

SOIL SURVEY OF HARFORD COUNTY, MARYLAND.

By W. G. SMITH and J. O. MARTIN.

INTRODUCTION.

Harford County, Md., lies between the parallels of latitude $39^{\circ} 20'$ and $39^{\circ} 45'$ north and meridians $76^{\circ} 05'$ and $76^{\circ} 33' 40''$ west from Greenwich. The boundary on the north is the Pennsylvania and Maryland State line; on the east and south the Susquehanna River and Chesapeake Bay, and on the west the Gunpowder River. The area of the county is 418 square miles.

The chapter on geology is based on the report of the Maryland Geological Survey, Volume III, 1899. The historical matter is taken in part from Maryland school histories and in part from information obtained from members of local historical societies, who also rendered valuable assistance by furnishing material for the chapter on agricultural conditions. The writers desire to acknowledge especially their appreciation of assistance received from Mr. James A. Lyle, of Belair; Mr. John D. Worthington, of the board of education, also of Belair, and Mr. Wm. L. Amoss, of Benson, superintendent of the State farmers' institutes.

The base map consists of recent topographic sheets prepared by the United States Geological Survey. They were found to be very accurate in nearly every detail, and were very satisfactory to work with in the field.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

During the spring of 1634 some English Catholics settled in what is now St. Mary County. This was the first white settlement in Maryland. It was under the leadership of Leonard Calvert, who succeeded his brother, Lord Baltimore, who had a short time before died, to the proprietary governorship of Maryland. These settlers were soon followed by other colonists possessing other religious beliefs, among them some English Presbyterians, who settled in the limits of Harford County, along the Gunpowder River, about the year 1650, and a colony of English Quakers, who took up lands along the Susquehanna River about the year 1700. In the northern part of the county there are

some families of German extraction that came in from the early and subsequent German settlements of southeastern Pennsylvania. There have also come into the county in late years some Bohemian immigrants. These are to be found mostly along the railroads and near canning factories, where they and their children find employment part of the year. About one-fifth of the population of Harford County is colored.

As was the case with so many of the early colonists, the motive which prompted the settlers of Harford County to leave the mother country was primarily that they might enjoy religious freedom, but the spirit of adventure and the desire for discovery and exploration very soon brought over many not imbued with the spirit of toleration toward other colonists or of justice to the Indians. The history of the early settlement is thus marked by many struggles with Indians, as well as by internal dissensions among the colonists themselves. These conditions for a long time prevented the settling of land remote from the water courses. It was not safe for individuals to venture far into the forest to settle when by so doing they might fall a prey to the Indians or some no less hostile white men. Thus it was that the early settlers confined themselves largely to the Coastal Plain section of the county and there mainly to the shores of the larger streams, where better protection was afforded by the more ready means of communication with each other, and where also a part of their food could be secured by fishing.

The Indian method of agriculture was of course primitive. Such as they practiced was confined mostly to the open savannas of the Coastal Plain section, where but little grubbing of trees was necessary and where, also, fishing could be engaged in. The fields consisted of small patches of ground, which were stirred with crude implements, consisting of sharp stones and sticks. This was about the only cultivation until the gathering of the crops. It is, however, interesting to note that these savages knew something of fertilization of the soil, for it was a practice with them to place with the corn and beans or potatoes they planted fish and other refuse matter. The labor connected with their agriculture was performed by the squaws, while the men hunted, fished, and fought in the tribal wars.

The agricultural products grown by the early whites were in the main those grown by the Indians, with some improvements, however, in methods of cultivation.

The offer by the proprietary government, about the middle of the seventeenth century, of large tracts of land on very easy terms attracted many settlers from the mother country, as well as some from those already located in Virginia and the Carolinas. This marked the beginning of the movement from the water courses back into the then unex-

plored upland of the Piedmont area. The century following was marked by many hardships suffered at the hands of savages by those who dared thus venture into the then trackless forest.

The building of public roads prior to and after the Revolution and the elimination of danger from the Indians also permitted the settlement of the portions of the county more removed from the main waterways and marked the beginning of a more extensive tilling of the soil. During these early times there was considerable legislation looking to the construction of public roads.

Harford County was erected out of Baltimore County in the year 1773, with Bush as the county seat. A few years later the county seat was removed to Belair.

CLIMATE.

The southern part of Harford County, low-lying and bordering the Chesapeake, has a climate rather more humid and temperate than has the more elevated Piedmont Plateau area. The extremes of temperature are not so great in the Coastal Plain section, and snow does not lie so long here as it does in the plateau. The annual rainfall averages about 42 inches and is quite evenly distributed throughout the year. The months of July and August, however, are sometimes rather too dry for corn and forage crops. The autumns are generally moist enough to give the winter grains a good start. The summer temperature ranges from 65° to 100°, and the winter temperature from -10° to 60° F. Early frosts of sufficient severity to injure tender foliage may come about the first week in October, and late frosts in the spring about the last week in April. The soil rarely freezes more than 6 inches deep in winter, and frequently there is scarcely a month during which plowing may not be done. Oftentimes both in summer and winter a heavy fog rolls up from the bay during the night, generally disappearing the following day. But when these fogs occur in winter and do not quickly disappear they give rise to wet, disagreeable weather, which if long continued makes the roads muddy and occasions other discomforts. As a whole, however, the climate of this county is conceded to be quite healthful and agreeable.

In the following table are given the temperature, precipitation, and dates of killing frosts for Darlington, situated upon the Piedmont Plateau, and Van Bibber, located in the Coastal Plain region of the county:

Normal monthly and annual temperature and precipitation for Harford County, Md.

Month.	Temperature.		Precipitation.	
	Darlington.	Van Bibber.	Darlington.	Van Bibber.
	°F.	°F.	Inches.	Inches.
January	29.7	31.5	3.07	2.34
February	30.2	33.0	3.20	4.42
March	40.5	40.8	2.93	.....
April	51.0	52.3	3.26	2.65
May	62.0	63.6	4.55	4.74
June	70.6	70.2	3.36	2.24
July	74.8	76.7	4.33	5.03
August	73.0	74.1	3.63	4.60
September	66.7	67.0	3.61	2.69
October	53.4	54.3	3.24	3.78
November	43.3	44.0	3.91	5.00
December	35.2	34.3	2.68	3.04
Normal annual	52.6	53.5	41.77	.....

Dates of killing frosts.

Year.	Darlington.		Van Bibber.		Year.	Darlington.		Van Bibber.	
	Last in spring.	First in fall.	Last in spring.	First in fall.		Last in spring.	First in fall.	Last in spring.	First in fall.
1893 .....	.....	Oct. 17	.....	.....	1898	Apr. 23	Oct. 26	Apr. 7	Oct. 27
1894	Apr. 12	Oct. 12	.....	.....	1899	Apr. 11	Sept. 30	Apr. 10	Oct. 21
1896 .....	.....	Oct. 8	Apr. 22	.....	1900 .....	.....	Oct. 18	.....	.....
1897	Apr. 21	Oct. 30	Apr. 20	Oct. 18					

PHYSIOGRAPHY AND GEOLOGY.

Harford County has within its borders two distinct physiographic systems. The northern four-fifths of its area lies in the Piedmont Plateau, 200 to 700 feet above sea level, possessing a surface varying from gently rolling to rather hilly, with streams that are generally rapid, flowing in deeply cut valleys. The southern one-fifth of its area lies in the Coastal Plain, 10 to 90 feet above tide level, with a surface generally quite flat, and with broad, tidal streams and sluggish creeks but little below the land surface.

The hills of the Piedmont Plateau adjacent to the larger streams are often quite steep-sided, while those in the interstream areas are moderately steep and rounded. They range in elevation from 40 to 200 feet above the streams.

The principal drainage of the county is southward into the Ches-

peake Bay by the way of the Gunpowder River, Deer Creek, Susquehanna River, and the several branches leading into these.

The rocks of the northern part of the county embrace those which are characteristic of the Piedmont Plateau from New England to the Southern States. These rocks represent the older formations of the earth's surface, consisting of granites, gneisses, and schists cut by intrusive masses of diabase, gabbro, and serpentine. Some of the younger rocks of the Piedmont Plateau, such as slate and the highly micaceous, schistose phyllite, occur here. A small outcrop of crystalline limestone occurs in the western part of the county. The gneiss and schist are believed to have originally consisted of sedimentary deposits. The rocks of the Piedmont Plateau, aside from many good soils that they give rise to, contain many economic products. The granites and gneisses furnish building stone, and though there are no large quarries getting out stone for export, there is some quarrying for local use.

The rocks of the Piedmont Plateau, with only one or two exceptions, give rise to productive soils. The granites and gneisses form either the Cecil loam or the Cecil mica loam, according as the mica content varies in the rock. Strangely, the highly micaceous-appearing phyllite weathers almost always into Cecil loam, which is a silty loam containing only a small proportion of fine fragments of mica. The gabbro, a fine-grained, bluish rock, originates red clay, a stony phase, and a peculiar heavy yellow clay, the latter derived from hypersthene gabbro, from which red clay would naturally be expected. The gabbro when crushed makes excellent road metal. The serpentine rock, extending in a general northeasterly course from Jarrettsville through to Mackton and Flintville, gives two soil types—a productive loam and a stony, droughty, unproductive type. The slate formation gives a heavy yellow clay soil that is quite productive and is also well adapted to forestry and orcharding. From the Coastal Plain formations are derived five types of soils, which vary in texture from gravelly to sandy, silty, and heavy clay.

That portion of Harford County lying in the Coastal Plain region consists of two quite large river necks, rising from the tidal marshes of Chesapeake Bay to an elevation of from 80 to 90 feet above mean tide level. The coast line is greatly lengthened by a series of indenting bays and creeks, and a large portion of this coast land consists of marsh, more or less submerged at high tide. The general topography is very gently rolling, with no steep slopes, and the farm lands of this region are consequently quite flat.

The geological history of the Chesapeake Bay Coastal Plain has consisted, at least since Cretaceous times, of a series of elevations and depressions of the land above and below sea level, thus giving rise to a series of soils which differ entirely in origin from those of the

Piedmont region, which has in the meantime remained above sea level. The position of the shore line at the maximum submergence is shown by the remnants of Susquehanna clay and gravel of the Cretaceous period, and follows in general the line of the Baltimore and Ohio Railroad. With the waters of the Chesapeake standing at this shore line, all of the Coastal Plain of Harford County was submerged and the streams of the Piedmont region cutting into the residual soils of that area were continually bringing down loads of sediment, which were deposited in the still waters of the bay. With elevation the older deposits were exposed to weathering and stream erosion and thus cut into irregular surfaces, besides being tilted from their original horizontal position; and thus we find the Cretaceous clays and gravels cut into exceedingly irregular forms. During the last submergence of this region, in late Pleistocene times, the present soils were deposited upon the eroded remnants of Cretaceous and later deposits.

At present the Chesapeake Bay region appears to be undergoing a descending movement, by reason of which the waters have backed up into the stream valleys, creating the numerous bays and tidal estuaries in which at present the streams are depositing a new series of soils, just as the Elkton clay was deposited at some earlier and slightly greater depression.

As a result of this geological history we have in the Coastal Plain soils which are sedimentary in nature, that is, soils deposited in water in distinction from the residual soils of the Piedmont, which result directly from rock decay.

SOILS.

Twelve soil types were recognized and mapped, six of which are residual and six sedimentary. The following table shows the extent of the soils found in the area surveyed:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Residual:			Sedimentary:		
Cecil loam.....	110,320	41.3	Sassafras loam.....	29,810	11.2
Cecil clay.....	39,890	14.9	Susquehanna gravel.....	12,930	4.8
Cecil mica loam.....	39,390	14.9	Elkton clay.....	11,370	4.8
Conowingo clay.....	6,510	2.4	Susquehanna clay.....	4,890	1.8
Conowingo barrens.....	3,280	1.2	Meadow.....	4,440	1.7
Cardiff slate loam.....	1,690	.6	Norfolk sand.....	2,470	.9
			Total.....	267,510	.....

CECIL CLAY.

Cecil clay occurs as a long, narrow strip, extending in a northeast and southwest direction through Benson, Belair, Dublin, and Darling-

ton to the Susquehanna River. Another area, shorter but much broader, extends from Carsins to Havre de Grace.

The surface of the Cecil clay varies from hilly to gently rolling. The elevation above the stream beds ranges from 10 to 60 feet and above the sea from 200 to 455 feet. This type is derived mainly from gabbro, a fine-grained bluish rock that has been intruded through the other formations. The process of soil forming has been by a slow weathering of the rock, which decays from the outside, a thin sheet at a time, leaving the inner portion often quite fresh, giving a clear ring when struck with the hammer. This form of slow weathering leaves in the Cecil clay soil the characteristic rounded bowlders locally spoken of as "niggerheads," and gives to the soil the name of "niggerhead land." The soil of the Cecil clay consists largely of a brownish clay loam from 6 to 15 inches deep, underlain by a heavy red or yellow clay subsoil. There are some local variations from this type, such as a heavy red or yellow clay soil. A notable instance of the heavy yellow clay soil phase was found in the vicinity of Aldino. In this case the original rock from which the soil is derived was found to be a highly altered hypersthene gabbro which contains considerable hornblende, diallage, and feldspar—minerals that usually give rise to a red clay instead of yellow clay as in the present case. The soil in this instance is locally known as "mud land," being flat and poorly drained, and very muddy during wet weather. It is also spoken of as "white-oak land," from the timber growth, which is also characteristic of the refractory Elkton clay in the southern part of the county. When artificially drained by ditching or plowing in beds, this heavy yellow clay phase is said to be very productive, yielding 2 or more tons of hay per acre, and grain and corn in like proportion.

Both soil and subsoil of the Cecil clay may contain from 10 to 30 per cent of rounded bowlders, varying from 4 to 10 inches in diameter. The larger stones have in many instances been removed and piled on the sides of the fields as stone fences. At a depth of 4 to 8 feet large fragments of rock and massive gabbro are generally met with. Quartz fragments are usually found in the soil. These are derived from the quartz veins that occur in the gabbro formation. There are stony portions (about 40 per cent of the area of the type as it occurs in Harford County) that are at present fit only for forests, being so stony that tilling is impracticable. The stones range from 10 to 60 inches in diameter, are rounded and subangular in form, and in places constitute the greater part of the surface. These areas are confined largely to the steeper slopes, where erosion has been more active in removing the earth as it was weathered slowly from the gabbro rocks. It is by no means waste land because of its use for forestry purposes. Considerable oak and hickory is cut from these areas each year, a more or less conservative system of cutting only the

mature timber being commonly practiced so as to continue such areas as forest reserves. It also serves very well as wooded pastures for cattle, sheep, and hogs. The portion of the Cecil clay area excessively stony, as just described, is indicated by symbol on the soil map, while the tillable portion is shown by plain color.

The Cecil clay ranks as a rather heavy soil, is strong and yields well, and in the growing of grain and grass crops admits of being brought up to a higher state of productiveness than any of the other soils in the county. The yield of wheat ranges from 25 to 35 bushels per acre, and even 40 to 50 bushels per acre are reported in instances where the soil was well manured and tilled. Shelled corn yields at the rate of 35 to 75 bushels per acre; oats from 40 to 80 bushels per acre. Tomatoes for canning purposes also produce well, yielding from 150 to 350 bushels per acre. It is good grass and hay land, yielding from 1 to 2 or more tons per acre, while fruit and forest trees thrive on this soil. The native forest growth consists of oak, maple, and gum. On the Cecil clay soil are to be found some of the best farms in the county. Indeed it is so well known for its natural strength that, though small in extent, it seems more spoken of than any other soil formation in the county. It holds fertilizers, manure, and moisture very well, and thus readily admits of permanent improvement. The Cecil clay is best adapted to grain and grass, either for hay or pasture, but a number of other crops are also successfully grown.

The following table shows the texture of samples of both soil and subsoil of the Cecil clay:

Mechanical analyses of Cecil clay.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.								
6113	2 miles W. of Darlington.	Clay loam, 0 to 10 inches.	0.06	9.38	1.72	3.46	2.70	9.10	3.74	39.56	29.86	
6115	2½ miles W. of Darlington.	Red silty loam, 0 to 10 inches.	.02	7.96	.58	2.00	1.54	4.98	3.90	46.22	32.12	
6114	Subsoil of 6113....	Yellow clay, 10 to 36 inches.	.02	9.48	1.38	3.82	2.90	8.86	3.94	34.62	34.66	
6116	Subsoil of 6115....	Red clay, 10 to 36 inches.	.01	8.00	.88	2.58	1.28	3.44	2.84	28.76	51.67	

CECIL LOAM.

The Cecil loam constitutes a soil type common not only in Harford County but also in Cecil County and in other parts of northern Maryland and adjoining States. It is the most extensive soil type in the present survey, amounting to 41 per cent of the area of the county. This type is well watered and well drained by the numerous streams that traverse it. The surface features of this type are those of the upland, varying from gently rolling to rather hilly, with hilltops lying in the same general sky line. The soil is derived from the slow weathering of the granites, gneisses, phyllites, and schists which occur in the Piedmont Plateau. Situated south of the limit of the erosive action of the ice during Glacial times, the slow action of subaerial decay has permitted the weathered material to accumulate as a soil covering, shallow or deep, depending on the local erosive action of rains. Generally this covering is several feet deep, being 20 or 30 or more feet in some cases. Oftentimes road cuts show thoroughly decomposed soil grading down through various stages of decayed rock to fresh rock. This forms a very favorable mass of material for the absorption and conservation of water for plants, as well as a reserve supply for springs and the numerous clear, flowing streams which characterize the Piedmont area in Harford County. The Cecil loam is thus a residual soil derived from the rocks that underly it. The soil consists of a brownish-yellow silty loam 10 or 15 inches deep, underlain by a lighter-colored silty clay loam. Both soil and subsoil may contain from 10 to 20 per cent of moderate-sized pieces of quartz and rock fragments, and oftentimes a considerable amount of small bits of partially decomposed gneiss is present. The sand wherever found is sharp and angular. Occasionally, at the depth of 20 or 30 inches, it grades into highly decomposed granite or gneiss that still preserves the rock structure. The local variations as to texture are not great as a rule. Occasional stony areas were noticed that are not easily tilled, but are kept in forest, consisting usually of desirable hard wood.

The steeper hillsides are generally stony and support a forest growth of useful trees, beneath which is generally a tangle of scrub laurel and brier. A notably stony area, indicated on the soil map by symbol, occurs as a narrow stony ridge about one-half mile wide and 6 miles long, extending in an east and west direction through the village of Rocks, in the northern part of Harford County. Except where it is bisected by Deer Creek it is one continuous ridge, with a very stony surface and rather steep sides, and ranging quite uniformly 500 to 600 feet above sea level. It consists largely of quartzite and quartzose sandstone and other metamorphosed rocks. The soil is generally found in a shallow layer resting on a broken mass of the rock from which it is derived. It usually contains a considerable quantity of

various sized rock fragments. On the top of the ridge and on its steeper sides large masses of rock 3 to 50 feet in diameter protrude several feet in the air. The process of soil forming here has been one of slow weathering of the quartzites and other resistant rocks. The disintegrated material was washed away by the rains from the steeper sides, causing some soil accumulation on the easier slopes, which alone are now tillable. This stony area is nearly all forested with a fair growth of chestnut, oak, and other useful trees. It would seem that the soil has some possibilities for chestnut culture and that it might be used in growing apples, plums, peaches, and other orchard fruits. At one time some iron was mined in this area, but the mines have for some time been abandoned, the lode being of too low a grade to be operated in competition with other and richer mines. The rock composing the ridges would make fairly good road material.

The greater part of the area of the Cecil loam type, however, is cleared and cultivated, and within it are found many good, substantial farm buildings and other improvements. The Cecil loam is classed as good soil and, while not naturally as strong as the Cecil clay, it can by careful management be made very productive. Large quantities of tomatoes are grown on this soil, ranging in yield from 150 to 300 or more bushels per acre. It seems to be especially good corn land, yielding from 40 to 80 bushels of shelled corn per acre in addition to from 4 to 6 tons of stover. Oats yield from 30 to 60 bushels, and wheat from 20 to 30 bushels per acre. The usual rotation practiced on these soils is: (1) Grain, consisting of wheat, oats, or rye, two years; (2) grass, consisting of a mixture of clover and timothy, two years; (3) corn, two years; after which comes wheat or other grain again. This rotation is modified to some extent when tomatoes are grown. Manure added to this soil has a marked beneficial effect, in that it supplies organic matter normally deficient in the soil and improves the moisture-retaining power of the soil. Lime, added in conjunction with the manure, improves the productiveness of this soil for several years afterwards. The farms are of moderate size, ranging from 150 to 250 acres, and are generally tilled by their owners. The fields and buildings are generally well kept, and the people appear prosperous. Some of the best improved farms are located on this soil formation, and the Cecil loam ranks as one of the desirable soils of the county.

Mechanical analyses of soil and subsoil are given in the following table:

Mechanical analyses of Cecil loam.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.								
6121	1 mile W. of Norrisville.	Brown, silty loam 0 to 10 inches.	0.01	5.40	5.96	6.14	4.36	13.68	6.38	33.84	23.67	
6125	2 miles NE. of Shawsville.	Brown, silty loam, 0 to 12 inches.	.01	5.92	2.80	2.96	1.80	9.44	6.10	41.42	29.27	
6122	Subsoil of 6121....	Silty loam, 10 to 36 inches.	.01	5.06	7.60	8.88	4.30	12.80	5.68	30.16	25.35	
6126	Subsoil of 6125....	Silty loam, 12 to 36 inches.	.01	5.92	3.86	4.28	2.10	9.72	5.66	42.40	25.49	

CECIL MICA LOAM.

The Cecil mica loam is closely related in its origin to the Cecil loam, just described. It is derived from the same rocks, namely, granite, gneiss, and phyllite, the difference being that the mica constituent of these rocks was such that a micaceous character was given to the soil, thus forming the basis of a new soil type. The presence of much mica in the soil has given it the local term of "isinglass soil." It has the same general surface features as the Cecil loam, namely, gently rolling to somewhat hilly. The elevation ranges from 300 to 600 feet above the sea. The area of this soil is mostly limited to the southwestern portion of the county.

The process of soil forming has been similar to that of the Cecil loam, namely, a slow weathering of the granites and gneisses to great depths without any rapid erosion, thus leaving a great mass of material suited to absorbing and conserving the water supply.

The Cecil mica loam is a residual soil, consisting of a brownish loam 10 or 15 inches deep, underlain by a lighter-colored heavier loam, both soil and subsoil containing varying amounts of mica. The color may vary from light brown to red, and the soil is sometimes called white or red isinglass soil. Rock fragments varying in diameter from 1 to 6 inches are generally present, but not in sufficient amounts to obstruct tillage to any great extent. Frequently very small bits of partially decomposed granite and gneiss are much in evidence. There is also an appreciable amount of sand generally present, which gives to the soil a somewhat sandy texture in distinction from the silty texture of the Cecil loam.

Often there is no marked difference between the soil and subsoil, the whole to a depth of 36 or more inches being a moderately light loam. Occasionally at this depth, or at a greater one, it grades into highly decomposed rock that still preserves in a measure the original rock structure. The texture of this material is of such a character that the roads cut deeper and work up rather more sandy than in the Cecil loam. The local variation of the Cecil mica loam as to texture is not great. Occasional stony areas are found, however, which are generally covered with hard-wood forests. The stony areas are usually confined to small knobs and the steeper hillsides, where erosion has been more active, just as they occur in the Cecil loam area. The greater part of the Cecil mica loam area is tilled, usually in moderate-sized and well-kept farms. It is classed as a good soil for general farm crops, though its texture is somewhat like that desired for a truck soil. It is not naturally a strong soil, but is susceptible of being made quite fertile and productive through intelligent tilling and manuring. It is warm and gets in condition early in the spring. Good crops of corn, grain, hay, and tomatoes are obtained, the yields nearly equaling those reported for the Cecil loam. The methods of rotation, manuring, and tilling used on the Cecil loam are followed generally on the Cecil mica loam. The ease of tilling under a wide range of weather conditions and the possibility of growing a variety of crops, where due attention is given to manuring, place this type also among the desirable soils.

The mechanical analyses of soil and subsoil of the Cecil mica loam are given in the following table:

Mechanical analyses of Cecil mica loam.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6129	2 miles S. of Jarrettsville.	White sandy loam, 0 to 15 inches.	0.01	7.66	3.80	10.46	9.86	20.84	4.98	21.48	20.45
6127	Scarff.....	Sandy loam, 0 to 10 inches.	.01	5.30	2.82	3.72	3.38	7.36	3.70	40.44	32.55
6130	Subsoil of 6129....	Sandy loam, 15 to 36 inches.	.01	3.68	13.48	29.52	15.40	22.66	2.98	4.40	7.93
6128	Subsoil of 6127....	Red sandy loam, 10 to 36 inches.	.01	6.94	5.36	12.52	7.30	18.12	3.22	15.98	30.45

CONOWINGO CLAY.

The Conowingo clay occurs in the northern part of the county, in the Piedmont Plateau, extending in broken strips in a southwesterly and northeasterly direction from Jarrettsville to Scarboro and Mackton. The surface varies from easy slopes to rather steep hills. The soil is derived from the weathering of serpentine and steatite or soapstone, altered intrusive rocks of a dark greenish color related to the gabbro, but differing from it in being poor in alumina, silica, and lime. The process of rock decomposition has been by weathering from the outside, assisted also by deep-seated mineral alteration processes within the rock itself. The minerals are largely iron and magnesian silicates. The content of lime, potash, and other constituents, recognized as essential to a fertile soil, are low, and to this has been ascribed in part the unproductiveness of some of the soils derived from the serpentine (peridotite and pyroxenite) rocks.

The Conowingo clay consists of a brownish or yellowish silty loam 10 to 15 inches deep, underlain by a yellowish or, sometimes, red clay loam. It represents what is termed the productive serpentine soil, in distinction from a barren phase (Conowingo barrens) that is also derived from the serpentine rock formation. Where the same attention is given to manuring and tilling, the Conowingo clay yields nearly as well as some of the productive loams previously described. Indeed, there are instances where it is difficult to distinguish it from the Cecil loam and the Cecil clay soil types. From 40 to 60 bushels of shelled corn, from 20 to 30 bushels of wheat, and from 30 to 60 bushels of oats per acre are reported grown on this type. A large part of the Conowingo clay is cultivated, and the remainder bears good forests of hard wood, including chestnut and oaks. Some prosperous and well-kept farms are to be seen on this type. Farmers, however, recognize the fact that if once the fertility is allowed to run down it is rather difficult to build it up.

The following table of mechanical analyses of soils and subsoils shows the physical character of the Conowingo clay:

Mechanical analyses of Conowingo clay.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.								
6133	2 miles N. of Dublin.	Yellow silty loam, 0 to 12 inches.	0.01	4.00	1.30	1.98	0.98	3.68	6.76	54.08	26.37	
6135	2½ miles N. of Dublin.	Reddish silty loam, 0 to 10 inches.	.01	5.02	0.28	1.00	1.06	2.20	2.22	53.56	34.35	
6134	Subsoil of 6133....	Yellow clay loam, 12 to 36 inches.	.01	4.44	0.64	1.36	0.70	2.50	2.84	59.62	27.37	
6136	Subsoil of 6135....	Red clay, 10 to 26 inches.	.01	6.84	1.34	1.70	1.88	5.48	3.46	36.72	42.65	

CONOWINGO BARRENS.

As far as origin is concerned this type is closely related to the Conowingo clay, with which it is found associated. It is the unproductive or barren phase derived from the serpentine rock formation, and has the same general position as that above described for Conowingo clay, occurring in the northern part of the county and extending in broken areas in a northeasterly direction from Jarrettsville to Mackton and on to the Susquehanna River. The elevation above the sea ranges from 500 to 700 feet. The aggregate area of this soil is small, being only 1.2 per cent of the area of Harford County. It is locally known as "glade land." The surface is stony and hilly; indeed, the Conowingo barrens are confined almost wholly to the stony knobs and ridges occurring in the serpentine rock formation. As the soil covering is generally shallow and the underlying rocks much cracked, a droughty condition is favored, which probably accounts in part for the barren aspect of the areas. Their unproductiveness has been ascribed also in part to an excess of magnesia, which, it is urged, may be neutralized by the addition of lime, thus converting these soils into moderately productive areas. The serpentine rock is composed largely of iron and magnesian silicates and is low in other constituents, such as lime and potash, recognized as essential to a productive soil.

The soil of the Conowingo barrens consists essentially of 8 or 10 inches of pale yellow loam, although sometimes the color is red, resting generally on a broken mass of serpentine rock. Generally the

soil contains a large percentage of medium-sized rock fragments more or less cubical in form. It is, in the nature of the case, unsuited to farm crops of any kind, nor does it seem to possess qualities to adapt it for forestry or orcharding, judging by the forest growth now found upon these areas, which is generally stunted and unpromising. The more pronounced phases of this soil type usually bear a very stunted growth of oak, beneath which is a tangled, well-nigh impassable undergrowth of sedge grass, briars, and laurel. Twenty or thirty years ago there were some extensive chrome and magnesia mines, as well as some iron mines, operated in this area, but these have long since been abandoned, because of the discovery of richer deposits elsewhere.

The following table of mechanical analyses shows the texture of the fine earth portion of the Conowingo barrens:

Mechanical analyses of Conowingo barrens.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>								
6131	3 miles N. of Dublin.	Brown silty loam, 0 to 9 inches.	0.01	4.90	5.62	3.94	1.90	3.00	3.64	47.18	29.43	
6132	Subsoil of 6131	Yellow silty loam, 9 to 36 inches.	.01	5.26	2.20	2.92	1.52	3.88	1.70	52.28	30.87	

CARDIFF SLATE LOAM.

This type of soil occurs on a prominent ridge lying in the northern part of the county and extending in a northeasterly course from Pylesville, through Cardiff, into Pennsylvania. It is a rather uniform ridge about 1 mile wide, with about 3 miles of its length within the limits of Harford County. Its surface is quite stony. It is generally forested with a good growth of oak and chestnut, and has an elevation above the sea of from 500 to 650 feet.

The soil is derived from the slow disintegration of slate rock, which—being composed largely of relatively insoluble material, namely, indurated mud, consisting of finely divided particles of quartz and other insoluble matter—does not readily form soil. The process is limited to physical disintegration, unassisted by much of the chemical breaking down of the minerals which occurs in the case of most of the crystalline rocks.

The soil consists of a heavy yellowish-brown loam, from 8 to 10 inches deep, underlain by a heavy yellow silty clay. Usually there is a large amount of small fragments of partially decayed slate in both soil and subsoil. These fragments seem to make quite friable, under a wide range of moisture conditions, what otherwise would be a heavy clay soil. At a depth of 36 inches or more the earth rests on a mass of broken slate or sometimes on a solid ledge. The massive slate usually stands with its cleavage at a steep angle; thus drainage is good, but not excessive, because of the heavy texture of the soil and subsoil. About 50 per cent of the Cardiff loam is cultivated and good crop yields are obtained. From 50 to 85 bushels of shelled corn, from 25 to 35 bushels of wheat, and from 1 to 3 tons of hay per acre are some of the yields reported for this type, although these are probably much above the average.

The land finds its highest value, however, in the large amount of commercial slate that largely composes the ridge. Several large quarries are operated, and the shipment of slate from the Harford County area amounts annually to 30,000 squares, valued at about \$150,000. Owing to the limited capital invested in working these quarries, the output is only about one-fifth of the market demand for this quality of slate.

The following analyses of soil and subsoil show the texture of the Cardiff slate loam:

Mechanical analyses of Cardiff slate loam.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.								
6137	½ mile S. of Whiteford.	Brown silty loam, 0 to 12 inches.	0.01	5.66	1.20	1.46	0.60	1.72	2.34	55.60	30.99	
6138	Subsoil of 6137....	Yellow clay loam, 12 to 36 inches.	.....	5.96	1.94	2.26	1.22	3.78	3.68	52.50	28.82

SASSAFRAS LOAM.

The Sassafras loam is the most productive and important of the Coastal Plain soils of Harford County. It occurs in areas of varying size on Bush River and Gunpowder necks, where it forms the bulk of the land at present under cultivation. The largest area of this type

occurs just south of the line of the Baltimore and Ohio Railroad, on Bush River Neck, where it is found at elevations of from 60 to 80 feet. Elsewhere the Sassafras loam occurs at lower levels and is intersected and cut up by numerous narrow areas of Elkton clay. The general slope from higher to lower levels is not broken by any distinct terrace shelf, but falls away gradually, with a gentle, rolling topography, to tide level.

The soil of this type consists of from 8 to 10 inches of brown loam, underlain by a heavy yellow loam to depths of from 4 to 30 feet.

For the most part the Sassafras loam is fairly well drained, though at low levels small areas occur that are so poorly drained that they have been left in forest. On the higher lands there are frequently flat fields that would be greatly benefited by underdrainage or by open ditches. The streams of the higher areas have a fairly well developed drainage, but in the lower portions of the river necks they have very little fall, and in their lower reaches are mostly tidal creeks. This condition makes the problem of drainage more difficult, but nevertheless much of the low-lying soil of this type could be easily and profitably drained.

The soil of the Sassafras loam type results from the weathering of beds of Pleistocene loam which were deposited during a comparatively recent submergence of the Coastal Plain. These beds of loam vary in thickness from 3 to 30 feet, and are generally underlain by a thin gravel bed from 10 to 30 inches in depth. In some places, however, the Sassafras loam is underlain directly by the Cretaceous clays and gravels of the "Potomac" formation. This occurs notably at the head of Gunpowder Neck and on the outlying hills of the Piedmont region. Scattered through the Sassafras loam of Harford County are found occasional bowlders and very coarse gravel stones that no doubt were brought down from the Piedmont region on floating ice, just as such bowlders are at present brought down during the spring floods.

The Sassafras loam is a fertile, durable soil, and is capable of being brought to a high grade of agricultural efficiency. This end, however, can not be reached by the indiscriminate use of commercial fertilizers. Stable manure is the best fertilizing medium to employ on this soil, but where this can not be had in sufficient quantities the growing of leguminous crops and plowing under of some green manuring crop, as, for instance, crimson clover, offer the best substitutes. It has been found by the majority of successful farmers whose farms are situated on the Sassafras loam that good stands of crimson clover are obtained by a heavy application of lime made previously to seeding. The result of a green manure crop on a heavy loam soil is to lighten it and make it easier to work, as well as to furnish a source of plant food. Lime by itself also has a beneficial effect upon the physical

conditions of the Sassafras loam, making it lighter and less liable to cake after plowing.

The Sassafras loam is one of the best general-purpose soils, as well as the one of largest extent of the Coastal Plain types, occurring in the present survey. It gives good yields of wheat and corn, which are, with tomatoes, the principal crops of the region. Since the advent of the canning industry much of this land has been put into tomatoes, with good yields. It also gives a good yield of grass, and when left in pasture furnishes good feed to the numerous herds of cattle, the fattening of which forms one of the prominent industries of the county.

The following analyses of soils and subsoils show the texture of the Sassafras loam:

Mechanical analyses of Sassafras loam.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
6151	3 miles S. of Aberdeen.	Brown loam, 0 to 10 inches.	0.02	4.88	0.52	4.46	6.28	5.72	6.08	59.80	12.54
6155	1½ miles S. of Edgewood.	Brown loam, 0 to 10 inches.	.03	2.54	.46	5.26	7.08	6.22	6.40	57.26	14.69
6152	Subsoil of 6151....	Heavy yellow loam, 10 to 36 inches.	.02	2.46	.32	3.80	6.88	5.80	4.60	55.32	20.90
6156	Subsoil of 6155....	Heavy loam, 10 to 40 inches.	.02	2.30	.40	4.26	5.28	5.12	5.20	56.38	21.16

ELKTON CLAY.

The Elkton clay, locally known as "white-oak land," is not at present an important agricultural soil, most of it being swampy, wet, and covered with a growth of white oak. It is at varying elevations between mean tide and 60 feet above. Occasional small areas are well drained, and these under cultivation form valuable farm lands, producing crops equal to those grown on Sassafras loam, which the Elkton clay in some of its phases resembles when it is well drained. The areas of this soil are extremely irregular in outline and as a general rule connect with the heads of streams or embayments of Chesapeake Bay.

The soil of the Elkton clay consists of from 7 to 9 inches of gray to brown silty loam, underlain by a subsoil of mottled yellow and gray clay, containing frequent specks of lignified vegetable matter and iron

oxide. This subsoil when drained loses its plasticity and becomes friable, breaking up into a light, porous mass. Occasionally both the soil and subsoil contain quite large percentages of sand, though this is an exceptional variation.

Geologically these soils belong to the late Pleistocene age, and probably represent the position of tidal swamps during a period of partial submergence. As a rule the areas of this soil occupy slight depressions in the gently rolling topography, and such depressions, in case of a partial submergence, would be occupied by coastal swamps such as those at present existing in the embayments of the present coast line.

Most of these soils are high enough above tide to admit of under-drainage, and large tracts of the present white-oak swamps might through this means be rendered arable and become valuable farm lands, equal to the Sassafras loam in agricultural possibilities.

Open ditching is used in many cases on the low-lying tracts of this soil type, and such tracts are valuable pasture and grass lands.

As is above indicated, when well drained the Elkton clay is a valuable soil, producing good crops of corn, wheat, and grass. Tomatoes have also been grown in considerable quantity on the better drained portions of this soil with very fair yields. Its chief value in its undrained condition, however, is for pasture. The natural grasses which grow on such pasture are coarse and have little feeding value for cattle, but would possibly make good pasturage for sheep.

The following analyses show the texture of the Elkton clay:

Mechanical analyses of Elkton clay.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6139	8 miles S. of Aberdeen.	Silty loam, 0 to 10 inches.	0.02	2.42	0.32	3.06	5.90	9.52	7.82	61.88	8.86
6143	3 miles S. of Perryman.	Silty loam, 0 to 6 inches.	.01	3.98	.38	2.76	7.08	13.38	4.76	51.74	15.19
6140	Subsoil of 6139.	Heavy clay, 10 to 36 inches.	.01	2.62	.38	2.42	5.34	8.20	10.62	51.12	19.23
6144	Subsoil of 6143.	Heavy clay, 6 to 36 inches.	.01	2.76	.16	2.50	5.50	12.54	3.50	49.18	23.25

SUSQUEHANNA CLAY.

The Susquehanna clay soil of Harford County is among the poorest of its agricultural lands. It occurs in small areas scattered along the

Baltimore and Ohio Railroad and the outlying slopes of the Piedmont Plateau. Most of these areas are found on rather steep slopes, and owing to the difficulty of working are seldom cultivated. The soil of this type consists of clays, which in this county are extremely variable in color, running from a deep red or purple through brown and drab to white. Frequently the various colors will be found mixed together in a relatively small space. The red and white phases of this clay are the most common and least productive. Mixed with the clay in varying proportions are considerable quantities of gravel, which often make it hard to separate the Susquehanna clay from the gravel of that name. There is a brown phase of the Susquehanna clay, the soil of which greatly resembles the Sassafras loam, but it is underlain by red and white mottled clay and contains large amounts of coarse gravel.

The Susquehanna clay is derived from remnants of the Cretaceous formation left clinging to the hillsides, upon which it was laid down as a series of shore-line deposits. Subsequent erosion has removed and cut up these deposits, and in some cases they have been covered by late Pleistocene deposits of Sassafras loam.

The brown phase of this clay frequently makes a fair soil, but the greater portion of the clay is difficult to work and of little agricultural value. It is sometimes used as pasture land, but for the most part remains in forest.

The following table shows the texture of samples of the soil and subsoil of this type.

Mechanical analyses of Susquehanna clay.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.								
6159	Near Magnolia ...	Clay loam, 0 to 14 inches.	0.01	2.82	1.60	5.34	5.90	7.14	5.76	50.00	21.69	
6157	Near Abingdon ..	Clay loam, 0 to 4 inches.	.01	5.02	.24	.80	1.14	1.40	1.22	32.28	58.03	
6160	Subsoil of 6159....	Stiff clay, 14 to 40 inches.	.01	6.36	.10	.66	.86	1.48	1.82	31.04	57.33	
6158	Subsoil of 6157....	Heavy clay, 4 to 40 inches.	.01	6.98	.14	.48	.28	.80	.48	21.02	69.55	

SUSQUEHANNA GRAVEL.

The larger areas of Susquehanna gravel in Harford County occur on the hillsides just north of the Baltimore and Ohio Railroad, and

these, like the Susquehanna clay, are mostly in forest. Some isolated remnants of former more extensive deposits are found capping the hills along the southern border of the Piedmont Plateau.

The soil of this type consists of gravel mixed in varying proportions with coarse sand and brown clay loam, underlain by the same material. Frequently the soil consists entirely of gravel, and many pits are to be met with where this material has been carted away for various purposes. This soil type is often more or less mixed with the Susquehanna clay, so that it is frequently very difficult to place the boundaries between these two types.

The value of this soil for agricultural purposes depends largely upon the percentage of clay, loam, or sand with which it is mixed; a large portion, however, has been recognized as unfit for cultivation and remains covered with timber. When cultivated this soil dries out rapidly on account of the ease with which water sinks through it.

The gravel taken from numerous gravel pits forms a good road material and is frequently used for that purpose. The gravel is derived geologically from a shore-line deposit of the Cretaceous age, and it is the fact of its shore-line origin which accounts for the coarse, sandy nature of this soil. Small occasional outcrops of the Susquehanna clay and gravel show that they extend farther south, forming the base upon which later deposits were laid down.

The following analyses show the texture of the Susquehanna gravel:

Mechanical analyses of Susquehanna gravel.

[Fine earth.]

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.		Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.								
6163	2 miles N. of Abingdon.	Gravelly loam, 0 to 8 inches.	0.01	3.30	7.48	10.90	5.76	3.24	1.32	44.02	23.89	
6164	Subsoil of 6163.....	Gravelly sand, 8 to 40 inches.	.01	1.54	47.86	17.16	6.62	12.04	3.10	5.00	6.31	

NORFOLK SAND.

There is no very extensive development of this soil type in Harford County. The largest area, occurring near Perryman, contains a trifle over 2 square miles, while other scattered small areas of less than half a square mile complete the extent.

The large area of Norfolk sand near Perryman appears to represent

an outcrop of the Cretaceous sediments which, as shown in railroad cuts, contain frequent and sometimes extensive beds of sand.

The soil of the Norfolk sand consists of from 6 to 8 inches of coarse yellow to brown sand, underlain by unweathered yellow sand of the same composition. Scattered through this soil are numerous gravel stones of varying size. The remaining sand areas appear to represent sand bars formed during the Pleistocene submergence.

This is a fairly productive soil type, but on account of its porous nature it is extremely droughty. It is also a poor soil on which to apply commercial fertilizers which have any great degree of solubility, as they quickly leach through the subsoil and are lost. This is not a good corn and wheat soil, but is especially adapted to tomatoes and truck, and should grow peaches and small fruits.

The following table shows the mechanical analyses of the Norfolk sand:

Mechanical analyses of Norfolk sand.

No.	Locality.	Description.	Soluble salts, as determined in mechanical analysis.	Organic matter and combined water.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6145	7½ miles S. of Aberdeen.	Coarse sand, 0 to 8 inches.	0.03	1.94	0.36	10.38	32.84	30.26	3.12	17.10	3.83
6149	Perryman	Coarse sand, 0 to 14 inches.	.04	3.48	1.98	13.50	21.34	32.98	1.92	17.54	7.60
6146	Subsoil of 6145....	Sand, 8 to 36 inches.	.02	1.12	.62	11.06	29.28	35.74	4.70	12.52	4.70
6150	Subsoil of 6149....	Coarse sand, 14 to 36 inches.	.02	2.54	.96	10.62	29.28	35.70	4.66	16.62	10.26

MEADOW.

This type occurs in the Piedmont area along the streams, in strips varying in width from one-eighth to one-fourth mile, and representing in the aggregate a very small part of the area of the county—only 1.7 per cent. The surface, as is usual with meadow land, is generally flat, and the drainage on the whole is fair. The soil is derived from the wash of hillsides and deposition by the streams. It consists of 8 to 12 inches of brown loam, underlain by a whitish subsoil that varies in texture from silty to mottled clay. The meadow land of Harford County is used largely as a permanent pasture; in the Piedmont area, usually, a swiftly flowing stream, generally fringed with a growth of willow, alder bush, gum, and other trees, runs through it, affording plenty of water and shade for the cattle. The wider and larger meadows are

used in rotation with the other fields, and good crops of corn, grain, hay, and other crops are grown on such land. As a rule, however, these areas are rather better adapted to grass and other forage crops than to grain, since there is a tendency for grain crops to form stalk rather than berry should the season be even moderately wet.

The meadow of the Coastal Plain region is of two types—one occurring along stream courses, essentially like that of the Piedmont region, the other at the head of embayments and along the tidal creeks which empty into these embayments. The soils of these meadows are for the most part unused and in brush or forest, but are sometimes used for pasturage. It is in their use as pasturage that their chief agricultural value lies, for their low position with reference to mean tide precludes the possibility of drainage in the majority of cases. On some of the low-lying tidal meadows coarse marsh hay is grown, but as a rule this hay possesses little value as feed.

AGRICULTURAL CONDITIONS.

Two centuries ago Harford County was heavily forested. To-day the forest areas are limited largely to hilly or stony areas that are relatively unsuited to tilling, while the remainder of the county is quite largely farmed. Each farm is generally provided with a wood lot from which material for firewood, fencing, and other purposes is secured by the farmer. These forest areas are usually carefully guarded and managed with even more care than the other portions of the farm, the dead and mature timber only being removed, while the younger growth is favored and allowed to grow for future use. Indeed, the force of circumstances has inaugurated on the part of each farmer, in a small way, a more or less practical system of forest culture. The timber growth of the Piedmont area of the county consists largely of hard-wood and other deciduous trees, such as walnut and several varieties of oak, ash, hickory, elm, poplar, beech, and willow. In the Coastal Plain section the timber growth is much the same, with possibly a larger proportion of pine, willow, and gum trees. Up to within the last quarter century there was much more available timber for sawmill purposes than now. Portable small-power sawmills were occasionally noticed in some forested areas, where they were usually taking out the material that would make salable lumber, leaving the remainder for the future cutting. Only the better grade (about one-fifth) of the lumber can be sold on the outside market, the remainder being sold for local use.

Corn and tomato canning, dairying, and cattle fattening are some of the important industries of Harford County. The canning industry was introduced by George H. Baker, who went into the business about thirty years ago in the central part of the county. He started in a small way, without much means, the laborers consisting of himself

and family, and in the course of a few years he had amassed a large fortune. In a short time many others, seeing the success of this venture, also embarked in the industry, until now the canneries in operation in Harford County range in number from 100 to over 300, according as the crops and prices vary. Owing to the small amount of capital (from \$100 to \$1,000 for building and equipment) needed for the equipment and operation of the plants common in Harford County, it is possible for a great number to quickly engage in the business whenever the crop and market demand seem to warrant.

A canning outfit costing \$100 has a capacity of from 500 to 2,000 cases per season; one costing \$1,000 has a capacity of 5,000 to 15,000 cases per season. A case consists of 24 cans. The tomato can is usually what is known as the 3-pound size, while for corn a 2-pound size is used.

The tomato crop in 1901 being exceptionally poor, comparatively few canning factories were operated.

Another important industry which has developed much within the last twenty years is the dairy business. Large shipments of milk are made daily to Baltimore, bringing a net return to the farmer of from 7 to 10 cents per gallon. There are also 11 creameries in the county, which use a considerable quantity of milk. These have been established within the last five years. The number of patrons for each creamery ranges from 60 to 200, and the quantity of milk received per day ranges from 1 to 4 tons. The payment for the milk is based generally on the amount of butter fat in the milk.

Some farmers, believing the skim milk returned from the creamery to be worth more for calf and hog feed than the difference between the creamery price and the higher price received in the Baltimore market, are now patronizing the creameries. The rate paid by creameries ranges from 15 to 22 cents per pound of butter fat, with from a half to the whole of the skim milk returned to the farmer. The butter fat ranges from 4 to over 5 per cent of the milk.

The creameries are equipped with steam separators costing about \$500 each and having a capacity of from 2,500 to 3,500 pounds per hour. The creamery butter, being of a more uniform and better quality than the average homemade product, brings from 20 to 30 cents per pound. This is from 5 to 10 cents more than the ruling price for butter made on the farm. There are instances, however, where homemade butter brings even more than the creamery-made product.

It is a common practice on the part of many farmers to purchase steers from the West for winter fattening. The grain and forage crops raised on the farm are thus in part converted into beef, while the greater portion is returned to the land as manure. Steers are purchased at from 3 to 4 cents per pound. These cattle usually weigh from 600 to 900 pounds. The farmers aim to add from 300 to 400

pounds to the weight of each animal during the winter, selling them in the spring at from 4 to 5 cents per pound, which represents a gain in value of \$15 to \$20 per head.

Considerable attention is being given to the growing of plums, apples, pears, and other fruits.

Among the important resources of Harford County having bearing on its agriculture may be mentioned the slate, granite, serpentine, and flint quarries. The flint (quartz) is crushed into a fine powder and sold to pottery manufacturers. The slate quarries in the northern part of the county are famous for the good quality of the slate they supply. The product is known in the market as Peach Bottom slate.

Lands in Harford County that brought from \$40 to \$200 per acre twenty or thirty years ago now bring from \$10 to \$50. This falling off in price is due rather more to outside influences than to local conditions. The opening up of the extensive prairie lands of the Middle West, as well as the invention of labor-saving farm machinery, which reduced the price of the crops (corn and grain) they produced in Harford, naturally also reduced the market value of the lands upon which these crops were grown. As a sequel to this reduction in the price of farm lands quite a number of farms are mortgaged. These mortgages have either been placed on the land during "boom" times to make additional improvements, or later to avoid selling the land at an immediate sacrifice after the depression came. Many such mortgages have either been foreclosed or satisfied by direct payment, but much of the land is yet under mortgage. The tax rates are moderate, the rate this year, including both local and State assessments, being \$1.02 per \$100 valuation. The land is generally assessed at about 60 per cent of its price at forced sale.

The farms usually range in size from 150 to 250 acres. The value of the improvements, barns, houses, fences, etc., ranges from \$4,000 to \$8,000 or more, the houses being worth from \$2,000 to \$6,000 and the barns \$1,000 to \$4,000. This is the reverse of conditions in some other sections surveyed, where the barn was often the most expensive building on the estate.

Farm labor, both male and female, is rather scarce the year round. The wages of male help ranges, according to the efficiency, from \$8 to \$20 per month and board, by the year. Female help receives from \$1 to \$2 per week. During the rush of harvest day labor is paid from \$1 to \$2 per day and board. There is some colored labor, but as a rule it is not considered as reliable or efficient as white labor.

Most of the canning of tomatoes and corn takes place during four to six weeks of September and October, and much hand labor is needed by these canneries. The available local labor—men, women, and children—is supplemented by some 5,000 Germans and Bohemians, men and their families, hired for the season in Baltimore. This class

of laborers is of a migratory character. From the 1st of April till about the middle of May they are found canning oysters, later green peas and small fruits as these ripen, and, finally, green corn and tomatoes. Some of these laborers, however, remain in the vicinity of the cannery the whole year, working a few acres of land during the time the canneries are not in operation.

Large quantities of commercial fertilizer are used each year, especially by those growing corn and tomatoes for canning. Liming is practiced quite generally, the lime being added every six to ten years, at the rate of 30 to 50 bushels per acre.

There are 800 miles of wagon roads in Harford County, or 1.9 linear miles per square mile.^a About one-sixth of the mileage is either shell or stone road, the remainder being dirt. There is only one toll road in the county—that portion of the Belair and Baltimore pike extending from Belair southwest to the county line. As a rule these roads are fairly well distributed, so that nearly all parts of the county are accessible, but in some sections they are hilly and not well surfaced. A movement is on foot to improve the roads at the lowest cost with the material nearest at hand. A sample stone road is being built between Belair and Fountaingreen with this object in view. Two railway lines, the Baltimore and Ohio and the Philadelphia, Wilmington and Baltimore, afford excellent transportation facilities for the southern part of the county. The central portion is provided for by a railway, now also controlled by the Pennsylvania Railroad Company, extending from Delta, Pa., through Cardiff, Rocks, Belair, and numerous other towns of Harford County, to Baltimore, which city is the principal market and railway and marine transportation center of the State. The railway last mentioned has been an important factor in the development of the canning and dairy industries of the central portion of the county. It was built about a quarter of a century ago as a narrow gauge, but within the last four years has been changed to a standard-gauge road. It is remarkably crooked, having been laid out to reach as many towns as possible in its course through the county.

Trolley lines to connect with the Baltimore, Lancaster, Pa., and other electric-car systems have been projected through Harford County, but so far they have not progressed beyond the survey. There is a movement, involving an investment of several million dollars, to develop the water power at a point about 5 miles above Havre de Grace to furnish power for trolley and electric-lighting purposes. Local and long-distance telephones are being installed quite extensively in the county. Many farmers have availed themselves of this modern convenience for business and social intercourse.

The public schools of Harford County are numerous and efficient,

^aMaryland Geological Survey, Vol. III, 1899.

there being about 89 white schools and about 21 colored. The school session for both white and colored lasts ten months.

Farmers' institutes under the direction of a State director are held during the winter session, and through this means much useful information is disseminated. At least one institute meeting for each county is attempted each season. This work is supplemented by local agricultural associations or farmers' clubs. These usually consist of a dozen or more farmers, who meet at stated intervals and discuss the agricultural topics in which they may be interested. There are four such clubs in Harford County.

There are no large cities in Harford County. The majority of the towns vary in size from 50 to about 100 inhabitants and are numerous and quite evenly distributed. The population of the county is about 29,000. The principal towns and market centers of the county are Belair, 1,400, the county seat; Cardiff, 1,500; Aberdeen, 1,500, and Havre de Grace, 3,244, the latter being also quite an important seaport town.

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