or 10 inches, changing to a yellowish loam beneath. The subsoil is a yellowish loam becoming heavier with depth and assuming a more reddish tinge to a depth of about 24 inches, where it grades into a reddish-yellow clay loam. A few chert, sandstone, and calcareous sandstone fragments occur on the surface, but seldom in such quantities as to make their removal necessary before the land can be tilled. Fragments of oolite are also common.

This type, which is not extensive, is confined to the region adjacent to the Barrens in Morrisons and Friends Coves. It represents a transition from the true limestone soil, Hagerstown silt loam, to the sandy soils of the Morrison series. It is nearly always associated with and possibly includes some unmapped areas of Hagerstown sandy loam. It occupies gentle to rather steep slopes and short but prominent ridges. The topography is rolling. Drainage is always well established, but the soil withstands drought well.

Like the Hagerstown sandy loam, the type is a mixed limestone and sandstone soil. It is derived from the solution of limestone and represents the resulting residue united with sand from the sandy members of the Trenton formation. The presence of the calcareous sandstone fragments indicates that in part at least it is the result of the disintegration of that rock. In places some of the sand has undoubtedly been washed down from the adjacent Morrison soils.

Most of this type is under cultivation and is regarded as an excellent general crop soil. No accurate figures for yields were obtainable, but the type is not rated as high as the Hagerstown silt loam. The soil is easily worked and the heavy subsoil prevents leaching, which makes the type capable of easy improvement. Lime should be applied to the land and clover grown extensively. Inoculation should be practiced if good stands are not readily obtainable. The type is naturally well adapted to corn, but would also give good yields of small grains. Some of the more stony and less easily tilled areas could profitably be put into fruit.

HAGERSTOWN SANDY LOAM.

The Hagerstown sandy loam consists of 10 inches of reddish-yellow or brown sandy loam, underlain by a material which is a sandy loam in the upper part but becomes heavier with depth and grades into a sticky reddish-yellow loam or clay loam. Some small sandstone and chert fragments are found on the surface, but rarely in such quantities as to hinder tillage. The depth and texture of the sandy loam surface soil may vary considerably and the boundaries between this type and the Hagerstown loam are not always well defined. Small areas of each of these types are no doubt included within the other.

Small isolated areas of the Hagerstown sandy loam occur adjacent to the so-called Barrens in Morrisons and Friends Coves. They occupy gentle to rather steep slopes and have good natural drainage.

The Hagerstown sandy loam is locally called "mixed sandstone and limestone land." Its formation is of doubtful origin, but it is evident that it is in part due to an accumulation of sand and sandstone over limestone material, either from direct disintegration of sandstone or by wash from the calciferous horizons of the Trenton which occupy the hills of the Barrens. Probably both processes have been in part factors in the formation of the type, as there are found fragments of sandy limestone as well as almost pure sandstone.

Much of this type is under cultivation. The ease with which the surface soil can be tilled, the rapidity with which it drains, and the heavier subsoil which to a large extent prevents injurious leaching, makes this a very popular soil type. It is principally devoted to general farming, and yields above the average are usually obtained. Commercial fertilizers, lime, and manure are all applied with good results.

This is an admirable small-fruit soil and could also be used for truck crops, but under the present market conditions can probably be better used for general crops. Alfalfa should also do well and could be grown to advantage.

HAGERSTOWN CLAY LOAM.

The typical Hagerstown clay loam consists of 6 to 10 inches of brownish-red or red heavy silt loam to clay loam, underlain by a compact and tenacious heavy red clay loam or clay subsoil. Solid limestone rock underlies this material at depths usually less than 30 inches. At the line of contact of the subsoil and the rock there are frequently a few inches of gray silty material which when rubbed between the fingers becomes red and assumes the properties of the overlying clay. Small, hard, blue limestone fragments are frequently found on the surface, but seldom in quantities sufficient to affect cultivation. Outcrops of limestone are frequent, and in many places, particularly along the larger stream courses, there is not enough soil to cultivate. There are phases of this type in which 5 or 6 inches of gray silty loam overlies the reddish clay loam. There are few areas of the type which have a uniform red color throughout, small spots of this gray material being commonly present. The gray silty coating probably covers the greater part of the surface in the large area north of Osterburg, for here the red clay loam spots, though numerous, are small. Part of this area was mapped as Hagerstown silt loam in the Johnstown area. A few chert and limestone fragments are characteristic of this area.

The largest areas of typical Hagerstown clay loam lie in the southern part of Cumberland Valley and a short distance south of Yellow Creek borough. Other areas occur on Warrior Ridge, in Dunning Cove, and on the west side of Wills and Dunning Mountains.

This soil is composed of insoluble material which has accumulated from the solution of the Lower Helderburg limestone. Only the lower half of that formation, which is a relatively pure limestone, gives rise to this type, the upper half giving the Frankstown stony loam. Areas of the Hagerstown clay loam usually occupy steep slopes. It is found on the north slopes of the synclinal Cumberland Valley and Warrior Ridge and on the south slope to the west of Wills and Dunning Mountains. South of Centerville there is a separate ridge occupied by areas of Frankstown stony loam and Hagerstown clay loam, but the types are usually found on opposite slopes. The area near Yellow Creek occupies a prominent isolated knob.

Steep slopes characterize the type and the drainage is rapid. The texture of the soil is against the absorption of the rainfall, and serious damage is likely to result from washing and erosion.

Though this is the strongest soil in the county, it is in many cases neglected and allowed to stand idle, as much of the soil is too shallow for successful cultivation, and over some of it the slope is so steep that plowing would only result in such severe washing as to unfit it for farming. The soil, except where the silty covering exists, is not easily cultivated, because of its heavy texture and the frequency with which the plow strikes the underlying rock. However, where conditions are favorable this is a highly prized soil, and excellent yields of corn, wheat, clover, and timothy are obtained.

Probably the principal limiting factor in crop production on this soil is its physical condition. To build up this soil frequent applications of lime are recommended, to flocculate the particles and make the soil more porous and open. It should be plowed deeper than at present—to at least 8 inches—but must not be plowed wet, as clodding results, making it hard to handle subsequently. It should be thoroughly disked and cultivated before putting in any crop, in order to get as fine a seed bed as possible. Thorough preparation and cultivation of the seed bed and the incorporating of green manuring crops, such as clover or other legumes, with the soil will bring it to its maximum productiveness.

HAGERSTOWN STONY LOAM.

The surface soil of Hagerstown stony loam consists of a grayish-brown silty loam or loam 8 inches deep. The subsoil is a rather heavy silt loam, becoming heavier, passing from yellow to reddish in color with depth, and grading at 24 inches into a heavy reddish clay loam or clay. The salient characteristic of this type is the large

number of chert fragments on the surface and throughout the soil profile. Some sandstone fragments are also found. Boring in the soil is difficult and in the subsoil seldom possible. Cultivation is hindered by the stones. Part of the type mapped in the Johnstown area has been changed to the Hagerstown silt loam in the present survey, because the stone content, while high, consists of only small fragments, which interfere little in the tillage of the soil.

With one or two exceptions, this type is confined to rather small areas in Friends and Morrisons Coves. Areas too small to map are sometimes associated with the Hagerstown clay loam, but it is usually found with Hagerstown silt loam or the Morrison series.

The type occupies slopes which may be rather gentle or too steep for profitable farming. Surface drainage is well established.

This type has been derived from cherty limestone. The sandstone fragments present are from higher adjacent formations. The chert being difficultly soluble has remained intact, though partially disintegrated, and gives the soil its stony character.

But little of this type is under cultivation, it being quite difficult to remove the stones and the soil not being particularly valuable after this has been done. It is mostly used for pasture. It will probably yield about 25 bushels of corn, 30 bushels of oats, and 15 bushels of wheat per acre. It could be improved by liming, by growing and turning under leguminous crops, and by applications of phosphatic fertilizers. The heavy subsoil prevents rapid loss of added manures by leaching.

HAGERSTOWN SILT LOAM.

The soil of the Hagerstown silt loam to a depth of 8 to 10 inches consists of a brown, grayish-brown, or reddish-brown silt loam or very fine-textured loam. The subsoil is a yellowish heavy silt loam or clay loam to about 24 inches, where it grades sharply into a tenacious reddish clay or clay loam, extending to undetermined depths. On well-managed farms the organic matter content is high as compared with most of the Dekalb soils. Over much of the surface and throughout the soil small chert fragments are found. These do not usually interfere with the handling of the soil, though in places some of the larger fragments are removed.

Except for slight variations in depth and the quantity of chert on the surface, there are no well-defined phases of this type, and in general it is remarkably uniform. The structure is such that the soil is much more easily worked than might be expected from the mechanical analysis. This is no doubt due in part to the small flint fragments. Under field conditions it is a light, open soil, loose and friable, and very rarely subject to baking or puddling. In wooded areas where the incorporated organic matter is less the soil is slightly more yellow and has a more mealy structure than in the cultivated fields.

The Hagerstown silt loam is extensively developed in Morrisons and Friends Coves. Small areas are also found within the Hagerstown clay loam, but few of these are shown on the map because of their small extent. The surface of the type may be characterized as rolling to undulating, as it occupies broad-topped ridges and knolls. Along the smaller stream courses the slopes are comparatively gentle, but along the larger streams the valleys are frequently steep sided. Sink holes are common throughout the type. Natural surface drainage is usually good, but underdrainage could be utilized to advantage along many of the narrow and shallow water courses.

The soil, which is comparatively deep, absorbs moisture readily; and this tends to prevent severe washing or gulying of the fields. The heavy subsoil aids materially in preventing leaching and tends to increase the moisture-holding capacity of the type. During the severe drought of 1911 crops, particularly clover, suffered but little on this soil.

The Hagerstown silt loam in the coves is derived from the Trenton limestone, while other areas are derived from the Lower Helderburg limestone. The material represents the insoluble residue from large masses of limestone, most of which has been removed in solution.

The soil thus accumulated is remarkably deep, in places reaching a depth of 90 feet. Outcrops of limestone occur frequently, especially along ravines, and in such places bodies of Hagerstown clay loam, too small to be shown on the map, are found.

This type is the most highly prized soil in Bedford County. It is easily cultivated, fertile, and of comparatively smooth topography, making it a very desirable soil for general farming, in which the use of farm machinery is an important factor in success. Corn and wheat are the principal products, though oats, barley, rye, and alfalfa are also extensively grown. Clover is universally grown and does well. Corn yields from 30 to 50 bushels per acre. Wheat averages about 20 bushels, though twice this yield has been reported. Oats average about 35 bushels and barley 25 bushels per acre. Dairying is extensively practiced, the farmers either marketing butter in Cumberland and Altoona, where they obtain good prices, or else selling the cream to local creameries. But little milk is sold because of inadequate transportation facilities. Silos are common on this type, the farm and buildings well improved, and the farms well kept. Although this is a limestone soil, the free calcium or magnesium carbonate, so essential to correct soil acidity, has largely been leached out and applications of lime are frequently made by the farmers. Phosphatic fertilizers are also used to some extent.

Alfalfa does well on this type and should be universally grown. While fruit growing shows good results, the possibilities of grain farming on this soil are too great to encourage its use for fruit, which

relatively can be better grown on the rougher land. There is every reason to believe that if this soil is well tilled and large quantities of organic matter derived from legumes incorporated the yield of all crops can be greatly increased.

MURRILL SILT LOAM.

The Murrill silt loam consists of 9 inches of grayish-brown to brown, slightly gritty silt loam, underlain by a yellow or slightly reddish-yellow silt loam, becoming heavier with depth until at 15 inches it grades into a very heavy silt loam or silty clay loam to clay loam. Some mottling frequently occurs in the subsoil, and spots of fine-textured loam are found throughout the type. In such locations the subsoil rarely becomes heavier than a silt loam. Spots of silt loam in which large quantities of fine shale chips occur also exist. Limestone outcrops are found throughout the type and in places give rise to a true limestone soil of either silt loam or clay loam texture. These spots are usually very small, rarely over 5 acres in extent; hence no attempt was made to separate them on the map. Over the surface and in places through the soil and subsoil occur varying quantities of fine-grained sandstone fragments, usually of small size, but sometimes 7 or 8 inches in diameter. In places they are sufficiently numerous to justify classification as a stony type and in such cases they have been indicated on the map with stone symbols.

This type is confined to Morrisons and Friends Coves, where it occupies the gently sloping approaches to the mountains which surround the coves. Watercourses usually mark its boundary with the true limestone soil (Hagerstown silt loam) on the valley side, while the Dekalb silt loam or stony silt loam on the mountain side begins with a rather sharp escarpment. This type is sometimes displaced by Dekalb stony loam, which, as mapped in Morrisons Cove in the Johnstown area, undoubtedly includes considerable land which would now be mapped as Murrill silt loam.

The topography is usually smooth, the surface varying from gently to sharply rolling, though the slopes are not steep. Natural drainage is usually well developed, but much benefit has resulted in areas where tile has been used, and underdrainage would no doubt be advisable in many places, as the soil tends to hold moisture and becomes somewhat soggy and injury is likely to result to grass crops during the winter months. This condition would be largely removed by underdrainage. Sufficient fall can always be obtained.

The exact origin of this type has not been worked out in detail. The silty material appears to be derived principally from shale, which could come only from the Hudson River and Utica formations, but whether in place or not is difficult to determine. The sandstone fragments, which are universally present, occasionally show evidence

of having been slightly worn, but water action seems entirely improbable. These, too, are probably fragments from sandstone lentils in the Hudson River formation. The outcrops of limestone found throughout the type would indicate that much of the material had slipped down the hillsides or been washed as delta fans over the Trenton limestone. Whatever the details of its origin, the material is evidently mostly derived from the Hudson River and Utica formations (these outcrop higher up the slopes) and has been influenced to some extent by material derived from the Trenton limestone, especially in the subsoil. In places limestone comes near the surface and has given rise to small patches of definite Hagerstown soil. Also the type includes some patches of distinct Dekalb soil, but too small to map.

The gentle surface slopes, the absence of stones to interfere with tillage, and the productiveness of this soil make it valuable farming land, and most of it is under cultivation. All the general crops of the area are grown. Corn yields from 25 to 50 bushels, wheat 12 to 20 bushels, oats 20 to 35 bushels, buckwheat 12 to 25 bushels, and potatoes from 75 to 150 bushels per acre. The finest alfalfa seen in the county is on this type. Some very good orchards, apple, peach, and pear, are also located on this soil. It is an excellent grass soil and is highly prized for potatoes.

Applications of lime are one of the first essentials in the improvement of this soil. All the clover possible should be grown and applications of phosphatic fertilizers made. The subsoil is sufficiently heavy to prevent severe leaching, so that all fertilizers last well. Deeper plowing should be practiced on nearly all farms. Tile drains should be laid wherever necessary. Much of the type is well situated for alfalfa, and farmers would make no mistake in sowing a few acres. Much of it could also be planted to orchards, but care should be taken that the slope is sufficient to insure air drainage, as protection against frost. If these suggestions are carried out this soil can be made one of the most profitable and valuable soil types in the county.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Murrill silt loam:

Mechanical analyses of Murrill silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
181247.....	Soil.....	1.2	2.6	3.4	14.7	8.1	57.2	13.0
181248.....	Subsoil.....	1.2	2.1	2.9	15.3	9.0	49.9	10.4

FRANKSTOWN STONY LOAM.

The Frankstown stony loam¹ to a depth of 6 to 8 inches consists of a gray to grayish-brown silt loam, underlain by a floury, yellow silt loam, tinged with gray and pink, but becoming clear yellow at a depth of 15 inches and nearly a loam in texture. At 36 inches a yellow true loam is frequently encountered. Over limited areas the surface soil may approximate a loam in texture and have a faint reddish tinge. Small angular rock fragments, known locally as "white slate," "bastard limestone," and "flint," represent from 10 to 75 per cent of the soil mass. Much of this material consists of chert fragments of varying size up to several inches in diameter. Many of the stones are brownish yellow, soft, being easily cut with a knife, and usually light for their size. These occur most abundantly in proximity to the Dekalb fine sandy loam. Nearest the Hagerstown clay loam the predominating rock fragments are almost white, thin shale-like fragments, quite hard and siliceous. The stones are so abundant that in places no soil whatever can be seen on the surface. After plowing the rains wash the soil particles between and underneath the gravel, leaving it exposed. Such areas at a distance appear almost white. The stone content increases slightly with depth, and boring is always difficult and seldom possible below 24 inches. The type is locally known as "limestone gravelly land." On a few areas stone symbols have been used to indicate large sandstone fragments from the Oriskany sandstone which have fallen over the type, in some cases making cultivation impracticable. Ordinarily the gravel does not interfere with cultivation.

As a rule this type occupies long, narrow belts, but the largest area in Bedford County is an exception. It occupies the most of Chestnut Ridge and is over 7 miles in length and $1\frac{1}{2}$ miles wide. Other areas occupy the east side of Shriver Ridge, running through the center of Cumberland Valley and around Dunning Cove, the west side of Warrior Ridge, a ridge to the west of Dunning and Wills Mountains, and another is found on Martin Ridge in Beans Cove. This soil is, therefore, distinctly a ridge type. Chestnut Ridge, an anticline, is an even-topped, turtle-back ridge, with long, smoothly scalloped descending slopes, ranging in elevation from about 1,400 to 1,700 feet. The other ridges are bolder in outline, their tops being a series of rather prominent knobs, while the sides are steep, with even contours. The southern slopes of Warrior and Martin Ridges give the nearest approach to ruggedness occurring in

¹A fragment of rock that occurs in abundance on the surface and through the soil mass of the Frankstown stony loam showed on analysis a content of 0.51 per cent of phosphoric acid (P_2O_5) and 0.21 per cent of potash (K_2O).

the type. Small sink holes are very common throughout the type and the surface has been known to give way suddenly, forming a considerable depression.

The Frankstown stony loam has been derived by disintegration of the siliceous and calcareous shaly members constituting about the upper half of the Lower Helderburg limestone. It has not, however, been separated from the true limestone. The parent rock is no doubt somewhat calcareous, which has some influence upon the resulting soil.

This rock lies immediately below the Oriskany sandstone and above the true limestone, which accounts for its association with the soils from those rocks. For instance, in ascending the slopes the Dekalb fine sandy loam is found at the foot of the eastern side of Shriver Ridge, the Frankstown stony loam beginning a short distance up the slope and continuing over the top, while on the west side occurs the Hagerstown clay loam. On Warrior Ridge the fine sandy loam continues over the top and the clay loam seldom appears. Outcrops of limestone are not uncommon throughout the type, and Chestnut Ridge is undoubtedly all underlain by limestone, though outcrops appear in only a few places.

Drainage on this soil is thorough and frequently excessive, owing to the steep slopes. If neglected the soil is apt to gully and unworked roads soon become impassable. While the proportion of fine earth in the soil is sometimes relatively low, the deeper subsoil is by no means impervious to water and readily absorbs rainfall. The large quantities of gravel act as a mulch, preventing evaporation from the surface, and this aids the soil to withstand drought. Some springy places occur. These can be readily drained.

The Frankstown stony loam is a valuable soil type and is devoted to the general farm crops. It is recognized as a good corn soil, yields frequently running as high as 50 bushels to the acre, this being about the maximum for the county. Wheat does not do as well as on some other types, the average being about 15 bushels. Oats yield about 35 bushels. Buckwheat and rye are not commonly grown. This type is recognized as one of the best fruit soils of the county and several of the best orchards are located on it. There is still much of it that could be profitably utilized for fruit. Apples apparently do better than peaches. Potatoes also do well, and for this purpose the type ranks with Dekalb shale loam and Dekalb silt loam. Less fertilizer is used on this soil than on many others, but phosphatic fertilizers used in conjunction with clover or other leguminous crops plowed under or fed and applied as manure increase the productivity of and permanently improve the soil.

MORRISON SAND.

The Morrison sand to a depth of 6 inches consists of a mixture of white quartz sand and organic matter, giving a gray, loose, and incoherent sandy soil. Beneath this and extending to a depth of 36 inches is a yellow to reddish-yellow sand or loamy sand, loose and incoherent under ordinary moisture conditions. The organic matter of the surface soil consists largely of leaf mold and decayed moss. Some sandstone fragments are found on the surface, and in spots these are sufficiently numerous to interfere with cultivation.

Small areas of this type are encountered in the so-called Barrens of Morrisons and Friends Coves. They occupy the tops of knolls and ridges at elevations of 1,600 feet, or about 200 feet above the general level of the surrounding limestone valley. The loose texture of the soil and its topographic position insures thorough drainage.

The Morrison sand has been derived by weathering from siliceous members of the Trenton formation, the particles having accumulated on high, nearly level tracts where there is little washing. This rock is supposed to be somewhat calcareous, but no reaction indicating the presence of calcium carbonate was obtained and the soil itself is acid.

None of this type was seen under cultivation. It supports a dense second growth of chestnut and chestnut oak and some jack pine and scrub oak, with an undergrowth consisting principally of blackberry and huckleberry bushes. The forests could be very much improved by a little attention. Crops on this soil would probably suffer severely in times of drought, owing to its light texture, thorough drainage, and low moisture capacity. It is possible that the depth of the soil, which would permit a much deeper moisture reservoir than many of the other types and allow a deeper penetration for plant roots, would in some measure offset the effect of texture. This has proved to be the case with the Dekalb fine sandy loam.

For successful cultivation this soil would require lime, and, as the organic matter which is already present would probably disappear within a few years, clover or some other crop would have to be grown for incorporation with the soil. Fertilizers would also be necessary for production of satisfactory crops. The soil is naturally a trucking type. It should also prove well adapted to peaches and plums. However, unless handled with a view to soil improvement the type will prove more valuable when left in forests than when used for crops.

MORRISON STONY SANDY LOAM.

The Morrison stony sandy loam consists of 6 to 8 inches of dark-colored light sandy loam or loamy sand, containing considerable organic matter, underlain by a yellow, slightly reddish subsoil of much the same texture as the soil. This material extends to a depth of 36 inches, frequently becoming somewhat heavier with depth, but

rarely as heavy as a loam. The predominating sand is usually of medium to fine grade. Small areas of loam may also be encountered, but no attempt was made to indicate them on the map. Over the surface and throughout the soil profile, either in spots or in some cases covering entire areas, sandstone fragments are encountered of sufficient size and quantity to make their removal necessary before cultivation can be attempted.

This soil is found most extensively in the Barrens of Morrisons and Friends Coves, where it occupies the slopes of the high ridges and knobs. The topography is rolling to rough and the natural drainage well established.

It is derived from siliceous rock of the Trenton formation, but as it occurs on slopes the accumulation of fine earth has not been so great as in the Morrison sand. Material from limestones probably has some influence in this type, as outcrops of these rocks occur in it and the subsoil sometimes shows unmistakable Hagerstown color. Small sink holes are not uncommon and a faint reaction for calcium carbonate was obtained from some of the sandstone fragments, so that some of the cementing material of the sandstone is probably lime.

So little of this type is under cultivation that not much evidence of its producing power is available. It is not generally considered highly productive, although it could undoubtedly be improved and made a good soil, especially for truck, small fruits, and orchard fruits. Some excellent pear trees were seen on this soil in the Johnstown area,¹ and it is believed that pears, peaches, or plums could be profitably grown for market. The soil is not markedly acid, though lime should be applied if easily obtainable. In general farming clover should occupy an important place in the rotations. The use of fertilizers would doubtless be found necessary to the best results.

At present most of the type supports a heavy growth of chestnut, pine, and oak, and unless intensive handling of the soil is contemplated it would better be left in forest, as probably not over three profitable crops could be grown on the land without heavy fertilization.

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

Mechanical analyses of Morrison stony sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
181235.....	Soil.....	0.9	6.9	15.1	45.0	9.9	16.8	5.3
181236.....	Subsoil.....	.8	7.1	15.7	45.8	9.7	16.8	4.0

¹ Mapped as Morrison sandy loam in the Johnstown area.

MOSHANNON LOAM.

The Moshannon loam consists of 8 inches of Indian-red loam, frequently having a brownish cast, underlain to a depth of 36 inches by material somewhat heavier than the surface soil and usually of Indian-red color, with little, if any, of the brownish tinge. In texture the soil is slightly coarser than the Huntington loam, there being a larger proportion of medium sand grains and less of the very fine grade. On the surface and throughout the profile occur varying quantities of rounded stones ranging from mere pebbles to large bowlders. In places these are very numerous and an obstacle to tillage. Such areas have been indicated by the stone symbol. The type as a whole is variable, and small areas of fine sandy loam and even sandy loam are common, but no textures heavier than a loam were encountered. Owing to the small patches in which these lighter textures occurred, their separation from the Moshannon loam was deemed impracticable.

This type is confined to the bottoms of streams issuing from or traversing the large areas of Upshur shale loam and Upshur stony loam in the western and southeastern parts of the county. The largest areas occur along Bobs Creek, in the northwestern part. Most of the bottom of Brush Creek is composed of this type, but the area is narrow and unimportant agriculturally.

The surface of the type is uneven, though the range in elevation is seldom more than a few feet. Small ridges and hollows are numerous. The streams through areas of this type have remarkably swift currents and at times of overflow frequently cut new channels. There is thus no opportunity for them to build up broad, level flood plains. Periods of inundation last but a few days and often but a few hours. The surface relief is sufficient to give rapid run-off and the texture of the soil permits ready percolation, so that drainage is seldom deficient except in an occasional depression. The soil in the depressions is heavier than the average, while that of the ridges is likely to be much lighter and is often a fine sandy loam.

This type is largely composed of soil particles washed from the Upshur soils and redeposited from the overflow water of streams. Its limits, however, are by no means determined by the boundaries of that series, as the particles have usually been carried for many miles into regions otherwise occupied only by Dekalb soils. There is considerable Dekalb material throughout the type, but the red particles of the Upshur are present in sufficient quantity to impart their color to the entire deposit. The gravel and stones are also mostly fragments of red sandstone from the Catskill formation.

Much of this type is under cultivation and cropped to corn, wheat, oats, and clover. The areas where the subsoil is heavier than the soil are always more highly prized, as they hold lime, manure, and fertilizers better than the fine sandy loam areas, which are rather leachy. Lime and manure are used extensively on this soil. Commercial fertilizers are seldom used. The ground limestone rock and raw-rock phosphate would be desirable for this soil, especially the more sandy places, as they do not leach as readily as the forms of these materials commonly used. Corn yields about 35 bushels per acre, wheat 15 bushels, oats 30 bushels, and clover $1\frac{1}{2}$ tons. Buckwheat and rye are seldom grown.

HUNTINGTON LOAM.

The Huntington loam, to a depth of 8 to 10 inches, consists of a fine-textured brown loam. The subsoil is a slightly lighter-colored material, varying in texture from a silt loam to loam, with thin lenses of fine sandy loam, and extending to a depth of 36 inches. In local areas a faint reddish cast may be noted in the surface soil. Gravel and rounded stones are quite common throughout the soil profile, but only rarely in sufficient quantities to interfere with cultivation.

This type is confined to the narrower bottoms of the larger streams or to the bottoms of streams having an unusually rapid current. The principal areas occur along the Raystown Branch of the Juniata River and Dunning, Buffalo, and Yellow Creeks. The type frequently occurs as a narrow strip adjacent to the stream channels, while farther back is found the Huntington silt loam. The surface of the type is composed of numerous small ridges and hollows. Some of the prominent ridges approach the Huntington fine sandy loam, while Huntington silt loam occupies some of the hollows. Practically all of the type is subject to overflow, but water recedes rapidly and rarely stands on it for many days at a time. The texture of the soil allows rapid percolation, while the relief is sufficient to permit run-off.

This type has been formed by the deposition from overflow water of particles washed from upland types. The materials have been laid down in currents sufficiently strong to carry most of the silt and clay farther back from the stream or farther down the channels.

Most of the type is or has been under cultivation, and is considered a good, strong soil, though not quite so good as the Huntington silt loam. It is better adapted to trucking than the Huntington silt loam and could be utilized advantageously for this purpose. Crops for canning should prove profitable. The type is also a good general crop soil and is highly prized for corn and wheat. On well-drained areas alfalfa should yield well.

HUNTINGTON SILT LOAM.

The Huntington silt loam consists of a brown silt loam, 8 to 10 inches deep, underlain to a depth of 36 inches by material similar to the soil, but slightly heavier in texture and usually somewhat lighter in color. Slight variations in the texture may occur. Thus, when the type grades into the Huntington loam and Moshannon loam the texture may closely approach a loam and the color may show a tinge of red. There also occur small patches of both of these types in areas of the silt loam.

This soil is a very extensive bottom-land type and occurs along practically all of the larger streams, particularly along the Raystown Branch of the Juniata River and Dunning Creek. It is usually developed in the wider areas in the bottoms. Frequently a narrow strip of Huntington or Moshannon loam occurs next the stream, with the Huntington silt loam farther back. While these bottoms are quite level, there are slight differences in elevation, due principally to the remnants of old channels. While the type is subject to overflow, unusually high water is required to inundate it, and water rarely stands upon it for many days at a time. There are low places and pools in which water collects and stands for some time, but there is usually sufficient natural drainage to permit water to run off freely. Much of the type would be benefited by open-ditch or tile drainage.

The material of this type represents a mixture of soil particles washed from the Dekalb, Hagerstown, and Upshur soils, carried by the streams at times of freshets and deposited in the wider bottoms as the currents subsided.

Nearly all this type has been cleared and has at some time been in cultivation, but as cultivation is carried on at some risk because of wet conditions, much of the type is now used only for pasture or mowings. Most of the cultivated area is devoted to the general farm crops, corn and wheat, though oats are grown to some extent. Buckwheat or rye are seldom sown on this soil, as these crops are principally grown on the poorer soils, while this is considered one of the best types in the county. Corn averages about 35 bushels to the acre, though higher yields are common. Wheat averages about 18 bushels per acre.

Most of this type is shown by field tests to be acid, and the use of lime is thus indicated. Complete fertilizers are applied sparingly on this soil, but give some increase in crops.

HUNTINGTON FINE SANDY LOAM.

The Huntington fine sandy loam consists of a brown fine sandy loam 8 to 10 inches deep, underlain to a depth of 36 inches by a some-

what lighter colored material ranging in texture from almost a fine sand to a loam. More or less rounded stone is encountered throughout the profile.

This soil is a relatively unimportant type and occupies only small areas in the creek bottoms, the largest being along Wills Creek. The surface has but little relief and is apt to be rather badly cut up by stream channels, which are occupied only in times of high water. It is subject to inundation and may be either badly washed or built up during periods of overflow. Areas too small to map frequently occur near the stream channels in the Huntington loam.

The type is alluvial in origin and consists of material derived from all the upland types in the county deposited where the overflow currents have been relatively swift, thus allowing only the sedimentation of the coarser particles.

The type is used but little for agriculture, as it is rather leachy and will not hold manure or fertilizers. It is naturally a truck soil and could be profitably used in small areas where general farming would not pay. In places irrigation water from springs could be utilized for watering truck crops with excellent results.

DUNNING CLAY LOAM.

The soil of the Dunning clay loam consists of a very dark gray to black silty clay loam to clay. Beneath this material there is usually an inch or two of black clay, which for a few inches may be underlain by a mottled black and yellow clay, but which at 15 inches grades into a yellowish clay loam or clay. This reaches to depths varying from 30 to 40 inches, where a gravel bed or bedrock is encountered. This soil is the heaviest type in the bottoms. While it is quite plastic and sticky when wet, if properly handled it is mellow and tractable, and easily put in a condition of good tilth.

The type occupies bottoms along the principal streams. One large area occurs in rather narrow bottoms near Schellburg.

Most of the soil is unquestionably alluvial in origin, although in places some washed material has become mixed with it. It has evidently been formed by sedimentation of clay and silt from stagnant water.

The topography is nearly flat and drainage is rather poor, though in most cases artificial drainage could easily be installed.

This is a fairly strong soil and high in organic matter. Fertilizers are sometimes used on it, as on the other soils. Corn and wheat are the principal crops, but all the general farm crops are grown. The soil if well drained is naturally adapted to corn. Where drainage is inadequate the type makes excellent grass land.

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

Mechanical analyses of Dunning clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
181229.....	Soil.....	0.0	0.5	0.5	1.2	1.5	50.2	46.0
181230.....	Subsoil.....	.5	1.4	1.4	3.4	5.9	43.0	44.1

MEADOW.

In some of the bottoms there is such a complexity of soils of varying textures that separation into types is impracticable. Such areas are mapped as Meadow. Drainage conditions are nearly always poor, but otherwise the soil is good. The largest area occurs near Spring Meadow and is quite sandy, particularly in the subsoil. Color characteristics are somewhat similar to those of the Lickdale soils, the material being highly mottled. Drainage either with open ditches and tile and the use of lime give the most marked improvement. At present Meadow furnishes a better income when used for hay production than if used for cultivated crops.

ROUGH STONY LAND.

Rough stony land embraces steep mountain slopes or narrow ridge tops which are either too stony or too steep to be used for agriculture. It frequently includes land so rocky that even trees can not find a foothold, but in some places, as over much of the Allegheny Front, the rocks are not so numerous, and here the exceedingly steep slopes which make cultivation impossible throw the land in this category. The fine earth of these areas may be of any texture or color.

The type is derived from the Oriskany, the Upper Conglomerate of the Chemung, and mainly from the white Medina, Pocono, and Pottsville conglomerates.

These lands should be left in forest, as they are capable of supporting a valuable growth of chestnut, oak, and jack pine.

SUMMARY.

Bedford County is situated in the lower tier of counties of Pennsylvania and has an area of 1,067 square miles, or 682,880 acres.

The country consists of a succession of mountains and valleys, with the Allegheny Front on the west and Rays Hill and Broadtop Mountain on the east. The topography as a whole is rough and hilly,

but ranges from rugged on the mountains to level in the stream valleys.

The greater part of the county drains to the north through the Raystown Branch of the Juniata River. The southern section, comprising perhaps one-fifth of the area, drains into the Potomac River through numerous creeks.

The present (1910) population of the area is 38,879, a slight decline from the figures of 1900. The area was settled in 1755, the pioneers being mainly Scotch-Irish and German. The present population is composed largely of descendants of the early settlers.

Rail transportation is supplied by the Baltimore & Ohio and the Pennsylvania systems. Most of the towns of the area are within easy haul of the railway.

The climate is marked by a wide range in temperature. The summers are delightful, but the winters ordinarily are long and rather severe. The normal rainfall is about 41 inches. The average dates of late and early killing frosts are May 5 and October 8, respectively. The average growing season is about 150 days.

Grain farming is the dominant system of agriculture, though considerable dairying is carried on in certain localities. Trucking is carried on in a small way. Fruit growing is of minor importance, but capable of profitable extension.

The general rotation of crops is corn, wheat, oats, and hay, consisting of timothy or clover, or both. Buckwheat and barley are also grown. Alfalfa is beginning to assume importance and is grown on many of the soils.

Silos are common in the cove regions.

Lime is in common use on nearly all the soils, together with commercial fertilizers, especially for the wheat crop. Farm manure is universally saved and is considered the best means of maintaining the soils in a productive state.

More effort should be made to increase the supply of organic matter in nearly all the soils in order to conserve moisture, prevent leaching, and increase crop yields. A more scientific use of fertilizers is urged.

On the nonagricultural lands systematic forestry is to be recommended.

There are three classes of soil in the county—residual, alluvial, and colluvial. The residual soils occupy the uplands and are the most extensive. They are derived from sandstones, shales, and limestones. The sandstones and shales give rise to two main series—the Dekalb, which is yellow, and the Upshur, which is red.

Of the Dekalb series 7 types were recognized—the silt loam, stony silt loam, loam, stony loam, shale loam, fine sandy loam, and stony sandy loam. These soils, as a rule, are the least productive of the

area. The stony silt loam is probably the strongest, followed closely by the silt loam and loam, while the shale loam ranks fourth. The stony silt loam and shale loam are excellent fruit soils. The fine sandy loam is well suited to truck, but the stony loam and stony sandy loam are but little used except for forestry.

Three members of the Upshur series were mapped—the shale loam, stony loam, and stony sandy loam. They are all better soils than the corresponding members of the Dekalb series. The shale loam is the most extensive and is a fairly good soil, both for general crops and fruit. The stony loam is somewhat less valuable and the stony sandy loam is but little used.

To the sandstone and shale soils belongs also the Chemung shale loam, which is somewhat better than the Dekalb shale loam, but not so good as the Upshur shale loam.

To the limestone soils belong the Hagerstown clay loam, silt loam, loam, stony loam, and sandy loam. The clay loam and silt loam are the best soils of the county, while the loam, sandy loam, and stony loam are also highly prized. In this group also is the Frankstown stony loam, which is a good soil for corn. It is also well adapted to apples.

The Morrison series is represented by the sand and stony sandy loam types. These are mostly in timber, but would probably be good truck or peach soils.

The alluvial soils belong mainly to the Huntington and Moshannon series. Of the former the silt loam, loam, and fine sandy loam were mapped, and of the latter the loam. These are good soils for trucking or general farming in areas that can be well drained.

The Dunning clay loam is of small extent, but valuable for general crops or heavy trucking.

The colluvial soils are represented by the Lickdale clay loam. It is poorly drained and composed principally of mowing lands, though it can be drained and made a good soil.

Meadow and Rough stony land are miscellaneous types. The former is poorly drained and used principally for grass. The latter is a nonagricultural type, but of value for forestry.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.