

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE MARYLAND GEOLOGICAL SURVEY, EDWARD BENNET
MATHEWS, STATE GEOLOGIST; MARYLAND AGRICULTURAL EXPERI-
MENT STATION, H. J. PATTERSON, DIRECTOR.

SOIL SURVEY OF BALTIMORE COUNTY,
MARYLAND.

BY

WILLIAM T. CARTER, JR., IN CHARGE, AND J. M. SNYDER, OF
THE U. S. DEPARTMENT OF AGRICULTURE, AND O. C. BRUCE,
OF THE MARYLAND AGRICULTURAL EXPERIMENT STATION.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1917.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., January 7, 1919.

SIR: In the extension of the soil survey in the State of Maryland during the field season of 1917 a survey was undertaken in Baltimore County. This work was done in cooperation with the Maryland Geological Survey and the Maryland Agricultural Experiment Station.

I have the honor to transmit herewith the manuscript report and map covering this work and to request their publication as advance sheets of Field Operations of the Bureau of Soils for 1917, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

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

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MAP.

Soil map, Baltimore County sheet, Maryland.

SOIL SURVEY OF BALTIMORE COUNTY, MARYLAND

By WILLIAM T. CARTER, Jr., In Charge, and J. M. SNYDER, of the U. S. Department of Agriculture, and O. C. BRUCE, of the Maryland Agricultural Experiment Station.—Area Inspected by W. EDWARD HEARN.

DESCRIPTION OF THE AREA.

Baltimore County is situated in the northeastern part of the State, its southern boundary almost encircling the city of Baltimore, which has been included in the map. The county is bounded on the north by York County, Pa.; on the east by Harford County, Md., and Chesapeake Bay; on the south by Chesapeake Bay, Anne Arundel and Howard Counties; and on the west by Howard and Carroll Counties. It comprises 673 square miles, or 430,720 acres.

The physiography of Baltimore County is that of a plateau, traversed by numerous streams which have cut narrow valleys, deep and shallow, resulting generally in a gently rolling to strongly rolling and hilly topography. Only a small part of the county is undulating or nearly level; most of it is quite rolling. Along the larger streams—Gunpowder Falls, Little Gunpowder Falls, Patapsco River, and Little Falls—the valleys are more than 100 feet deep and bordered by rough and hilly areas. The areas between the larger streams are dissected by tributaries, so that the areas of gently rolling topography are not large. A number of narrow limestone basins are in the central part of the county. In these the surface is undulating to gently rolling, the bounding slopes being steep and more than 100 feet high. In the extreme southeastern part of the county (adjacent to Chesapeake Bay) are low undulating areas of marine terrace.

The elevation of the county ranges from practically sea level on the tidal marshes along the Chesapeake Bay and its tributaries to

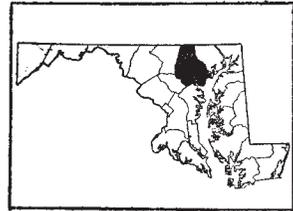


FIG. 1.—Sketch map showing location of the Baltimore County area, Maryland.

¹The survey was extended to include Baltimore City, which is distinct from Baltimore County. The area of agricultural land included in this extension is negligible, and the statistics given in subsequent chapters refer solely to Baltimore County.

between 900 and 1,000 feet in the extreme northwestern part. The greater part of the county lies between 200 and 700 feet above sea level. Baltimore City has a maximum elevation of 400 feet in the extreme northwestern corner. The elevation at Arlington is about 400 feet, at Towson 465 feet, at Cockeysville about 264 feet, and at Hereford 671 feet.

Little Gunpowder Falls drains a narrow belt of the county along the eastern border. Gunpowder Falls, the largest drainage way in the county, crosses it in a south to southeasterly direction and unites with Little Gunpowder Falls to form Gunpowder River. The Patapsco River and its tributaries drain a narrow belt along the southwestern and southern borders of the county. The southeastern part is drained by small streams that flow into Middle River and Back River. Water power developed along certain of the creeks and rivers has long been used for operating grist mills, but many such mills have been abandoned, notwithstanding the cheapness of operation and the seeming opportunity of greatly extending the use of this power.

Baltimore County was created in 1659, and included at that time areas since withdrawn to form other counties. The earliest settlements were made in the northeastern part of the area about 1628. The earliest settlers came largely from Pennsylvania, Delaware, and Virginia. Some came direct from the British Isles.

The population of Baltimore County in 1910 was 122,349, all classed as rural. A large part of the population is comprised in small villages and in the suburbs adjacent to Baltimore City, but agriculture is the principal industry, and the farming population is well distributed.

Baltimore City, in the southern part of the area surveyed, was laid out in 1730. Its population in 1910 was 558,485. Because of its good harbor it is an important shipping point for agricultural products and various manufactures, which are sent to all parts of the world. There are a large number of important industries in Baltimore.

Sparrows Point, several miles southeast of Baltimore, is an important manufacturing town, having large steel and shipbuilding industries. Other towns in Baltimore County are Towson, the county seat; Catonsville, Cockeysville, Lutherville, and Texas.

Transportation facilities in the southern part of the county are excellent, but in the northern part some farms are 6 or 8 miles from a railroad. Steam and electric railroads extend from Baltimore in all directions, giving ready communication with Philadelphia, Washington, New York, and other large centers of population. Passenger and freight boats ply between Baltimore and Maryland and Virginia

shore points on Chesapeake Bay and its estuaries. Other lines are engaged in coast traffic, and seagoing vessels carry on an extensive trade with foreign countries.

A large number of State highways radiate from Baltimore. The roads in the southern part of the county are well kept. There are only a few improved State roads in the northern part, but a number of dirt roads are kept in fairly good condition, except in wet weather.

Practically all parts of the county are reached by rural mail delivery routes. Telephones are in general use, and good schools are located in all sections.

Baltimore is the principal market for the various products of the farms.

CLIMATE.

The climate of Baltimore County is mild and healthful. The mean annual temperature at Baltimore is 55.3° F. The mean temperature for the winter is 35° , for the spring 53° , for the summer 75° , and for the fall 57.3° . The lowest recorded temperature is -7° and the highest 104° .

The mean annual precipitation of 43.3 inches is distributed quite uniformly throughout the year, the greatest amount falling from March to September. The total rainfall for the driest year of which there is any record (1870) was 22.43 inches, while that of the wettest year (1889) was 62.35 inches. The average annual depth of snowfall is 23.9 inches. Prolonged droughts rarely occur and the rainfall is very seldom excessive. Local hailstorms occasionally do some damage to crops.

The average date of the last killing frost in the spring is April 5, and that of the first in the fall November 5, giving an average growing season of 214 days. The date of the latest killing frost ever recorded in the spring was May 12 and that of the earliest ever recorded in the fall, October 6.

The following table gives the normal monthly, seasonal, and annual precipitation and temperature as recorded at Baltimore. There may be some slight departure from these conditions in the northern part of the county.

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

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1870).	Total amount for the wettest year (1889).	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	36.9	73	- 3	3.08	1.04	0.61	4.2
January.....	33.4	74	- 6	3.22	2.00	4.22	6.1
February.....	34.7	78	- 7	3.63	1.50	2.53	7.5
Winter.....	35.0	78	- 7	9.93	4.54	7.36	17.8
March.....	41.9	86	5	3.88	1.90	5.71	4.5
April.....	53.0	94	12	3.27	3.03	8.70	.6
May.....	64.2	96	34	3.56	2.52	6.82	T.
Spring.....	53.0	96	5	10.71	7.45	21.23	5.1
June.....	73.0	99	46	3.84	3.37	6.17	0
July.....	77.3	104	55	4.82	.35	11.03	0
August.....	74.4	100	51	4.21	1.68	1.40	0
Summer.....	75.0	104	46	12.87	5.40	18.60	0
September.....	68.6	101	39	3.85	1.76	4.59	0
October.....	57.5	90	30	3.02	3.00	4.12	T.
November.....	45.8	79	15	2.92	.28	6.45	1.0
Fall.....	57.3	101	15	9.79	5.04	15.16	1.0
Year.....	55.3	104	- 7	43.30	22.43	62.35	23.9

AGRICULTURE.

The chief industry of Baltimore County has always been agriculture. Tobacco was the principal crop for many years and large shipments were made to Europe from Elkrige and Baltimore during the Colonial period. Considerable wheat was grown as early as the latter part of the eighteenth century and ground into flour at water mills. Early in the nineteenth century corn, wheat, and hay had largely taken the place of tobacco. Beef cattle, horses, and other stock were raised in a small way at an early date.

Improvement in farm lands has been most pronounced in the last 50 years. Since the Civil War more attention has been given to building up the soils and in the last 25 or 30 years most of the farms have gradually increased in productiveness through careful crop rotation, the use of lime and commercial fertilizers, the keeping of more cattle and other stock, and the plowing under of organic matter.

According to the census, there were 39,433 acres in corn in 1879, producing 1,204,698 bushels. There were 28,629 acres in wheat, producing 393,402 bushels. Oats occupied 16,264 acres and produced

314,060 bushels. Hay was cut from 37,772 acres and produced 41,032 tons. From 4,990 acres of rye a total of 49,821 bushels was obtained. Market-garden products were valued at \$533,197 and orchard products at \$101,808.

Slightly smaller acreages of corn and wheat were grown in 1889 than in 1879, but yields per acre were somewhat higher. Hay was cut from 51,126 acres, producing 68,855 tons, and 6,863 acres of rye were grown, producing 75,936 bushels. There were 3,775 acres in potatoes, with a production of 296,960 bushels. The value of market-garden products, including small fruits, sold was \$232,231.

The census of 1900 shows some increase in the corn acreage, this crop being grown on 38,447 acres and producing 1,530,990 bushels, while wheat was grown on 36,486 acres and produced 536,290 bushels. Rye had been reduced to 3,953 acres and oats to 5,785 acres. Clover was cut from 6,863 acres, with a production of 7,164 tons. Over 41,000 acres of tame grasses were cut for hay, producing nearly 44,000 tons. From 4,549 acres of potatoes 356,256 bushels were gathered. The vegetables reported grown in 1899 were valued at more than \$900,000. A total of 479 acres of strawberries produced over 1,000,000 quarts, and there were over 100 acres of other berries. Orchard products were valued at \$142,838. Animals sold or slaughtered brought \$311,436, dairy products over \$900,000, and poultry \$161,219.

The present varied agriculture has been carried on for many years. It consists in the production of general farm crops for sale and for home use, dairy farming, market gardening, and the feeding of beef cattle, with hog raising and fruit growing as side issues. Combinations of these types of agriculture are often followed. Many farmers engaged in general farming grow some vegetables and fruit, while some market gardeners grow corn for work stock. Some farmers combine general farming and dairy farming, and the feeding of beef cattle is always carried on in combination with general farming.

Hay is grown on a larger acreage than any other crop. The census of 1910 reports 46,653 acres in tame hay, producing 57,176 tons, and 866 acres of wild grasses cut. A large part of the hay is used on the farm, but much is sold in Baltimore.

Corn is the second crop in acreage and importance and is grown on practically every farm. According to the census, 36,305 acres were grown in 1909, with a production of 1,187,574 bushels. A considerable acreage is cut for ensilage. The greater part of the corn produced is used on the farms for feeding work stock and dairy stock and fattening steers and hogs. The remainder is sold in Baltimore.

The third crop in importance is wheat. A total of 30,840 acres were devoted to wheat in 1909, producing 571,200 bushels. Much

wheat is used locally, but the greater part is shipped from the county, most of it to Baltimore, from which point it is sent to other markets.

Oats and rye are grown to some extent. The oat crop is rather uncertain owing to occasional dry springs or other unfavorable climatic conditions, but fair yields are often obtained. In 1909, 6,376 acres were in oats, producing 166,762 bushels. Rye was grown on 3,242 acres, producing 42,276 bushels. These crops are also valuable for spring pasturage.

Dairying is a very important industry. Some farmers specialize in the production of milk, and many general farmers, especially near the railroads, produce some milk for market. The census reports over \$1,000,000 worth of dairy products in 1909, excluding the amount used in the home. Dairy herds ordinarily range from 10 to 20 cows, but some dairies have over 100 cows. Holstein, Guernsey, and Jersey and grades of these breeds predominate. Nearly all of the milk is sold in Baltimore, but a part is taken by small local creameries for the manufacture of butter. Numerous farms are equipped with silos.

Many steers are shipped into the county from Virginia and other near-by Southern States and some from as far west as Chicago. These are brought in late in the fall and sold in lots of 5 to 50 to farmers, who feed and graze them several months and ship them when fattened to Baltimore and other cities. Some farmers use ensilage as part of the ration. The steers are grazed in mild weather and heavily fed on corn, fodder, and hay during the winter, with occasionally some cottonseed products. In 1909 there were 8,854 calves and 4,336 other cattle sold or slaughtered in Baltimore County.

The census reports 20,573 hogs sold or slaughtered in 1909. Practically every farm has a few hogs, but on none of the farms is the number large. The value of the poultry and eggs produced is given as \$491,972 for 1909. Every farm produces some poultry and eggs, and these are sold largely in Baltimore.

Near Baltimore market gardening is by far the most important branch of agriculture, and market gardening either exclusively, or in conjunction with general farming, predominates throughout a considerable portion of the southern half of the county. Irish potatoes are an important crop, being grown in all parts of the county in areas up to several acres in connection with either general farming or market gardening. Berries and fruits are grown in a small way on many farms. The census reports the value of vegetables produced in 1909 as \$1,219,038. Irish potatoes were grown on 6,027 acres, producing 467,881 bushels. These are mainly late potatoes of the McCormick variety. Other vegetables were grown on about 14,000 acres. Fruits and nuts produced were valued at \$245,467. Strawberries were grown on 657 acres, producing 1,227,342 quarts, and over

50 acres of other berries were grown. Baltimore affords an excellent market for all these products. The chief canning products are tomatoes, sugar corn, peas, and beans, and the canning industry is very important in and around Baltimore.

There are no large commercial orchards, but nearly every farmer and market gardener has a small orchard of apples, pears, peaches, plums, cherries, or quinces, from which fruit is sold in Baltimore. The principal varieties of apples are York Imperial, Stayman Wine-sap, Grimes Golden, and Ben Davis.

The value of all the agricultural products of Baltimore County in 1909 was \$6,819,824. Cereals produced were valued at \$1,509,009, hay and forage at \$870,399, and animals sold or slaughtered at \$585,219.

The farmers of Baltimore County have learned in a fairly definite way the crop adaptations of the various soils. They realize that the heavier soils are best suited to grass and small grain, the loam types to corn and wheat, and the lighter soils to vegetables. They recognize that the Montalto clay loam and the Chester, Louisa, Hagerstown, and Mecklenburg loams are good soils for corn, wheat, and grass; and that the Iredell and Conowingo silt loams are better suited to grass and wheat or other small grains than to corn or other crops. The Manor loam, while considered best suited for potatoes, vegetables, and fruit, is also known to be a fairly good soil for corn where well fertilized, but is often too light for high yields of wheat and grass. It is well known that the Sassafras sandy loam and gravelly loam are better suited to vegetables than to other crops, and that the Sassafras loam and silt loam are well suited to vegetables and corn and fairly well suited to wheat. The Leonardtown silt loam is best suited to grass and wheat; the Leonardtown loam to grass, wheat, and corn; and the Keyport silt loam to grass and vegetables. The farmers recognize the inherent adaptation of the Congaree silt loam to corn, but they understand that under present conditions of drainage it is better suited to pasturage than to cultivated crops. In the vicinity of Baltimore City, and as far as the county lines on both sides, the soils are used to a great extent for vegetables, though better suited to other crops. The proximity of the good city market is the determining factor and the soils are fertilized and manured heavily to overcome as far as possible the deficiency in adaptation.

In growing corn the land is plowed generally in the spring to a depth of 6 or 8 inches and harrowed until a good seed bed is worked up. Corn is cultivated three or four times. Wheat is drilled in on the corn land in the fall without plowing, the land being harrowed to remove the trash. Frequently wheat is grown two years in succession. In this case the stubble land is plowed as soon as possible

after harvest, dragged, and then harrowed several times before seeding. Timothy is drilled in with the wheat where wheat is not to follow the next year, and the following spring clover is sowed in the wheat and grass. After the wheat is harvested the timothy and clover are cut for hay the following year and pastured to some extent. The timothy is pastured or cut for hay for another year, when the land is again plowed for corn. The usual rotation is corn one year, wheat two years, and grass two years, but this is sometimes varied in the time devoted to wheat and grass.

The farm buildings are generally substantial, and the houses are often of stone. The barns are large, and usually of the "bank-barn" type. They have accommodations for a considerable number of stock and a large amount of hay and grain. The work stock is mainly of rather heavy draft type, and the farm machinery is adequate and of improved types. Traveling thrashing outfits serve the farmers.

In 1909 nearly 80 per cent of the farmers used fertilizers, at an average expenditure of \$115.20. Fertilizer is used principally for wheat, corn, and vegetables. As a rule that used for wheat and corn contains 8 or 10 per cent of phosphoric acid and sometimes a very low amount of nitrogen, usually not over 2 per cent. Until the last year or two many of the fertilizers contained a small amount of potash. Recently considerable ground phosphate rock containing 14 or 16 per cent of phosphoric acid has been used. Ordinarily 300 to 500 pounds per acre is used for wheat and somewhat less for corn. Many farmers do not fertilize the land for corn. Large amounts of high-grade mixtures are used by market gardeners. Most of the farmers lime their land and the practice is considered beneficial. Lime is frequently applied to land to be used for wheat and sometimes to corn land. The general impression prevails that quicklime is the best form of lime to buy. The applications range from 20 to 35 bushels per acre every 5 or 6 years. Hydrated lime is more conveniently applied. Used in this form from 600 to 1,000 pounds per acre is applied.

Barnyard manure is considered very valuable and is used by all farmers, though often not enough is available except on dairy farms. Manure is applied to grass land and corn land. All the manure in Baltimore is bought and used by market gardeners, and garbage from that city is also used in large quantities.

Owing to the demands of the numerous commercial industries farm labor is very scarce in Baltimore County. Much of the farm labor is colored. Wages vary greatly according to the season and the necessity for harvesting. Hands are paid \$20 to \$30 a month, with the use of a house and, in some cases, other perquisites. Day labor is paid \$1 to \$2 with board, and during the harvesting of corn

and wheat considerably more. Market gardeners employ considerable labor and have to pay rather high wages. About 71 per cent of the farmers in Baltimore County reported an average expenditure for labor in 1909 of \$490.14.

The farms range from a few acres to 200 or 300 acres. Most of them contain from 80 to 150 acres. Market-garden farms range ordinarily from 10 to 50 acres. The census for 1910 gives the average size of farms as 78.1 acres, only about 10 acres less than in 1880.

About 75 per cent of the farms are operated by owners, 20.6 per cent by tenants, and 4.5 per cent by managers. Tenants usually remain on the same farm for a number of years. A share of the crops, approximately one-half, is usually paid as rental, the landowner furnishing part of the seed and fertilizer. The census of 1910 reports 4,178 farms in the county. The improved land averages 55.2 acres per farm.

In 1910 the value of all property per farm was \$9,883, of which the land represented 57.9 per cent, buildings 30.6 per cent, implements 4.1 per cent, and domestic animals 7.5 per cent.

The price of land in Baltimore County varies widely. Within a zone of 8 or 10 miles from Baltimore City it varies according to the distance from that city. In the rest of the county the price depends largely on location with respect to railroads and State highways. Where the prices are normally dependent on agricultural values they range from \$40 to \$125 an acre.

SOILS.

Baltimore County lies principally within the Piedmont Plateau, the physiographic province just east of the Appalachian Mountain system from New York to Alabama. The southeastern one-fifth, approximately, lies within the Coastal Plain. The boundary between these provinces is fairly well marked, though small isolated areas of each province are included in the other. Thus, near the general boundary some high areas of Piedmont material are capped by small bodies of Coastal Plain material, while low slopes of Piedmont material have been exposed by erosion within the Coastal Plain section. The general boundary reaches in a general southwesterly direction from the Harford County line near Franklinville, passing just south of Towson and through the northwest corner of Baltimore City and leaving the county near Relay. A considerable body of isolated Coastal Plain material lies around Catonsville. In places the Coastal Plain deposits extend 10 or 12 miles from the coast.

There are three general groups of soils: Residual soils, formed in place through the disintegration and weathering of the underlying rocks; soils of the Coastal Plain, formed by the weathering of uncon-

solidated sedimentary deposits which were laid down on the floor of a former ocean; and alluvial soils, which represent recent water-deposited sediments along streams.

The Piedmont Plateau in Baltimore County is made up principally of igneous and metamorphic rocks, but small areas are composed of consolidated sedimentary deposits. The igneous and metamorphic rocks are mainly granite, gneiss, schist, gabbro, serpentine, and diabase. They have weathered into a relatively deep accumulation of soil. The consolidated sedimentary rocks consist of limestone (Cockeysville marble) and quartzite (Setters Ridge quartzite). The limestone has weathered deeply in places. It underlies the soils in a number of small valleys in the central part of the county. These valleys are usually more than 100 feet below the tops of the steep Piedmont slopes adjoining. The quartzite occurs on narrow ridges, frequently as high as those of the igneous and metamorphic rocks and often bordering the limestone valleys.

The Coastal Plain material in the southern and southeastern parts of the county consists of interbedded unconsolidated sand, gravel, and clay. This material has been brought down in former ages from the Appalachian, Piedmont, and limestone-valley regions through the agency of rivers. It has been washed and reworked by the sea and deposited over the crystalline rocks.

The alluvial soils consist of silt, sand, and clay washed from the uplands and deposited in narrow strips along streams, forming bottom lands through all parts of the county. The alluvial soils are not extensive.

The upland soils represent the long-continued weathering of the bedrock formations and old sedimentary deposits. They show some relationship to the parent materials, and differ according to original differences in the lithologic and chemical character of the rocks.

The soils are grouped into series on the basis of difference in color, origin, and structure, and classed in types according to texture. The soils of the Piedmont Plateau derived from the igneous and metamorphic rocks are grouped in the Chester, Manor, Louisa, Montalto, Mecklenburg, Iredell, and Conowingo series. Those derived from the consolidated sedimentary rocks (limestone) are placed in the Hagerstown series. The sedimentary materials of the Coastal Plain have produced the soils of the Sassafras, Leonardtown, Susquehanna, Keyport, and Elkton series. The alluvial soils are mainly of the Congaree series.

The Chester series has brown to yellowish soils and yellow to yellowish-brown subsoils. This series covers the greater part of the northern half of the county. Where it is derived from granite and gneiss the subsoil is heavy on the gently rolling areas and gritty

and friable on the slopes, but the lower subsoil is very friable in the areas derived from schist, owing to the admixture of finely divided mica.

The Manor series has brown to yellowish surface soils with light-red to reddish-yellow or brown subsoils. The material is characteristically micaceous, especially in the subsoil, and when moist the subsoil has a greasy, slick feel. This series is derived from schist and to some extent from gneiss.

The Louisa series has brown to red surface soils, with red to brownish-red subsoils, usually somewhat micaceous. These soils resemble the Chester on the surface, and are somewhat similar to the Manor in the subsoil, though containing less mica. They are derived from schists.

The Montalto series includes types with brown to reddish-brown surface soils and red to brownish-red subsoils. The one type mapped, the clay loam, is derived principally from gabbro and to a slight extent from diabase.

The soils of the Mecklenburg series are brown and the subsoils yellowish brown to reddish yellow, with a characteristic greenish tinge, especially in the lower subsoil. These soils are derived from the weathering of gabbro and occasionally serpentine.

The Iredell series comprises light-brown or dark gray surface soils, with yellow, yellowish-brown, or brown subsoils. The lower subsoils are characteristically waxy and plastic and have a greenish tinge. These soils are derived from the weathering of gabbro and diorite.

The Conowingo series has gray to pale-yellow surface soils, with yellow or brownish, heavy subsoils. A pronounced greenish tinge is characteristic in the lower subsoil. The Conowingo soils are derived from the weathering of serpentine.

The Hagerstown series includes brown to reddish-brown soils, with reddish-yellow to reddish-brown or dull-red subsoils. The one type mapped, the loam, is derived from the Cockeysville marble, a phlogopitic limestone.

The soils of the Sassafras series are brown to yellowish brown, with yellowish-brown to brownish-yellow or reddish-brown, friable subsoils. This series is derived from highly weather Coastal Plains deposits.

The Leonardtown series comprises light-brown to grayish or pale-yellow surface soils, and yellow to mottled yellow and gray subsoils that are characteristically compact in the lower part of the 3-foot section. These soils consist of Coastal Plain deposits that are less weathered and less aerated than those forming the Sassafras series.

The Susquehanna series represents soils light brown to yellow in color, underlain by heavy, plastic, mottled red or pink and gray clay subsoils.

The Keyport series consist of soils on low, smooth terraces. They are derived from Coastal Plain material, and are probably estuarine sediments. The surface soils are light brown or gray to pale yellow. The upper subsoils are yellow and the lower subsoil mottled yellow and gray. Owing to the comparatively smooth topography, the lower subsoil is imperfectly oxidized. In small areas on this terrace where the topography is such that drainage is good and oxidation has progressed deeply, small areas of the Sassafras soils appear. In the low, wet, basinlike areas of this terrace the Elkton series is developed. The Elkton soils are characteristically gray to whitish and are underlain by gray or mottled gray and yellow subsoils which are more or less impervious. It will be seen that on these low coast terraces there is a close relationship between the Sassafras, Keyport, and Elkton soils. The Sassafras, represent the better drained and more highly oxidized material, while the Elkton are the least advanced in drainage, aeration, and oxidation. The Keyport series represents a transition of the Elkton into the Sassafras and lies between them in age and development.

The Congaree soils are brown, with brown to yellowish-brown subsoils. The lower subsoils are sometimes grayish or mottled. The Congaree soils represent stream-bottom lands that have been built up from soil sediments washed from areas of the crystalline rocks of the Piedmont Plateau. The one type mapped in Baltimore County has been formed in places in the central part of the county from sediment washed from the limestone soils. In the southeastern part of the county it is also derived in places from sediments washed from Coastal Plain material.

Tidal marsh has been formed by the deposition of very fine sediments from the waters of Chesapeake Bay. This material has been laid down along streams emptying into the bay or deposited from backwater due to tidal movements.

In the following pages of this report the various soils of Baltimore County are described in detail. The table on the following page gives the name and the actual and relative extent of each.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Chester loam.....	116,672	26.7	Chester stony loam.....	9,856	2.3
Manor loam.....	97,024	22.5	Sassafras silt loam.....	8,960	2.1
Hagerstown loam.....	26,880	6.2	Iredell silt loam.....	7,360	1.7
Sassafras loam.....	25,856	6.0	Manor stony loam.....	7,332	1.7
Congaree silt loam.....	20,288	4.7	Conowingo silt loam.....	4,160	1.5
Leonardtown silt loam.....	17,024	4.0	Shallow phase.....	2,240	
Montalto clay loam.....	14,016	3.3	Sassafras gravelly loam.....	5,504	1.3
Mecklenburg loam.....	13,056	3.0	Susquehanna silt loam.....	4,160	1.0
Leonardtown loam.....	12,928	3.0	Tidal marsh.....	2,752	0.6
Sassafras sandy loam.....	13,952	3.2	Louisa loam.....	1,792	0.4
Unclassified city land.....	10,816	2.5	Elkton silt loam.....	1,624	0.2
Keyport silt loam.....	10,368	2.4			
			Total.....	423,920

CHESTER STONY LOAM.

The surface soil of the Chester stony loam is a brown or yellow loam, 8 inches deep. In timbered areas the surface 2 or 3 inches is brown, but below this the color is yellow. The subsoil to 36 inches is a yellow or yellowish-brown loam or clay loam, somewhat micaceous and having a slick greasy feel in the lower part. Numerous fragments of schist ranging up to several inches in diameter are scattered over the surface and through the subsoil. Considerable of the type is underlain by more or less weathered bedrock at less than 3 feet and outcrops of the rock sometimes occur.

This is not a very extensive or important soil type. It occurs in a number of narrow strips on steep valley slopes in the northern part of the county, along Gunpowder Falls, Little Falls and some of their tributaries. Small areas along these streams near Spook Hill are so rough as to warrant the classification of Rough stony land, but owing to their small size they are included with the Chester stony loam. Several small patches or strips of the type are mapped in the central part of the county, occupying ridges composed of Setters quartzite. One of these lies just north of Butler.

The topography of the Chester stony loam is rather steep and occasionally rough. The drainage is rapid, and if cleared the soil is likely to erode badly. Probably less than 40 per cent of the type is in cultivation. The forest growth consists largely of chestnut, white oak, red oak, and hickory. Where cultivated the type is farmed in conjunction with the Chester loam, with which it is closely associated. It is practically the same type as the Chester loam, except for its stoniness and steeper topography. It is, of course, handled with more difficulty than the loam, and is likely to suffer from erosion. It is farmed, fertilized, and managed in the same

way as the Chester loam, but lower yields are obtained. The inclusion of this soil in farms tends to lower the selling price.

The Chester stony loam is probably best suited to pasturage purposes and forestry. If cleared it should be used for grazing. Grass and clover grow well on the soil.

CHESTER LOAM.

The surface soil of the Chester loam is a grayish-brown, brown, or yellowish-brown friable loam, 6 or 8 inches deep. In timbered areas where the soil remains in its virgin condition the surface soil is yellow or brownish yellow, and takes on the brown color under cultivation through the admixture of organic matter. The surface soil is often relatively high in silt. The subsoil to depths ranging from 18 to 24 inches is a yellow to brownish-yellow or yellowish-brown friable clay loam, frequently containing a small but noticeable admixture of finely divided mica particles, the proportion increasing with depth until at 18 to 24 inches the material is a friable micaceous loam. The lower part of the subsoil is occasionally a mass of finely divided mica. As a rule the micaceous material is nearest the surface on the slopes, and it may not occur within the 3-foot section on the wider ridges. The Chester loam has weathered to depths of several feet, but throughout the soil and subsoil there are fragments of partially weathered gneiss and schist and many small irregular fragments of quartz. These rocks rarely occur in such quantities as to interfere with cultivation.

In the northern part of the county the soil is derived from a smooth schist and the subsoil has a rather slick feel, due to finely divided mica. Where derived from gneiss, as in the vicinity of Glencoe, the subsoil is a loose, gritty loam containing little mica. Narrow beds of quartzite are closely associated with the gneiss and schist rocks. The soil derived in part from this rock is very similar in color and texture to that derived entirely from gneiss, and as the areas are small they are included with the Chester loam. In such places there are sometimes considerable fragments of quartzite on the surface and in the soil and subsoil. The stony areas, unless mapped as Chester stony loam, are shown by stone symbols. Small bodies of Louisa loam and Manor loam too small to map also occur throughout the areas of Chester loam. About 2 miles southwest of Shawan in the west-central part of the county an area of more than 1 square mile of Chester silt loam is included with the Chester loam.

In the western and central parts of the county there are several good-sized areas in which the underlying parent rocks are Baltimore gneiss and granite. These occur principally 1 mile south of Warren, 1 mile south of Glenarm, between Baltimore and Towson, just north of Pikesville, around Granite, and 3 miles southwest of Catonsville.

Here the soil differs materially in structure and texture from that derived from schist. It consists of a friable, brown loam about 8 inches deep, underlain by a yellow or yellowish-brown clay loam to clay. On the steeper slopes much of this part of the type is underlain by a subsoil of yellowish or brownish gritty loam. A number of small areas of Cecil loam occur throughout this part of the type.

The Chester loam is the most extensive type mapped. It occurs in large areas and many small ones throughout the northern, central, and western parts of the country. The surface is gently rolling to hilly, but practically none of the type is too steep for cultivation. The greater part of it lies from 300 to 800 feet above sea level. Drainage is everywhere thorough. The subsoil is permeable but heavy enough to retain moisture well, and crops are carried over considerable periods of light rainfall with little injury from drought. Care is necessary to prevent erosion on some of the steeper slopes.

The Chester loam is one of the most important soils in Baltimore County. Probably 85 to 90 per cent of it is in cultivation or in pasture. Many small areas support a forest of chestnut, white oak, red oak, hickory, occasional pine, and other trees.

The leading crops are corn, wheat, and hay. In certain sections oats, rye, and buckwheat are grown in small acreages. Wheat is the chief money crop, corn and hay largely being used to feed work stock, dairy cattle, beef cattle, and hogs. A surplus is sold in Baltimore. Considerable dairying is carried on. Potatoes, cabbage, and other vegetables are grown for market. There are no large commercial orchards, but every farm has a small orchard of apples, pears, cherries, plums, and sometimes peaches, from which some fruit is sold in the Baltimore markets.

Corn yields range from 30 to 80 bushels per acre, wheat 15 to 30 bushels, and hay 1 to 1½ tons. These yields are sometimes exceeded in favorable seasons on some of the better farms. Irish potatoes yield 100 to 200 bushels, rye 12 to 20 bushels, oats 30 to 60 bushels, and buckwheat 20 to 40 bushels per acre.

The Chester loam is friable and easily tilled where properly cultivated, and does not clod or bake to a great extent on drying, especially where a fair supply of organic matter is maintained. Most farmers employ good methods of cultivation and fertilization, and the soil is very responsive. Systematic crop rotation is practiced.

All the wheat is fertilized, as well as much of the corn. Potatoes are fertilized heavily. In general, the fertilizers contain 8 to 10 per cent phosphoric acid, 1 to 2 per cent nitrogen, and 1 to 2 per cent potash. Wheat and corn receive 300 to 500 pounds per acre. Most of the farmers on this type use lime. Where quicklime is used the applications range from 1,600 to 3,000 pounds per acre. Where hydrated lime is used the applications are considerably lighter but

are made more frequently. Large amounts of stable manure are used on corn land. As a rule the farms are most productive where large quantities of manure are used, and these are usually farms where dairying or steer feeding is carried on.

Well-improved farms on the Chester loam near railroads or improved turnpikes sell for as much as \$100 or \$125 an acre. Good farms more remote may be bought for \$40 to \$75 an acre. Many farms near Baltimore are held at much higher prices.

The Chester loam is very productive if cultivated and fertilized properly, but if neglected it soon deteriorates. It should be limed every few years and a good supply of organic matter should always be maintained. Growing leguminous crops, such as clovers, alfalfa, and cowpeas is very beneficial. The organic-matter supply can be maintained by plowing under weeds and crop residues and green-manure crops, and this together with the use of barnyard manure and the growing of legumes should furnish sufficient nitrogen for most crops.

There are a considerable number of fields of alfalfa on this type. Many farmers have grown this crop with profit and the acreage devoted to it is apparently increasing. There seems to be no reason why alfalfa should not become a very important crop if the soil is properly prepared, inoculated, and manured or fertilized. The soil also seems well suited to oats, but climatic conditions are not in every way favorable. The Chester loam is apparently a very good fruit soil. Orchards are thrifty and productive, where cared for, and the growing of fruit on a commercial scale would probably be successful. The apples grown are chiefly York Imperial and Stayman Winesap. The type also produces fine grapes, small fruits, and berries.

MANOR STONY LOAM.

The surface soil of the Manor stony loam is a yellow or yellowish-brown loam about 8 inches deep. In cultivated fields the color has been changed to brown by the incorporation of organic matter. The subsoil to 36 inches or deeper is a reddish-yellow, brown, or brownish-yellow, friable, micaceous loam, having a slick, greasy feel due to fine mica particles. The amount of mica increases with depth. Scattered over the surface and throughout the soil mass is a considerable quantity of schist fragments, and the bedrock, more or less weathered, comes near the surface or outcrops in many places.

The Manor stony loam is found in a number of small areas in the northern part of the county. It occupies steep slopes along Gunpowder Falls and some of its tributaries. The largest areas lie in the vicinity of Parkton and White Hall. Some areas of rough stony land near Parkton, White Hall, and Cockeysville, too small to map, are included with this type.

The surface of the Manor stony loam is rather steep and hilly, though usually smooth. Where unprotected the soil erodes badly. Probably not more than 35 per cent of the type is in cultivation, and this is usually in small areas forming part of fields of Manor loam. The forest growth, consisting of chestnut, white oak, red oak, poplar, and hickory, with a few other trees, is rather heavy.

The same crops are grown as on the Manor loam, principally corn, wheat, and grass. The soil is handled and fertilized in the same way as that type. Yields are somewhat lower. The soil is cultivated with difficulty, owing to its steep and stony character, and it can probably be used to better advantage for grazing and forestry than for cultivated crops.

The type is very similar to the Manor loam in texture and tilth, and practically the same as the Chester stony loam in topography and stoniness. It decreases the price of farms in which it is included.

MANOR LOAM.

The surface soil of the Manor loam consists of a brown or grayish-brown, friable loam, about 8 inches deep. The subsoil is a reddish-yellow, friable, micaceous clay loam grading at 12 to 15 inches into a micaceous loam which ranges from reddish yellow to light red or reddish brown. In places a loam texture extends from the surface soil to a depth of 36 inches or more. Finely divided mica is a characteristic of the subsoil, the lower part of which is frequently a mass of this material. The surface soil also frequently contains considerable mica. Quartz and schist or gneiss fragments occur over the surface and throughout the soil in small quantities. On the steepest slopes partially weather schist or gneiss may lie within a few feet of the surface or outcrop. There are many included areas of Chester loam and Louisa loam too small to indicate on the map.

The Manor loam occurs in a number of large areas throughout the Piedmont section of the county. The largest areas occur in the north-eastern part around Baldwin, Jacksonville, and Unionville; in the central part around Sparks, Gentsville, and Hereford; and in the western part around Holbrook and Woodensburg.

The topography is characteristically rolling and hilly. There are numerous small valleys, many of them deeply intrenched with steep walls, but as a rule the slopes are smooth enough for cultivation.

Drainage is everywhere thorough and erosion is severe in places. Owing to the porous nature of the subsoil and substratum the movement of soil water is rapid, but usually there is sufficient clay in the subsoil to maintain a considerable moisture supply. On the steeper slopes where the mica content of the subsoil is greatest the soil mass is more porous and permeable than in the areas of more gentle topography, where as a rule there is more clay in the subsoil.

Probably 85 or 90 per cent of the Manor loam is in cultivation. In small uncultivated areas the native growth of chestnut, white and red oak, hickory, and some poplar still remains. Much of the best timber has been cut.

The principal crops on this type are corn, wheat, and hay. Relatively unimportant areas are devoted to oats and rye. Small quantities of orchard fruits, grapes, and berries are produced, principally for home use. A little fruit finds its way to the Baltimore market. Vegetables are grown by some farmers for the same market. Dairying is carried on in conjunction with general farming, the milk being shipped to Baltimore, sold to creameries, or made into butter on the farm. On many farms beef cattle are fattened. Hogs and poultry are raised on all the farms and a few sheep are kept on some. The condition of a few small fields of alfalfa seen during the survey indicated that the better areas of this soil are fairly well adapted to this crop, if well prepared, manured, and inoculated.

Corn ordinarily yields 25 to 50 bushels per acre. The yield is sometimes much higher on the better farms and in especially favorable seasons. The yield of wheat is 12 to 25 bushels, and of hay 1 to 1½ tons per acre.

The Manor loam does not bake or clod badly on drying and is easily cultivated and kept in good tilth. Practically all the farmers follow a rotation, consisting of corn 1 year, wheat 1 or 2 years, and timothy and clover 2 years. Most farmers apply lime, the applications ranging from 1,000 to 3,000 pounds per acre. Lime is generally applied once in each rotation. All farmers use commercial fertilizers for wheat, at the rate of 300 or 400 pounds per acre. Its use for corn is less general. Usually the mixtures are of low grade, containing about 8 per cent phosphoric acid, 1 or 2 per cent of nitrogen, and sometimes in addition 1 or 2 per cent of potash. In late years ground phosphate rock, containing about 16 per cent of phosphoric acid, has been substituted on many farms for the treated phosphate. Barnyard manure is used for corn, but the supply is usually inadequate except on the dairy farms.

The Manor loam, where neglected, quickly deteriorates, but under proper methods of farming it is productive and can be maintained so. It responds quickly to applications of lime, organic matter, manure, and commercial fertilizers, but the results are not so lasting as on the Chester loam.

Farms on this type sell for \$40 to \$100 an acre, depending on the location and improvements, and sometimes bring more where especially favored by proximity to good roads and shipping points.

Lime should be used on this soil once during each rotation, at the rate of 2,000 or 3,000 pounds per acre. In conjunction with liming organic matter should be supplied, by turning under sod, weeds,

crop residues, or, where the supply of such materials is not sufficient, by growing green-manure crops, such as cowpeas and crimson clover. Certain areas, especially those steeply sloping, should be handled carefully to prevent erosion.

LOUISA LOAM.

The surface soil of the Louisa loam is a brown to reddish-brown, friable loam 6 or 8 inches deep. The subsoil is a light-red, reddish-yellow, or reddish-brown clay loam containing some fine mica particles which give it a greasy feel. The mica content increases with depth and in places at 24 to 36 inches the material becomes a micaceous loam. A few small quartz and schist fragments occur throughout the soil and subsoil.

Only a few small areas of this type are mapped. It occurs in the west-central part of the county, a few miles north of the Green Spring Valley and in the vicinity of Cronhardt. A small area of Cecil loam about 1 mile east of Texas is included with this type.

The surface of the Louisa loam is gently rolling to rolling. The type usually occupies high, broad ridges in areas of Manor loam and Chester loam, and patches too small to map are frequently included with those soils. Drainage is everywhere good.

Probably 80 per cent of the soil is cultivated, the remainder being covered with chestnut, white oak, red oak, poplar, hickory, and other trees. The principal crops are corn, wheat, and hay (timothy and clover). The type is farmed in the same way as the Chester loam, and yields are about the same. It is quite productive if limed and well manured. Some commercial fertilizers are successfully used for wheat and corn. Vegetables, fruits, and berries do well.

MECKLENBURG LOAM.

The surface soil of the Mecklenburg loam is a brown, friable loam about 8 inches deep. The subsoil to 36 inches is a brownish-yellow or reddish-yellow to yellowish-brown, friable clay loam or loam. The lower subsoil is quite friable owing to the admixture of coarse fragments of disintegrated rock. The subsoil usually has a characteristic greenish tinge. On some steep slopes the parent rock (gabbro or serpentine) may come within 1 or 2 feet of the surface. A few small fragments of the rock sometimes occur throughout the soil mass.

Stone symbols are used on a few small areas to represent the Mecklenburg stony loam. These lie in the extreme southern part of the county along the steep slopes of the Patapsco River, and in places are so steep and stony as to constitute Rough stony land. Only small patches of the Mecklenburg stony loam are included in fields,

and it can not be cultivated except with great difficulty and then only after the removal of some of the stones.

The Mecklenburg loam is not a very extensive type. It occurs in several areas a square mile or more in size in the southwestern part of the county and within a few miles of Baltimore. An important area occurs just north of Mount Washington, and another just south of Powhatan. A small area occurs in the eastern part of the county near Fork.

The surface is gently rolling to very rolling, with some rather steep slopes. The type often lies on the steep slopes of areas of gabbro where the higher surfaces consist of Montalto clay loam and Iredell silt loam. On some of the steeper and unprotected slopes erosion may be severe. The type has good underdrainage.

The native growth on this soil is poplar, chestnut, white oak, and red oak, with some beech along the lower slopes. Perhaps 75 per cent of the type is cultivated. The principal crops are corn, wheat, and hay. Some potatoes, tomatoes, and other vegetables are grown for market. There are some small orchards of apples, pears, and small fruits and patches of berries. These fruits seem well suited to the type. The same general farming methods are used as on the Chester loam. Where the soil is properly handled and fertilized it gives good returns. Corn yields from 25 to 65 bushels per acre, wheat 15 to 30 bushels, and hay 1 to 1½ tons.

This soil requires some liming and is greatly improved by the use of barnyard manure and by plowing under vegetation.

Most of this type lies near Baltimore, and its selling price is enhanced by its value for suburban residence. Farm land is held at \$100 an acre or more.

In the table below are given the results of mechanical analyses of samples of the soil and subsoil of the Mecklenburg loam:

Mechanical analyses of Mecklenburg loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
201242.....	Soil.....	3.5	3.8	3.5	18.0	20.7	40.0	10.2
201243.....	Subsoil.....	.9	2.2	1.8	26.7	22.1	26.5	18.8

IREDELL SILT LOAM.

The surface soil of the Iredell silt loam is a light-brown to yellowish-brown, smooth silt loam, 8 or 10 inches deep. The immediate surface dries out to a light-gray color. The upper subsoil begins as a yellow silty clay loam, in many areas slightly mottled with gray. At a depth of 16 or 18 inches it abruptly passes into a heavy, waxy,

plastic clay of a yellow to brown color with a slight greenish tinge. Soft, partially weathered diorite, gabbro, or serpentine rock is usually encountered at 24 to 36 inches below the surface. Some dark iron concretions are occasionally found on the surface or mixed with the soils.

The Iredell silt loam occurs in several areas in the southern part of the county a few miles west of Baltimore. The largest are around Hebbville, Ralston, Howard Park, and Arlington. The soil is locally called "white land."

Most of the area of the Iredell silt loam is undulating to gently rolling, and only in a few places does it occupy moderately steep slopes. Surface drainage is fairly good, but owing to the compactness of the lower subsoil the underdrainage is not thorough. Where the surface is nearly level water stands and the soil becomes "cold" and sour.

Probably 80 per cent of the type is in cultivation, the remainder being in the native forest growth of white oak, black oak, red oak, poplar, cedar, and hickory. The principal crops grown are corn, wheat, and hay. As much of the soil lies within a few miles of Baltimore it is used to an important extent for market gardening. Potatoes, cabbage, tomatoes, sugar corn, beans, peas, turnips, beets, and other vegetables are grown. There are some small orchards of apples, pears, and plums, and patches of berries. On the better farms corn ordinarily yields 25 to 40 bushels per acre, wheat 15 to 25 bushels, and hay 1 to 2 tons.

The Iredell silt loam bakes rather hard on drying unless cultivated when it contains just the proper amount of moisture. Where general farming is carried on corn, wheat, and timothy and clover are rotated.

Commercial fertilizers are used for wheat and sometimes for corn. Vegetables are grown with the aid of heavy fertilization. Considerable barnyard manure is used, but not enough for best results. The Iredell silt loam is deficient in organic matter, and heavy applications of manure and all crop residues should be incorporated with the soil. Probably all the type is in need of lime.

The price of farms on this type is influenced largely by proximity to the Baltimore suburbs and nearness to the city markets. Farms composed largely of the type lying several miles from Baltimore probably could not be bought for less than \$75 or \$100 an acre. Much of it would sell considerably higher where held in small tracts.

This soil seems best suited for growing hay and small grains such as wheat. Some very good yields of timothy hay have been obtained.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Iredell silt loam.

Mechanical analyses of Iredell silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
201249.....	Soil.....	3.2	2.5	0.6	3.2	9.0	68.6	12.5
201250.....	Subsoil.....	2.1	1.1	.3	1.7	4.0	69.1	21.6
201251.....	Lower subsoil...	1.4	1.0	.3	1.9	4.0	43.0	48.3

CONOWINGO SILT LOAM.

The surface soil of the Conowingo silt loam, locally called "white land," is a yellowish-brown or light-brown silt loam, 8 or 10 inches deep, which on drying assumes at the immediate surface a light-grayish color. In forested areas the surface 1 or 2 inches is whitish and the rest of the soil pale yellow. The subsoil to 18 or 24 inches is a yellow silty clay loam, frequently slightly mottled with gray. Below this it grades into a slightly waxy, sticky clay of yellow or brown color, tinged with green and frequently mottled with gray. This passes, often above the depth of 36 inches, into soft disintegrated greenish serpentine rock. Frequently the material is not waxy and the subsoil, from 18 or 24 inches consists of the disintegrated and only partially decomposed rock. In many places the lower subsoil contains black iron concretions. On some slopes and in other places the parent rock comes near the surface or outcrops.

There are only a few small areas of Conowingo silt loam in Baltimore County. These occur in the southern part just west of Baltimore and between that city and Patapsco River. The largest body of the type occurs around Belmont in a strip more than 1 mile wide and several miles in length. A small strip lies in the eastern part of the county just south of Fork, and a small area just south of Kingsville.

The topography of the Conowingo silt loam is undulating to gently rolling. Surface drainage is fairly good, but the underdrainage is rather poor, as the lower subsoil is somewhat compact in many places.

About 80 per cent of this type is under cultivation or used for pasture. Some of the original timber growth of white oak, blackjack oak, and hickory remains. The large proportion of the type in cultivation is doubtless due to its favorable location near the Baltimore markets. Both general farming and market gardening are carried on. In general farming corn, wheat, and hay are grown. Various vegetables are produced, together with some apples, pears, peaches, and cherries. Sometimes the growing of general farm crops is combined with vegetable production. On the better farms corn ordinarily yields 25 to 40 bushels, wheat 15 to 25 bushels, and hay 1 to 3 tons per acre. Vegetables yield fairly well.

This soil is inclined to bake on drying. Wheat and clover sometimes suffer from the freezing of the soil. Lime is used with good results. Commercial fertilizers are applied to wheat land and sometimes to corn land. Fertilizers are in general use by market gardeners and truckers. Barnyard manure is used, but an insufficient amount is available for best results. This soil seems best suited to the production of hay and wheat. It is deficient in organic matter and much of it is rather cold and probably inclined to be acid. It should be heavily limed and manured, and all vegetation and crop residues plowed under to increase the supply of organic matter.

Owing to the nearness of the type to Baltimore, land of this type of soils sells for \$100 or more an acre.

Conowingo silt loam, shallow phase.—The Conowingo silt loam, shallow phase, consists of 6 or 8 inches of grayish-yellow silt loam, underlain to 18 or 20 inches by a subsoil of yellow or yellowish-brown silty clay loam. From this depth downward more or less disintegrated serpentine rock is frequently encountered and most of the phase has the rock within 36 inches of the surface and in many places outcrops occur on the steeper slopes. In some places a layer of yellow or reddish-yellow, slick clay loam or clay, having a greenish tinge, occurs just above the rock, at depths of 18 to 36 inches. There are many variations in color, texture, and depth of the subsoil, according to the depth of soil covering above the rock. There is always a prevailing greenish tinge in the lower subsoil.

This phase occurs in one body, a few square miles in extent, about 4 miles west of Green Spring Junction, in the extreme western part of the county. Its topography is rolling to gently rolling. Erosion has cut many small valleys and gullies, exposing the underlying rock, making the surface in places very rough and stony.

Probably less than 25 per cent of the phase is cultivated, and much of the native timber remains, principally a thin forest of blackjack oak with some white oak. Old fields, where the soil mantle is very thin, have a very scant growth of broom sedge.

Small areas of this phase are devoted to corn, wheat, and hay, but yields are very poor. Owing to the generally unfavorable soil and surface conditions, the land has very little agricultural value.

Included with this phase is an area of "barrens." This lies in the south-central part of the county, about 3 miles north of Baltimore, and has an extent of somewhat less than 1 square mile. The area is hilly and serpentine rock outcrops frequently, being in nearly all places less than 8 to 18 inches below the surface. There is very little soil accumulation at any place, but occasionally about 6 inches of brown to reddish-brown loam overlies a reddish or yellowish clay loam or clay which has a pronounced greenish tinge. In places the subsoil may extend to 18 inches before the rock is encountered. The

subsoil contains numerous small particles of soft serpentine, which gives it a soapy feel. The surface is rolling to hilly, with steep, eroded, and gullied slopes. A few blackjack oaks and pines with a sparse growth of broom sedge and some other grasses occupy the land. It was formerly cultivated, but has no present value, except for the rather indifferent grazing it affords.

In the table below are given the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the typical Conowingo silt loam:

Mechanical analyses of Conowingo silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
201246.....	Soil.....	1.1	2.2	0.8	4.2	6.7	70.7	13.9
201247.....	Subsoil.....	1.6	2.5	.9	6.3	11.6	57.6	19.0
201248.....	Lower subsoil...	5.2	3.0	1.0	14.8	16.0	33.6	25.0

MONTALTO CLAY LOAM.

The surface soil of the Montalto clay loam, locally known as "red land," is a brown to reddish-brown clay loam, 4 to 8 inches deep. The subsoil to 36 inches is a dull-red to brownish-red or reddish-brown, rather heavy, smooth clay. In some places erosion has removed the surface soil and the clay subsoil is exposed, but these areas are too small to map accurately and have not been separated. Frequently the surface soil is relatively high in silt and occasional small areas of true silt or loam are included. Much of the surface is strewn with fragments of gabbro, occasionally several feet in diameter, and some small areas could properly be classed as a stony type. Symbols are used to indicate the more stony areas.

The Montalto clay loam occurs in a number of good-sized areas in the eastern and southern parts of the county. The largest body lies around Kingsville, near which place several smaller areas also occur. Areas are mapped also a few miles west of Baltimore, and near Rockdale, Arlington, Sudbrook Park, Franklin, Kingsville, and North Bend.

In topography the type ranges from gently rolling to rolling and hilly. It occupies some very steep, high slopes adjacent to the larger streams and is well drained. Some of the slopes where unprotected are subject to erosion. The subsoil is quite retentive of water.

About 75 per cent of this type is in cultivation. Where it is uncleared the original forest growth, consisting principally of white oak, chestnut, and poplar, with some pine, cedar, hickory, and red oak, remains. Some of the land is used for growing corn, wheat,

and hay, but it is devoted very largely to the production of vegetables, even at a distance of 10 or 12 miles from the city. Potatoes, beans, peas, cabbage, tomatoes, sugar corn, and turnips are important products. Small orchards of apples, pears, and other fruits are successful. Small fruits and berries are grown to some extent.

Corn yields 30 to 60 bushels per acre, wheat 15 to 25 bushels, potatoes 120 to 200 bushels, and hay (timothy and clover) 1 to 2 tons. Good yields of vegetables are obtained.

This soil is rather heavy and somewhat difficult to cultivate, but if plowed when not too wet or too dry it may be kept in fairly good tilth. It bakes in hard clods if plowed when wet, and these are broken down only with difficulty. Baking is most pronounced where the clay subsoil comes near the surface or is exposed.

For the general farm crops the land is limed, fertilized, and handled in about the same way as the Chester loam. The same rotation is followed. Much barnyard manure is used in the production of corn and vegetables. The soil is greatly improved by growing leguminous crops such as clover and by adding organic matter. The Montalto clay loam is a strong soil, seemingly especially well suited to wheat and grass. It is apparently adapted to the production of apples.

Farms on this type at a distance from Baltimore sell for \$60 to \$100 an acre, but within a few miles of the western part of the city much higher prices are frequently asked.

HAGERSTOWN LOAM.

The surface soil of the Hagerstown loam is a brown, usually rather silty loam, 5 to 8 inches deep and of a reddish-brown color. The subsoil to 36 inches is a red, reddish-brown, or reddish-yellow clay loam to friable clay. In some places where the parent rock contains considerable mica the subsoil is slightly micaceous. This is also the case along the outer margin of the type where mica has been washed down from the higher slopes occupied by the Manor loam. Just north of Towson there is a thin scattering of quartz gravel over some areas of the type.

Many areas of Hagerstown clay loam too small to indicate on the map are included in the Hagerstown loam. They consist of a red to reddish-brown clay loam underlain by red to light-red clay. They occur on slopes and in swales. The soil is slightly more difficult to cultivate than the loam but is used for the same crops. Several very small areas of a soil in the Green Spring Valley just west of Luther-ville which resembles the Conowingo silt loam are also included.

The Hagerstown loam occupies a number of irregular areas in the limestone valleys in the central part of the county. These valleys are from one-fourth mile to 2 or 3 miles across and generally

connected. The largest areas of the type comprise the Green Spring Valley about 6 miles north of Baltimore, Dulaney Valley just north of Towson, and Worthington Valley just east of Emory Grove. The towns of Cockeysville, Lutherville, and Texas are located on this soil.

The Hagerstown loam has a gently rolling to rolling surface, favorable for agriculture. The type occurs in the form of long, narrow valleys bordered by somewhat steep slopes of Manor loam or Chester loam which rise in places to a height of 100 feet or more above the valley floor. Surface drainage and underdrainings are generally good, but in a few small areas streams coming down from the higher lands spread over the undulating areas of the Hagerstown loam and form poorly drained spots. Some of these are ditched. The subsoil of the type is sufficiently heavy to retain moisture for crops throughout considerable periods of dry weather.

Practically all this type is in cultivation. The principal crops are corn, wheat, and hay (timothy and clover). Potatoes are grown on many farms and some farmers produce vegetables for the Baltimore market. Small orchards of apples, pears, peaches, plums, and cherries do well, and bush fruits and berries succeed. Dairying is engaged in on a number of farms, and some of the largest dairies in the county are located on this type in the Green Spring Valley. Some beef cattle are fed. Hogs and poultry are raised on all the farms. A few large fields of alfalfa, some containing as much as 80 acres, are established on the type, and the crop gives good results, especially in connection with dairy farming. On the better farms corn yields as much as 100 bushels per acre, but ordinarily 40 to 60 bushels; wheat 20 to 30 bushels, oats 40 to 60 bushels, and timothy and clover hay 1 to 2 tons. Alfalfa yields 3 to 5 tons per acre in 4 cuttings. Large yields of corn ensilage are obtained on some dairy farms.

The Hagerstown loam is fairly easy to till, except in the small spots where clay loam occurs at the surface or is turned up by the plow. Where general farming is practiced the regular crop rotation consists of corn 1 year, wheat 1 or 2 years, and grass 2 years. On the farms where no small grain is grown, as in dairy farming, this system is modified. Heavy applications of lime are used on this soil, and commercial fertilizers are used for wheat and oats and sometimes for corn. Approximately the same kinds and amounts are applied as on the Chester loam. Considerable barnyard manure is used for corn and alfalfa, and on dairy farms the heavy manuring gives excellent results and renders unnecessary the use of commercial fertilizers for these crops.

The Hagerstown loam is naturally a strong, productive soil. Farms composed largely or entirely of this type range greatly in price according to location. Farm land some distance from Balti-

more is held at \$100 or \$125 an acre, and in some of the valleys, like the Green Spring Valley, used largely for country residences, the land could not be bought for several hundred dollars an acre.

The use of lime and heavy applications of barnyard manure are necessary for best results on this soil, and with liming and heavy manuring it is probable that only small amounts of commercial fertilizers would be needed, except for some phosphoric-acid fertilizers for the small grains. It is said by some growers of alfalfa that applications of wood ashes have improved the stand and yield of that crop. The best results in seeding alfalfa have been obtained by inoculating the soil.

SASSAFRAS GRAVELLY LOAM.

The surface soil of the Sassafras gravelly loam consists of 6 or 8 inches of brown or yellow gravelly loam or gravelly sandy loam. The subsoil to 36 inches is a yellow, yellowish-brown, or brown gravelly loam or gravelly clay loam. The immediate surface material dries out to a grayish color. The gravel in the soil and subsoil consists of smooth, rounded fragments of quartz ranging up to 2 or 3 inches in diameter. The gravel constitutes 25 to 75 per cent of the soil material and in many places is used in road building and other construction.

This type occurs in a number of small areas scattered over the southern part of the county in close association with the Leonardtown and Sassafras soils. The largest area is located just west of Necker. The topography is rolling, and in some places steeply sloping, with some narrow bodies forming gently sloping crests of narrow ridges. Surface drainage is good throughout the type and under-drainage is excessive.

Probably not more than 5 per cent of the type is in cultivation, the remainder being covered with forest of oak, chestnut, and other trees. The cultivated areas are small, generally forming parts of fields of other soils. On the less gravelly areas fair yields of tomatoes are obtained. Other vegetables, small fruits, and berries succeed fairly well where the land is well manured and fertilized. Grapes would probably do well.

SASSAFRAS SANDY LOAM.

The Sassafras sandy loam consists of 8 to 12 inches of a brownish-gray to brown, light sandy loam, underlain to a depth of 36 inches by a yellow or yellowish-brown to reddish-yellow sandy loam. In uncultivated areas or in fields where only a small amount of organic matter has been incorporated in the surface the color is often pale yellow.

The immediate surface in dry cultivated fields has a grayish color. Sometimes the lower subsoil in depressions is slightly compact and faintly mottled with gray. Frequently there is a small quantity of rounded quartz gravel in the soil, subsoil, and substratum. On the lower terraces near the coast the soil and subsoil are of a richer brown color than on the higher positions farther inland.

The Sassafras sandy loam occurs in a large number of small areas throughout the southeastern part of the county. The largest body occurs in the vicinity of Chase and just north and west of Bengies. Smaller areas occur east of Baltimore in the vicinity of Brooks Hill and Stemmer Run. To the east of Fort Armistead there are small bodies of Sassafras sand which are less productive than the typical soil. These sand areas were not separated in the map on account of their small extent.

The topography is gently rolling. Frequently the smaller areas occupy the ridgelike or knoll-like positions surrounded by areas of the Leonardtown soils and other Sassafras soils. In the vicinity of the coast the surface is nearly level to gently undulating. Surface drainage is good and the underdrainage is rapid, although the subsoil contains sufficient clay to hold a fair amount of moisture.

About 80 or 90 per cent of the Sassafras sandy loam is under cultivation. Some smaller bodies of the original forest remain. This consists principally of chestnut, pine, white oak, red oak, and black oak.

Vegetables are the principal crops. Some small fruits and berries are also grown. These crops are produced for the Baltimore market. The soil where properly cultivated and given applications of manure and high-grade fertilizers produces good yields. It dries out rapidly and warms up early in the spring, which makes it valuable for growing early vegetables. It is naturally deficient in organic matter, which may be applied either in the form of barnyard manure or green-manure crops.

This type is sold in farms with the surrounding soils at prices ranging from \$75 to \$100 an acre.

SASSAFRAS LOAM.

The surface soil of the Sassafras loam is a brown, friable loam, about 8 inches deep. The subsoil to a depth of 36 inches is a brown, brownish-yellow, or reddish-brown clay loam or silty clay loam. In a few patches the subsoil is red. Frequently some small, rounded quartz gravel occurs in the soil and subsoil. Occasionally faint gray mottlings occur in the subsoil at 30 to 40 inches below the surface. Some areas of Sassafras sandy loam too small to show on the map are included in this type.

The Sassafras loam is not an important type, owing to its small extent, although it occurs in a large number of bodies widely scattered throughout the southern part of the county within a few miles of Baltimore. The largest areas lie around Landsdowne, Grange, and Walters, and within the city limits of Baltimore.

The topography is gently rolling to rolling. Surface drainage and underdrainage are good. The native forest growth consists of pine, white oak, red oak, poplar, chestnut, and other trees. Much of the timber has been removed, and perhaps 85 per cent of the land is in cultivation.

The Sassafras loam is used principally for the production of vegetables, largely tomatoes, potatoes, sugar corn, beans, and peas, to be sold in the Baltimore market and to canneries. Small acreages are devoted to wheat, corn, and hay. There are small orchards of apples, pears, and peaches. Small fruits and berries are grown by market gardeners. The ordinary methods of cultivation and fertilization are followed for general farm crops and vegetables. Wheat is produced with commercial fertilizers, and large quantities of fertilizers are used in growing vegetables. Manure is used in large quantities for vegetables and corn. Lime is also applied.

Corn yields 20 to 60 bushels per acre, wheat 15 to 25 bushels, and hay 1 to 1½ tons. Irish potatoes yield 100 to 150 bushels per acre and tomatoes 150 to 200 bushels. Oats may yield 40 bushels per acre in favorable seasons, but the production is small owing to the uncertainty of the crop. Alfalfa does well and is grown in a few small fields.

The price of this land is based principally on its value for building sites, as it is located near Baltimore and its suburbs.

This type is more easily improved and kept in a good state of productiveness than the Leonardtown soils, and it is somewhat better adapted to the production of vegetables and small fruits, although it is necessary to use manure and organic matter as well as lime and commercial fertilizers in order to maintain good yields.

SASSAFRAS SILT LOAM.

The surface soil of the Sassafras silt loam consists of 8 or 10 inches of brown silt loam. The subsoil to 36 inches or more is a yellow, yellowish-brown, or brown silty clay loam, often faintly mottled with gray in the lower part.

This type occurs in a number of small, widely separated areas throughout the southern part of the county, where it is closely associated with the Sassafras loam and the Keyport silt loam. Its topography is very gently undulating to gently rolling, and it has good surface drainage and underdrainage. Some of the type lies

on the low terraces which form narrow peninsulas projecting into Chesapeake Bay and which are composed largely of the Keyport silt loam.

Probably 90 per cent of this type is cultivated. The growth in the uncleared areas is largely white oak, red oak, and poplar. The crops grown are principally vegetables for the Baltimore market, with occasionally a small acreage in corn, wheat, and hay. The soil is quite productive. It is well suited to vegetables and fruits, but for best results should be fertilized, limed, and manured. It is handled in the same way as the Sassafras loam, and gives practically the same yields. Owing to its higher position and better drainage it is better suited to cultivation than the Keyport silt loam in similar situations.

LEONARDTOWN LOAM.

The Leonardtown loam consists of about 8 inches of pale-yellow or light-brown loam, underlain by yellow or brownish-yellow clay loam or silty clay loam to depths of 24 to 36 inches, slightly compact and faintly mottled with gray in the lower part or in the substratum. In uncultivated areas only the immediate surface is brown, the soil in general being brownish-yellow. On drying the surface becomes somewhat grayish. A small quantity of small, rounded quartz gravel is sometimes mixed with the soil and subsoil. As mapped the type includes small areas of Leonardtown silt loam, Sassafras gravelly loam, and Sassafras loam.

The Leonardtown loam is a type of little importance. Its principal areas occur around Perry Hall, Necker, Parkville, and Rose-dale. Numerous small bodies are mapped throughout the southeastern part of the county. The type occurs in close association with the Leonardtown silt loam and the Sassafras soils.

The topography is undulating to gently rolling, with some steep slopes and moderately deep valleys. Surface drainage is good throughout the greater part of the type. The underdrainage, while better than that of the Leonardtown silt loam, is not very thorough in many places, owing to the slightly compacted condition of the subsoil and substratum.

Probably 85 per cent of the Leonardtown loam is under cultivation. Where uncleared it supports a growth of white oak, red oak, black oak, and chestnut, with some pine and hickory. Much of the more valuable timber has been cut. A large part of the type is used for the production of vegetables, as it is located along good roads and easily accessible to the Baltimore markets. Some corn, timothy, and wheat are grown. Most of the type is used for market gardening, the principal crops being Irish potatoes, tomatoes, cabbage, turnips, kale, spinach, and sugar corn. There are on this type several

orchards of apples, peaches, cherries, plums, and pears. Berries and small fruits are grown to some extent. Corn ordinarily yields 20 to 50 bushels per acre, wheat 12 to 25 bushels, and hay 1 to 1½ tons. The condition of small fields of alfalfa indicates that this crop may be grown successfully in favored sections. Irish potatoes yield 100 to 150 bushels per acre, and tomatoes 150 to 200 bushels.

Where general farming is carried on the farming methods are about the same as on the Chester loam. Commercial fertilizers are used for wheat and sometimes for corn, and heavy applications of high-grade fertilizers are made for vegetables. Barnyard manure and garbage also are used in large quantities for vegetables. Many farmers use lime for all crops. The soil is deficient in organic matter and is greatly benefited by plowing under vegetation.

The Leonardtown loam is well suited to the production of vegetables, corn, small fruits, and berries where the supply of organic matter is maintained and the soil is limed and fertilized properly. Probably most areas of the type would be improved by tile drainage.

Farm land of this type more remote from Baltimore ranges in price from \$50 to \$100 an acre, but within a few miles of Baltimore it sells for much higher prices.

LEONARDTOWN SILT LOAM.

The surface soil of the Leonardtown silt loam is a light-brown or brownish-yellow silt loam, 2 to 8 inches deep. In cultivated fields the surface soil is brown to about 8 inches, but where the land has never been cultivated the lower part of the surface soil is yellow. When dry the surface in cultivated fields has a grayish appearance. The subsoil to 18 or 30 inches is a yellow silty clay loam, frequently slightly mottled with gray at 30 inches. Below 18 or 30 inches and extending to 36 inches the subsoil is a compact mottled yellow and gray silty clay loam or silty clay. This compact layer or so-called hardpan is a characteristic feature of the type. It is very hard in many places and almost impervious. Sometimes small rounded quartz gravel is scattered sparingly through soil and subsoil.

The Leonardtown silt loam is mapped in a number of small areas in the southeastern part of the county. The largest occur around Upper Falls, just north and east of Whitmarsh, just north of Baltimore, and around Hamilton and Parkville.

The topography is nearly level to gently undulating and in places gently rolling. In general, the type has fairly good surface drainage, but there are many small basinlike areas in which water stands after rains. The compact lower subsoil and substratum retard the underdrainage.

Probably 70 per cent of this land is in cultivation. The areas farther from Baltimore are cultivated to a less extent than those

near the city. Within a few miles of the city nearly all this soil is used for the production of vegetables. The more remote areas are used also for corn, wheat, and hay. The vegetables produced are chiefly cabbage, potatoes, tomatoes, beans, peas, sugar corn, spinach, turnips, onions, and kale. Considerable quantities of manure and high-grade fertilizers are used for vegetables, which give moderate yields. Corn yields 20 to 50 bushels per acre, wheat 12 to 25 bushels, and hay 1½ to 2 tons. For corn, manure and sometimes commercial fertilizers are used, the fertilizer being applied at the rate of 300 or 400 pounds per acre. These fertilizers are of various kinds, but as a rule phosphoric acid is the most important constituent. Potash gives good results, and its use in mixtures up to 6 per cent has been found profitable for wheat. Lime is used with profit on this soil.

The Leonardtown silt loam has a tendency to become acid, and lime should be used regularly. The aeration of the soil, which is poor, could be improved to a considerable extent by tile drainage. This soil is naturally deficient in organic matter, which is supplied in the form of barnyard manure and crop residues. The type seems especially adapted to the production of hay.

Farms made up largely of this soil range in price from \$40 to more than \$100 an acre. Forested areas from which a considerable part of the better timber has been removed sell for less. Within a few miles of Baltimore farms situated partly on this type sell for \$200 to \$300 an acre. The values in this case are influenced by the extension of suburban improvement.

The results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Leonardtown silt loam are given in the following table:

Mechanical analyses of Leonardtown silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Caly.
		<i>Per cent.</i>						
201232.....	Soil.....	1.4	3.1	1.6	6.1	9.2	64.0	14.4
201233.....	Subsoil.....	.9	2.0	1.1	4.0	5.7	61.6	24.7
201234.....	Lower subsoil...	1.7	2.8	1.6	5.6	7.8	55.1	25.3

SUSQUEHANNA SILT LOAM.

The Susquehanna silt loam is a brown to yellowish silt loam, 8 or 10 inches deep, underlain to 18 or 20 inches by a yellow, brownish-yellow, or yellowish-brown silty clay loam, and below that depth by a red or pink, mottled with gray, heavy tough clay or silty clay. This type is not very uniform and in some places it resembles the Leonardtown silt loam, but at a depth of 3 feet the distinguishing

reddish, mottled clay is encountered, which is a sufficient basis for differentiation.

The Susquehanna silt loam occurs in several small, widely separated areas in the southeastern part of the county. One of the largest lies just north of Rossville, another near Rosedale, another just east of Landsdowne, and one east of Halethorp.

The topography is gently rolling to rolling, and the type has fair surface drainage, but the underdrainage is poor, owing to the impervious nature of the subsoil.

Probably 75 per cent of this soil is cultivated. Forested areas support a growth of white oak, red oak, and pine. Like the surrounding Coastal Plain soils this type is used principally for market gardening. It is farmed in conjunction with the Leonardtown and Sassafras soils, and has about the same agricultural characteristics as the Leonardtown silt loam. It is naturally somewhat "cold," owing to poor drainage. The application of lime, organic matter, and fertilizer is necessary for the best results. The type is probably best adapted to the production of hay. Its selling value shows about the same range as land of the Leonardtown silt loam.

KEYPORT SILT LOAM.

The surface soil of the Keyport silt loam consists of about 6 inches of yellowish-gray to grayish-brown silt loam. The subsoil to a depth of 12 or 15 inches is typically a yellow silty clay loam or silt, though in depressions it may show mottlings of gray. From 12 or 15 inches to 36 inches the subsoil is a mottled yellow and gray, compact silty clay loam, approaching a silty clay in the lower part in places. In the more rolling areas the gray mottling of the subsoil is less pronounced than in the level or depressed areas. Throughout the type there are patches of Elkton silt loam and occasionally Sassafras silt loam, too inextensive to map.

The Keyport silt loam occupies several square miles in the southeastern part of the county on Patapsco River Neck, Back River Neck, and Middle River Neck. The largest areas extend northward for several miles from Sparrows Point. These necks, which are cut into by a number of small bays and creeks, are smooth terraces lying a few feet above the waters of Chesapeake Bay, from which they are separated by a low bluff. The topography is gently undulating to nearly level, with many slight depressions. Most of the type lies less than 40 feet above sea level. Drainage is fairly good in most places, though much of the land would be improved by artificial drains.

Probably 75 per cent of the type is cleared and used for crops. Uncultivated areas support a forest consisting principally of white

oak, red oak, water oak, pin oak, sweet gum, and pine. This soil is used principally in growing vegetables for the Baltimore market and for canneries. The more important crops are beans, peas, tomatoes, spinach, cabbage, potatoes, sugar corn, turnips, and kale. Only small acreages of corn, wheat, and hay are grown. There is a small production of apples, peaches, and small fruits and berries. In some of the better drained situations small fields are devoted to alfalfa. Beans yield 200 to 250 bushels per acre, tomatoes 200 to 250 bushels, potatoes 100 to 200 bushels, spinach 700 to 1,000 bushels.

Lime is used to some extent on this soil and barnyard manure, garbage, and other refuse is applied in large quantities. Commercial fertilizers are also used extensively, principally nitrate of soda and phosphoric-acid mixtures.

Land of the Keyport silt loam ranges in price from \$100 to \$200 or even \$300 an acre. The higher prices prevail on the Patapsco River Neck, where values are influenced by the industrial growth of Sparrows Point and Baltimore and also by the development of private pleasure grounds.

The Keyport silt loam is fairly productive where drainage is good. It needs liming and large applications of barnyard and other organic manure. Tile drainage would prove of great benefit. The type is well suited to the production of hay.

Mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Keyport silt loam gave the following results:

Mechanical analyses of Keyport silt loam.

Number	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
201227.....	Soil.....	0.1	1.1	1.2	6.2	10.7	66.0	14.4
201228.....	Subsoil.....	.0	.7	1.0	4.4	9.3	61.0	23.7
201229.....	Lower subsoil...	.0	.5	1.1	6.0	10.8	48.3	33.1

ELKTON SILT LOAM.

The surface soil of the Elkton silt loam consists of 6 or 8 inches of gray silt loam, nearly white when dry. The subsoil is a gray and yellow mottled silty clay loam to silty clay, which below 24 inches is in places compact and lighter in texture than the upper subsoil.

This type occurs in small, scattered areas in the southeastern part of the county. Many areas exist that are too small to map. The type is developed on the low marine terrace which occupies the necks of land projecting into Chesapeake Bay. The surface is flat to very slightly depressed, and surface drainage is very poor. The subsoil is almost impervious, and underdrainage is correspondingly deficient.

Probably not more than 5 per cent of the total area of the type is cultivated. The rest is covered with forest growth consisting of pin oak, water oak, water maple, white oak, and a brush undergrowth. The soil without artificial drainage is of low productivity, grass seeming to do best on it. When drained it is best adapted to the production of hay and wheat, but even with improved drainage the soil requires lime and heavy applications of manure and other forms of organic matter to make the crop yield satisfactory.

CONGAREE SILT LOAM.

The surface soil of the Congaree silt loam is a brown or gray silt loam, frequently very micaceous. It has a depth of 8 to 15 inches. The subsoil to 36 inches is typically a brown loam or in places clay loam, but varies in color to yellow or yellowish brown. Frequently the lower subsoil is mottled with gray and rusty brown. There are some textural variations in this type. Near the banks of the small streams the texture is usually loam, while adjacent to the uplands in very narrow strips of low wet land the soil is a grayish silt loam underlain by a mottled gray or bluish-gray and yellow or rusty brown silty clay loam subsoil. In some of the very narrow valleys or creek bottoms the soil is almost entirely a brown, micaceous loam to a depth of 2 or 3 feet.

The Congaree silt loam occurs along streams throughout the county, occupying bottom lands which vary in width from 100 or 200 feet to more than one-fourth mile. In the southeastern or Coastal Plain part of the county the soil is grayer and resembles the Ochlockonee series, but on account of its small extent such areas are not mapped separately.

The Congaree silt loam has a nearly level surface. In the wider bottoms certain narrow areas adjacent to the upland are slightly lower than near the stream. Drainage is fairly good except where water stands for some time, producing marshy conditions in places. The type ordinarily lies only 3 to 6 feet above the stream bed and overflows occur occasionally.

The danger of crop loss through floods prevents extensive cultivation. Probably much less than 10 per cent of this soil is used for crops. Some corn is grown with fair yields. There are few farms in the county that do not include a small acreage of this type. Much of it is cleared or partly cleared of timber. Such areas make fine pasture. The forest growth consists of white oak, pin oak, shingle oak, some poplar and sycamore, and a small tree locally called ironwood. The type is used almost entirely for the pasturage of all kinds of stock, and is a very valuable soil for this purpose.

The Congaree silt loam if properly drained and protected from overflow is a valuable soil for corn and forage crops. It is naturally

quite productive, and with ditching and straightening and deepening of the streams more of it could be farmed. With better drainage conditions it would be well suited to the growing of vegetables.

Just south of the reservoir at Loch Raven, in an area of perhaps 50 acres or more occupying a stream terrace approximately 25 feet above the river bed, the soil is a brown, heavy silt loam, 8 inches deep, underlain to 3 feet by a brown to bluish-gray silty clay loam. The surface is level, but the area lies above overflow and has good drainage. It is farmed and gives good yields of corn, potatoes, and other crops. Owing to the small extent of this soil it is included with the Congaree silt loam on the map.

TIDAL MARSH.

The term Tidal marsh is applied to the narrow strips of wet lands along the lower courses of streams and estuaries of Chesapeake Bay. The soil material is a black to bluish or bluish-gray silt loam with faint mottlings, mixed with a mass of finely divided and more or less decomposed grass roots. The surface is covered with water most of the time.

In its present condition the Tidal marsh has no agricultural value. Near Carroll Island, where some of the type lies rather high, the surface becomes dry at times and some marsh grass is mowed for hay, which is used for bedding.

If thoroughly drained this soil might be well suited to growing onions and celery, but the cost of reclamation would probably be prohibitive under present conditions.

UNCLASSIFIED CITY LAND.

The term Unclassified city land is applied to areas in Baltimore City and Sparrows Point and at the edge of Baltimore City, where the soil has been changed by excavations and fillings for buildings and other purposes. In much of the city the area is covered by buildings and pavings, while at the edge of the city much material has been dumped on the soil and has completely changed it.

SUMMARY

Baltimore County lies in northeastern Maryland, reaching from Pennsylvania to Chesapeake Bay. It surrounds Baltimore City on all sides except where the city touches the waters of the Chesapeake. The area surveyed, including Baltimore City, covers 673 square miles, or 430,720 acres.

The topography varies from nearly level or undulating to strongly rolling and hilly, the greater part being strongly rolling. Narrow, level bottom lands are developed along the streams. The elevation

ranges from sea level along the coast to more than 900 feet in the northern part of the county, the greater part between 200 and 700 feet above sea level. All the drainage flows into Chesapeake Bay.

Baltimore County had a population of 122,349 in 1910, all classed as rural. Baltimore City had a population of 558,485. The principal towns, all of them small, are Towson, Cockeysville, Lutherville, Texas, Catonsville, and Sparrows Point.

Transportation facilities are good throughout the southern half of the county, but the northern part has only one railroad. Excellent highways extend throughout the southern half of the county. All parts of the county are connected by telephone. There are numerous churches and schools.

Baltimore is the principal market for all the farm products. Some of these are reshipped to other markets, and a large quantity is used by canneries in and around the city.

The climate is mild and healthful. The mean annual temperature as reported at Baltimore is 55.3° F., and the mean annual precipitation 43.3 inches. There is a normal growing season of 214 days.

The agriculture of Baltimore County consists in the production of general-farm crops, including corn, wheat, and hay; dairy farming; the feeding of beef cattle; hog raising; and market gardening. The farm buildings are large and substantial, and the farms are well kept and fenced. Good work stock and improved farm machinery are used.

Uniform farming methods are followed throughout the county. Farmers practice systematic crop rotation. Lime and commercial fertilizers are generally applied to the land, especially for wheat and market-garden crops. Manure is used extensively, and market gardeners use a large amount of garbage and sewage from the city.

Farm labor is scarce and high priced.

The farms range in size from 50 to 300 acres, but most of them contain 100 to 150 acres. Farm land, away from urban influences, sells for \$40 to \$150 an acre.

The greater part of Baltimore County lies within the Piedmont Plateau region. Approximately the southeastern fifth lies within the Coastal Plain.

The soils of the Piedmont are formed from the weathering of schists, gneiss, granite, gabbro, serpentine, diabase, and to some extent limestone. These rocks produce soils of the Chester, Manor, Louisa, Conowingo, Montalto, Iredell, Mecklenburg, and Hagerstown series. From the unconsolidated deposits of the Coastal Plain the Sassafra, Susquehanna, Leonardtown, Keyport, and Elkton soils are derived. The alluvial soils are grouped in the Congaree series and Tidal marsh.

The Chester loam and Manor loam are the main soil types of the county. They are farmed and fertilized in much the same manner, and the farming methods generally followed throughout the county are practically the same as on these two leading types. The Chester loam is best suited to corn, wheat, and hay, and the Manor loam to corn, Irish potatoes, vegetables, and fruit.

The Montalto clay loam is especially suited to the production of apples and other fruits and of wheat and hay. The Conowingo and Iredell silt loams seem best suited to grass and wheat. The Mecklenburg loam is a good soil for corn, vegetables, and fruit. The Hagerstown loam is best suited to grass, wheat, alfalfa and corn.

The Leonardtown silt loam and loam are good grass soils and under the best management are well adapted to wheat, corn, and vegetables. The Sassafras sandy loam and gravelly loam have a special adaptation for vegetables, berries, and small fruits. The Sassafras loam is a fine vegetable and corn soil and is fairly well adapted to wheat, alfalfa, and grass. The Sassafras silt loam gives good yields of hay, corn, and other general farm crops. This is also used successfully in the production of vegetables. The Keyport silt loam is a fine grass soil, and with good management is well adapted to vegetables and other crops.

The soils of Baltimore County are on the whole rather strong and suited to a large variety of crops. They may be built up to a high state of productiveness. These factors, with the accessible good market, make the conditions favorable for general farming, dairying, market gardening, fruit growing, and poultry raising.



[PUBLIC RESOLUTION—No. 9.]

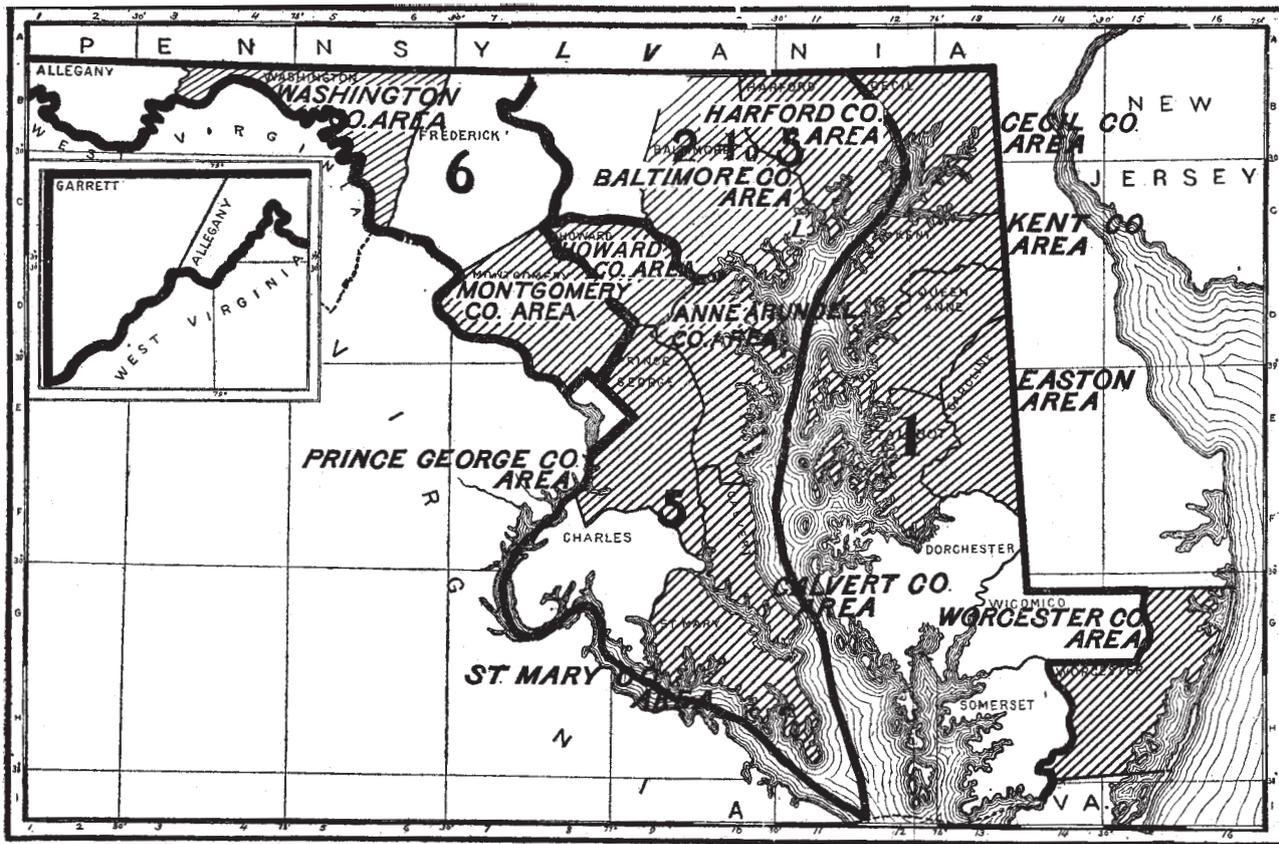
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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

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

Approved, March 14, 1904.

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



Areas surveyed in Maryland.

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