SOIL SURVEY OF CALVERT COUNTY, MD.

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GEOGRAPHY.

Calvert County comprises an area of 218 square miles of land surface lying between the Patuxent River and the Chesapeake Bay. It is the smallest county in Maryland. Its extreme length from northwest to southeast is slightly over 35 miles, and it varies in breadth from 9 miles in the northern part to about 5 miles in the southern part. The northern boundary of the county is formed by Lyons Creek and by 3½ miles of north-and-south land boundary, and about 5 miles of east-and-west land boundary, separating it from a prolongation of Anne Arundel County. On the west the Patuxent River separates Calvert County from St. Mary, Charles, and Prince George counties.

The entire area of the county is included between the parallels of 38° 20′ to 38° 45′ north latitude and the meridians of 76° 22′ to 76° 41′ west longitude. Its extreme elevation above sea level is less than 200 feet. Its long coast line and the numerous embayments along the Patuxent shore make the county easily accessible by water.

Prince Frederick is the county seat and Solomons its largest town. Agriculture and oyster fishery are the chief occupations of its inhabitants.

PHYSICAL GEOGRAPHY.

Calvert County extends as a long, narrow peninsula between two tidewater estuaries, and, while half of its area rises to 120 feet elevation or higher, the surface is uneven and much cut up by streams. This is due to the steep, short fall of the water courses and to the unconsolidated nature of the materials upon which the water acts. Hunting Creek, flowing into the Patuxent, and Fishing Creek, flowing into Chesapeake Bay, have nearly cut the county in two parts. Battel Creek and Parker Creek have almost accomplished the same dissection farther south, while St. Leonard Creek has its head waters within a half mile of Chesapeake Bay, though flowing into the Patuxent. Many smaller streams have trenched the surface deeply.

As a consequence of this active stream erosion, the greater part of the county consists of steep-sided, flat-topped hills and long, narrow necks of upland country. On the east this upland descends by a high cliff to the level of Chesapeake Bay throughout most of the

distance between Fishing Creek and Drumpoint. The streams flowing into Chesapeake Bay have cut deep notches in this cliff line and at some points, as at Dares Wharf, slight remnants of old terraces remain between the general upland level and the water's edge.

The western shore line is quite different from the eastern coast. The surviving portions of upland extend nearly to the Patuxent River as long, narrow divides with flat or rounded tops. The slope toward the river is usually very steep and rarely descends entirely to water level. Along the greater part of the Patuxent shore line a narrow, flat-topped foreland or terrace is found between the upland slope and the water. In the vicinity of Solomons Island and St. Leonard Creek this foreland has a breadth of about 2 miles, and its surface lies at an elevation of between 20 and 40 feet above tide level. Between St. Leonard Creek and Sheridan Point the foreland is narrower and more sloping, while from Sheridan Point to Deep Landing it is broad and flat. Above Deep Landing the foreland terrace rises in elevation to a maximum of over 80 feet at Lyons Creek Wharf and it varies greatly in elevation, extent, and in soil types in this northern portion of its extent.

The Chesapeake Bay shore line of Calvert County forms one of its most interesting natural features. High cliffs of clay, sand, and gravel rise from the water's edge to elevations of 150 feet or more. The larger streams have cut through these cliffs nearly to sea level, and they have brought to the coast line loads of sand and silt, which the waves of the bay are distributing along the shore in the form of sand bars and sand spits. Along the greater part of the Chesapeake Bay shore line active wave cutting is taking place and the land area is being encroached upon at a rate varying from a few inches to several feet per year, depending largely upon the exposure of any particular area to wave action. The streams of any size in Calvert County flow into the Patuxent River with but two exceptions, Parker Creek and Fishing Creek. This fact, considered in connection with the general presence of forelands along the Patuxent and their absence along the bay, bears testimony to long-continued wave cutting on the bay shore, resulting in the destruction of formerly existing forelands, as well as causing large and continued inroads upon the main upland. Old survey records and natural phenomena like those cited above prove that the Atlantic coast line is gradually sinking below sea level throughout the entire distance from Maine to the Carolinas, so this land destruction must be anticipated along exposed shores for many years and probably for centuries to come.

The streams of Calvert County which flow into the Patuxent River constitute the major part of the drainage area of the county. Their head waters are uniformly found near the Chesapeake Bay shore and they flow south or southwest into estuaries branching off from the Patuxent. The valley walls are uniformly steep and poorly adapted

to cultivation, while the stream bottoms are usually narrow, flat, and wet, and adapted to pasturage more than to any other agricultural use.

Along the lower courses of the larger streams there are found some notable exceptions to the general rule of steep, sloping, wooded valley walls. Beginning just above where the stream proper empties into its tide-water estuarine portion are low-lying, flat-topped terraces, rising to an elevation of from 40 to 60 feet. If the surface of these terraces or terrace remnants is followed toward the Patuxent River, it will be found to descend to slightly lower elevations and finally, in many instances, it is continued along the Patuxent itself by the foreland areas already described. In fact the foreland is essentially a terrace formed along the Patuxent similar to the stream terraces farther inland.

The usual elevation of the foreland and stream terraces above tide water is about 30 feet in southern Calvert County, while in the northern part it rises to about 60 feet, as shown along Lyons Creek west of the railroad bridge. This rise is accomplished in a distance of about 30 miles, indicating an average slope of about 2 feet per mile. This same slope is indicated by similar deposits along the western shore of the Patuxent, by the slope of another deposit (the Leonardtown loam) in St. Mary County, and again by the slope of the fragments of Leonardtown loam areas found in Calvert County. Near Frazier the Leonardtown loam is present at about 100 feet elevation, and near Sunderland at 160 feet elevation, giving a general slope of $2\frac{1}{2}$ feet per mile. It is not to be inferred that these slopes are absolutely uniform, for local variations are frequently found, but the agreement of these general slopes on both sides of the Patuxent, and in two different formations, definitely show an elevation of the general land surface, greater toward the north and less toward the south, as one of the more recent geological events of the region. These changes of level will be discussed more fully under the consideration of the geology of the region.

From an agricultural standpoint these facts of physical geography are of greatest interest in connection with the results produced on the land surface. As a brief summary of the effects upon Calvert County, it may be stated that the continual action of storm waves along the bay shore will steadily, though slowly, cut away the land area at exposed points and deposit this material as sand bars and mud flats where sheltered positions or cross currents cause a slack-water area. The equally continuous erosion performed by the headwaters of all streams will wear away the upland surface and transport the derived materials to tide-water estuaries, where they will be deposited, forming mud flats and marshes and causing a general shallowing of all adjoining water courses except where tide and stream currents are strong enough to keep the channels open. Thus, exposed areas subject to rapid rain wash must be carefully tended, while the wearing

away of the bay shore and the silting up of bays along the Patuxent are inevitable, and affect both agriculture and transportation.

GEOLOGY.

Calvert County lies entirely within the Coastal Plain division of Maryland, and the geologic formations which enter into its structure are composed of unconsolidated clays, sands, and gravels, together with remains of organic life like the infusorial earths and the marl beds. They are still passing through the earlier stages of rock formation, and neither pressure nor cementation has progressed far enough to bind the incoherent masses into firm, solid rock.

All geologic formations of sedimentary origin are divided and subdivided into various groupings according to their age, as determined by the character of the fossil organisms entombed in them, and according to the sequence of the formations. Thus, the grand divisions of Archæan, Algonkian, Paleozoic, Mesozoic, and Cenozoic are divided again and again. Only strata of the Cenozoic age are represented in Calvert County, so only their subdivisions will be considered.

Era.	Period.	Group.	Formation.	Soil type.
Cenozoic	Pleistocene	Columbia	Cape May	Meadow soil.
				Sassafras sandy loam.
			Wicomico	Norfolk sand.
				Sassafras loam.
			Dunkirk	Norfolk loam.
				Leonardtown loam.
				Susquehanna gravel.
				Windsor sand.
				Norfolk sand.
	Neocene	Chesapeake	Nomini	No soil areas.
			Choptank	Windsor sand.
				Norfolk sand.
			Calvert	Sassafras loam.
				Basal clay.
	Eocene	Pamunky	Nanjemoy	No soil area.
			Aquia	No soil area.

The oldest strata found belong to the Pamunky group of the Eocene. They consist of greensands, which outcrop along the Patuxent River and its tributaries from the vicinity of Ferry Landing northward to the county line. They reach the surface as outcrops, which form no surface features and no soils. Over this group is found the Chesapeake (of Neocene period), which is subdivided into three formations. The lowest, the Calvert, consists of layers of infusorial earth, which is made up of siliceous skeletons of animals and plants, living in an ancient sea, and of clays and silty sediments deposited in that sea. The only surface occurrence is in the form of a modified type of Sassafras loam. For the most part its rôle is to form the basal structure upholding the soil proper of the county. The next formation is the

Choptank, composed of fine and medium grained sands, and containing marl beds. The surface exposures contribute to the Windsor sand and form the main part of the Norfolk sand. Above the Choptank occur the Nomini strata, which form no extensive surface feature and thus give rise to no soil type.

These subdivisions of the Eocene and Neocene, after their deposition as marine sediments, one above the other in a nearly horizontal position, have been lifted above sea level by a slow elevation, which was greater toward the northwest than toward the southeast. The strata were tilted by this movement at a slope of about 11 feet per mile, and, after subsequent erosion, their upturned edges appeared at the surface in succession—the oldest, Eocene, toward the northwest, and the three Neocene formations in succession toward the southeast. After the end of the Neocene period the formations could have been seen overlying each other like a slanting pile of boards.

After this the land surface of the entire county was again submerged to a different depth and extent than in the earlier sea, and much more recent (Pleistocene) deposits have been laid down over the upturned beveled edges of the older formations. In this way there arose what is known as an unconformity, since the newer layers do not conform to the attitude of the older ones. A lapse of considerable time, accompanied by erosion of the old surface, is thus recorded.

It will be seen from the table above that the Eocene has no soil equivalent, because buried too deeply under more recent material. Even the Neocene, with its three formations, plays but small part in the soils of the present time. Almost the entire land surface is derived from the three formations of the Columbia group of the Pleistocene period. These three divisions are the Dunkirk, the Wicomico, and the Cape May, named in the order of their deposition.

The oldest (Dunkirk) formation exists as an almost continuous sheet of gravel, clay, and loam, covering the upland portions of the county. According as the component materials differ in texture and structure, depending upon the origin of the materials and upon the methods and conditions of their deposition, they give rise to the Norfolk loam, the Leonardtown loam, the Susquehanna gravel, the Windsor sand, and the Norfolk sand. The last two of these soils also occur as derivatives from the Choptank formation of the Chesapeake group.

The Wicomico, which occurs as a fairly well-defined terrace along the Patuxent and its tributaries, gives rise to the Sassafras loam over the main terraces and occasionally to small areas of Norfolk sand, where these terraces are continued inland along the larger streams.

The latest-formed Cape May terrace presents two characteristic soil types—the meadow areas of the foreland and the Sassafras sandy loam.

It will be noticed that several of the geologic formations give rise to two or more soil types, and that some of the soil types are derived

from two or more geologic formations. This emphasizes the fact, already noted, that the geologic classification of sedimentary rocks is based upon the time when the material was deposited, that is, upon the relative age as shown by the stage of development of life forms rather than upon the character of the material. The soil classification is based upon the character of the material without regard to its age. An ideal section showing the arrangement of the soils is shown in fig. 17.

There are several interesting problems regarding the origin and deposition of the Pleistocene deposits. The beginning of the Pleistocene stage of deposition was marked in Calvert County by the contribution of rather coarse sand and gravel containing some bowlders of such large size that flowing water could not carry them. They could have been brought to their present location only as débris frozen into or borne upon the surface of floating ice cakes. Some of these bowlders found in Calvert County are very interesting, as they show the source of the material, and consequently give some idea of the land area existing at the time of their deposition. Along Hunting Creek a bowlder was found which came from the granite area near

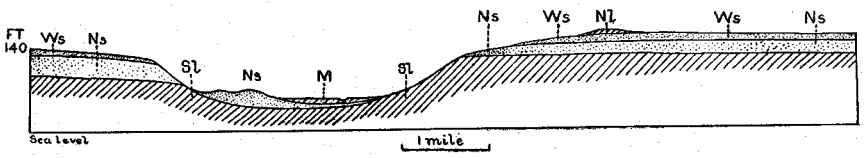

FIG. 17.—Section across Hunting Creek: *Ws*, Windsor sand; *Ns*, Norfolk sand; *Sl*, Sassafras loam; *M*, Meadow; *Nl*, Norfolk loam.

Ellicott City. It possesses the same peculiar texture as that granite—the large pink feldspar crystals surrounded by smaller-sized crystals of other component minerals. There are also found bowlders of other rocks, notably gabbro-diorite, a dark green or black rock derived from the same general region. The presence of these bowlders not only gives some idea of the land surface existing in this former geologic time, but their transportation by floating ice also gives some idea of the climatic conditions then existing. The layer of material bearing these bowlders, when now exposed, gives rise to the Susquehanna gravel.

After the deposition of this gravelly layer, clay and silt were brought in. The peculiar structure of the Leonardtown loam is due to the form this deposition took in its earlier stages. Clay pebbles and clay bowlders, probably derived from a shore line by wave action, were rolled together as the first deposit over the gravel and interbedded with sand and small gravel. When these were firmly packed down by the weight of accumulating sediments the clay pebbles were flattened out into lense-shaped nodules, and the resulting soil structure produces the effect of a heavy clay subsoil with sand partings. This

feature and its result are described under the Leonardtown loam soil type.

The Leonardtown loam deposit was succeeded by silty and sandy materials, giving rise to the Norfolk loam. After this the entire area was slowly elevated above water level and stream drainage was established over the newly formed surface. In many cases these streams closely followed the stream beds occupied during Neocene times, as these were only partly filled in during the Pleistocene submersion. As erosion began again the newly deposited materials were removed, together with older Neocene strata, and terraces were built near the mouths of the new streams while other deposits were made in the larger drainage systems like the Patuxent River. As the gradual elevation of the land proceeded, the erosion and deposition continued and the terraces of the Wicomico age, whose fragmentary remains are found still clinging along the Chesapeake and Patuxent shores and recognized as Sassafras loam soils, were formed. As the latest stage of this action, the foreland areas of the county, the Sassafras loam and meadow soils, were formed during the Cape May stage. These low-lying terraces were constructed along the Patuxent and probably also along the Chesapeake, though subsequent wave action has largely destroyed them there. At this time the deeper waters were receiving clayey materials and the shallow ones sand and silt. This area is slowly sinking again with most of the Atlantic coast, though the motion can be detected only by careful observations extending over long periods of time. The usual process of weathering, erosion, transportation, and deposition are in progress, and strata now are being formed which succeeding ages may sometime have an opportunity to study and classify.

SOILS.

The soils have about the following areas:

Areas of the different soils.

Soils.	Acres.	Per cent.	Soils.	Acres.	Per cent.
Norfolk sand	58,800	42	Leonardtown loam	7,950	6
Windsor sand	24,500	18	Norfolk loam	5,220	4
Meadow	15,800	11	Susquehanna gravel	3,900	3
Sassafras sandy loam	10,900	8	Swamp	3,600	2
Sassafras loam	8,850	6			

NORFOLK LOAM.

Norfolk loam is found in irregularly shaped areas on the highest uplands near Port Republic, Prince Frederick, and Mount Harmony. These scattered tracts of Norfolk loam represent an area of the soil which must have been much greater at some former time, but which

has been largely removed by active stream erosion, which still continues.

The areas as they exist form flat-topped or gently undulating divides between stream courses, sloping away on all sides toward the stream valleys. They are frequently bordered by exposures of the barren-clay subsoil of the formation, which is being washed away by the heavier rain storms with such rapidity that vegetation is unable to maintain itself. In many cases the clay scald thus formed descends to a ledge of iron-cemented sand and gravel or to a distinct gravel bed. Such an occurrence can be found about 1 mile south of Prince Frederick along the main highway.

The soil itself consists of a fine sandy to silty loam, having an average depth of about 10 inches. The subsoil is a heavier, sandy, yellow loam or, in some cases, a yellow loam. It varies in thickness from about 20 inches to over 3 feet.

This soil is usually cultivated over the entire area where it occurs, so that all natural tree growth has been removed. Corn produces a good crop upon this soil, and it was noticeable that during the exceptionally dry months of August and September, 1900, corn crops on this soil were among the last to suffer. Wheat is also raised on this soil, and, while it is one of the best wheat soils of the county, it is not a typical wheat soil. On the other hand, tobacco does well upon this soil, both as regards the quality and the quantity of the crop. Norfolk loam is probably the best general-purpose soil lying in the upland portion of the county.

The following analyses show the texture of the soil and subsoil of this formation.

Mechanical analyses of Norfolk loam.

No.	Locality.	Description.	Organic matter and loss.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
5159	1 mile NW. of Port Republic.	Yellow, sandy loam, 0 to 9 inches.	2.59	1.28	7.52	5.87	6.48	14.41	51.99	9.79
5160	Subsoil of 5159	Heavy, yellow loam, 9 to 30 inches.	2.40	1.02	6.15	5.36	5.57	10.32	50.71	18.19

LEONARDTOWN LOAM.

Leonardtown loam is a type of soil found extensively in St. Mary County and named from the county seat. In Calvert County the type is found chiefly in the forest country between Drum Point and St. Leonard Creek, though many small areas of this soil occur over the

uplands farther north. Like the Norfolk loam, only a small part of its original extent remains, the greater part having been removed by the universal stream cutting.

The surface of the Leonardtown loam forms a part of the nearly flat but gently sloping upland, and in any single area it is nearly horizontal or only slightly rolling. The individual extent of the tracts in the southern part of the county frequently contain about 1,000 acres of very uniform soil, while the areas farther north are much smaller, some of them comprising only a few acres of almost barren clay subsoil, for erosion has progressed to such an extent that only small remnants survive, and so rapidly in many instances that the surviving fragments furnish no soil of agricultural value. Such areas are occasionally selected as building spots because their slight elevation above the general level of the country gives good drainage facilities.

Leonardtown loam owes its origin to the deposition of clayey sediments on the bottom of an old estuary or marine area. This deposition over a large portion of the area did not take place in the usual method by a mechanical settling of fine sediment from suspension in water. Such a course gives rise to continuous homogeneous layers of clay, while the Leonardtown loam, where undisturbed by cultivation and by the action of frost, rain, and other atmospheric agencies, presents the appearance of an accumulation of clay lenses or nodules, imperfectly separated from one another by veins and pockets of sand interspersed with scattered pebbles.

A visit to the present cliff line of Chesapeake Bay in Calvert County will give some idea of the manner in which the clay lenses of the Leonardtown loam were derived. Wherever the waves are cutting on clay layers steep cliffs are formed, and the continual wearing near tide level undermines large masses of clay, which fall down within reach of the waves, where they are further broken into bowlders and pebbles or ultimately reduced to a fine mud. The mud is generally washed away to some distance and only settles to the bottom in comparatively still water, while the pebbles and bowlders of clay are rolled on the bottom of the bay through accumulations of sand and mud and finally come to rest, unless completely broken up, as a pavement of clay lumps interspersed with finer materials. The waters of Chesapeake Bay are so shallow that only small portions of its bottom lie below the zone of wave action, especially during the more severe storms. As a result, the clays are usually broken up very completely and only the finer sediments are deposited. Still, enough of the bowlders and pebbles survive, even along the shore, to give an idea of the general operation of wave forces and of the deposition resulting from such action. If the waters of the bay were deeper, the shoreward slopes more shelving, and the materials worked upon more resistant to wave action, it is easy to see that the result would be a quite general deposition of beds of clay pebbles.

The Leonardtown loam, over a large part of the area occupied by it, was deposited in just such a manner. The subsoil of this formation is mottled red, yellow, purple, and gray by the deposition of hydrated iron oxide in various proportions in irregular patterns. A close examination of this mottling shows that the darker colors outline a series of clay lenses lying with their shorter axes nearly vertical and with their edges overlapping like shingles on a roof. Some of the clay masses are very regularly lenticular; others are irregular; while in some instances this structure is only partially indicated. Along the laps of the clay lenses are little seams of sand, with occasionally pockets or masses of sand of greater extent. Some fine gravel is mixed with the sand.

The entire structure suggests the accumulation of a large number of clay masses which have become flattened through the pressure exerted by overlying materials. These clay masses were probably derived by wave action, rolled along a somewhat sandy shore line or sea bottom, and finally deposited in more quiet water. The formation is almost uniformly underlaid by sandy and gravelly layers from which the sand content might have been derived, and the amount of sand in a given mass decreases as the distance from the sand layer becomes greater.

This structure of the subsoil of Leonardtown loam is one of its marked characteristics, not only in Calvert County, but over larger areas of the same soil formation in adjoining territory. It indicates a marine or estuarine origin of the soil material, and shows that the soil was deposited as a pebble or bowlder mass of clay in water of a moderate depth. The agricultural significance of this peculiar structure is also marked.

The soil of the Leonardtown loam areas consists of a yellow, silty loam, containing scattered pebbles of small size. Its usual depth is about 1 foot, and it is underlaid by a clay loam subsoil having the characteristics already described. The total depth of soil and subsoil varies greatly, both because of differences in thickness of the original deposit and because erosion has removed the formation to different degrees in different localities. Originally it must have been about 20 feet thick on most of the area of the county. The Leonardtown loam subsoil acts as a heavy clay in its relationship to the circulation and retention of soil moisture, though a mechanical analysis of any given portion of it would show it to be a somewhat sandy loam.

Water, in circulating through soils and subsoils, depends for its rate of motion upon the size and arrangement of the spaces existing between individual soil particles. Thus, a coarse, sandy soil has less actual open space in a cubic foot of material than a fine-grained, compact clay has. But the soil pores are large, and the volume of space, compared with the area of the walls of the cavities, is much greater than in the clay soil. As a result, water moves more freely through

sandy soils than through clays. Sandy soils are incapable of retaining the high percentage of soil moisture usually found in clays when all other conditions but those of texture are similar.

With the Leonardtown loam the actual texture of the soil masses is largely modified in its influence upon the circulation and retention of soil moisture by the peculiar structure. Water, in passing through the subsoil, must pursue a very roundabout course, for the clay lenses are highly impervious, while the sandy joints permit of a much easier flow. Thus, the soil water flows from the surface of one clay lens to that of another, and is much more retarded in its progress than would be the case if the same materials were mixed in a homogeneous mass. As a consequence, the Leonardtown loam presents the agricultural features of a heavy clay soil while composed of the materials of a somewhat sandy loam. The peculiar structure also makes the subsoil more friable, and the Leonardtown loam is frequently spoken of as a brittle soil to distinguish it from more plastic masses of clay.

The natural growth common to the Leonardtown loam comprises the white oak, pitch pine, and, in low-lying wet areas, the sweet gum. The white-oak growths are such a common feature of this soil that it is locally known as "white-oak soil," while the fact that much of its area is covered with timber also causes it to be spoken of as "forest land." The Leonardtown loam is one of the heaviest soil types found in Calvert County, and with proper cultivation it should produce good crops of wheat and furnish fair pasturage and clover crops. It is too heavy for the production of the best grades of tobacco, and, consequently, it has not been utilized to the best advantage in the Maryland areas where it occurs when this crop is used as the standard of comparison in estimating land values.

The uniformly yellow appearance of the surface soil indicates a lack of organic matter, which should be supplied in the form of stable manures and by plowing under green crops, like crimson clover and cowpeas. Such a treatment would not only increase the actual supply of plant food, but would also improve the texture of the soil. Unless it is absolutely necessary that tobacco should be raised upon areas of this type, the application of lime should be tried in connection with stable manures and green fertilizers. The fact that tobacco is not largely raised on this soil should make this line of improvement much easier than on other types of soil to which tobacco is one of the crops best adapted.

The present production of wheat and corn on the Leonardtown loam is scarcely equal to the average of the county, and large areas of the formation are left to forest occupation, furnishing only scanty pasturage for a few head of stock. The soil is capable of considerable improvement, and should be cleared and farmed according to modern methods, especially in the production of grain and forage crops.

The fact that the peculiar structure of the Leonardtown loam sub-

soil influences its crop value to a great extent is well shown by the following mechanical analyses. The actual percentage of clay present is only slightly greater than that in the Norfolk loam, while the silt percentages are nearly equal. The arrangement of the clay in nodules and lenses and the accumulation of sand along the overlapping edges produce a more impervious subsoil than is the case where the entire mass is homogeneous, as is true of the Norfolk loam.

Mechanical analyses of Leonardtown loam.

No.	Locality.	Description.	Organic matter, and loss.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
5161	Frazier	Yellow silty loam, 0 to 8 inches.	2.94	Tr.	2.01	3.68	9.38	10.53	59.00	11.81
5163	1¼ miles NE. of Barstow.	Yellow silty loam, 0 to 10 inches.	2.58	Tr.	2.91	3.76	11.83	20.86	50.57	7.52
5165	1¼ miles W. of Dares Wharf.	do	2.58	1.12	4.30	5.84	10.42	17.04	46.53	11.98
5162	Subsoil of 5161	Clay loam, 8 to 30 inches.	2.61	.64	4.01	4.54	6.26	13.44	53.73	10.81
5164	Subsoil of 5163	Clay loam, 10 to 30 inches.	2.31	.93	2.20	3.51	11.22	11.43	47.14	21.02
5166	Subsoil of 5165	Clay loam, 10 to 40 inches.	2.12	.80	3.48	5.17	7.65	10.44	48.55	21.75

SUSQUEHANNA GRAVEL.

About 6 square miles of territory in Calvert County are occupied by a distinctly gravelly soil. The gravels usually appear on slopes in narrow bands and in isolated patches, but near Adelina and about 1 mile east of Ferry Landing considerable areas of the upland are occupied by medium-sized quartz pebbles very loosely coherent and mixed with little other soil material. Also along some of the slopes from the upland region to the lower levels, soil-creep and rain wash have spread considerable gravel over the slopes. This concentration of gravel is in part due to the exposure of gravel bands originally deposited along with other material and in part to the concentration of the gravel by the washing away of finer materials. The resulting soil condition is not very favorable to agricultural operations. The soil, such as it is, consists of from about 60 to 85 per cent or even more of rounded quartz pebbles, varying in size from that of a pea to several inches in diameter. Some finer material present gives a foothold for vegetation, and near Adelina corn and tobacco are raised on this soil. Where a heavier subsoil is present at no great depth a sufficient water content can be maintained to produce a crop under favorable circumstances of rainfall.

In other localities grapes are raised on soils nearly as gravelly, but it is done in a climate where the rainfall is greater and the seasons of drought not so frequent nor so prolonged. Irrigation would aid in crop production on this gravel soil, but it is not well situated nor of sufficient value to warrant so expensive a remedy. For the present, therefore, these soils are considered quite valueless for agricultural crops. Fortunately, there are no large areas and the total area is small.

WINDSOR SAND.

This soil formation lies along the lower portions of the stream divides in the southern part of the county and occupies the highest crests in the northern part. The surface of the formation is usually gently rolling, and the more level portions of the type are interrupted by numerous small, flat-topped hills covered by Norfolk or Leonardtown loam, or else consisting entirely of the barren subsoils of these formations which have been exposed by rain washing. In some parts of the area, notably between Battle Creek and the Patuxent, gravel knolls and slopes are found scattered through this soil formation.

The Windsor-sand type owes its origin to the exposure of the horizon of orange-colored sands and gravels of the Dunkirk age, described in the chapter on the geology of the county. This layer of material at one time formed an almost continuous sheet over all the upland part of the county, and when first built into the land area of the region it was covered by other sediments which have since been removed by stream action. The remaining portions of these other sediments, the Norfolk loam and Leonardtown loam areas which still exist, are surrounded by bands or areas of Windsor sand. In many instances it is still possible to trace the sands and gravels of this soil type to the edge of Norfolk loam or Leonardtown loam areas and then to observe their continuation under the heavier materials of those types. This fact is conclusive evidence in itself of the origin of the type, but the location of the type between stream heads and along divides, where erosion has been most active, and its general presence immediately over Neocene strata throughout the entire area corroborate the more direct evidence. The close similarity of the materials of the soil to those of the orange sand and gravel, in many cases amounting to complete identity, also supports this explanation of the origin of the type, that is, a definite layer of sedimentary materials has been exposed by erosion and worked over to form a definite soil type. This is not the only case to be found in the county, as is indicated under the discussion of Norfolk sand and Sassafras loam.

One marked feature of the Windsor sand area is the absence of surface streams. The incoherence and porosity of the soil allow the water falling on its surface to sink immediately to considerable depths, and the flow of water takes place as a gradual seepage along

the surface of slightly more dense materials lying under the sand and gravel of this soil. As a result stream channels are only sparingly present in the area, for absence of surface flow prevents the formation of stream ways, and the small washes formed by the most torrential storms are rapidly obliterated by the crumbling of incoherent margins or by the ordinary operations of cultivation.

The soil proper of the Windsor sand areas consists of a medium to coarse grained sand, usually containing considerable quantities of small pebbles. Locally, the material frequently becomes finer grained, forming a sandy loam type, but this is more usual near the boundary with some other type where rain wash has brought in finer local material. The subsoil is a rather coarse-grained yellow sand mixed with pebbles and broken iron crust, and usually very loosely coherent. The soil varies in depth from 8 inches to about 1 foot, while the subsoil may be 3 feet or 10 feet in thickness, depending upon the amount of the material originally deposited and upon the progress of what little erosion takes place over the area. It is very uniformly underlaid by the finer grained sands and sandy loams of the Choptank or Nomini divisions of the Chesapeake. The contact between the Windsor sands and the underlying material is frequently well shown in the deeper road cuts.

The natural growth of this type of soil in Calvert and near-by counties consists of forests of pitch pine and yellow pine, which give it a distinctive character so pronounced that where the forest still remains it is usually easy to recognize the boundaries and extent of the areas by the tree growth. It is also noticeable that the most sandy roads of the county are, with few exceptions, found in areas of Windsor sand soil.

In Calvert county this soil type has lately been adapted to peach orchards, and supports some of the finest peach orchards of the region. The fruit is noteworthy for its fine color and flavor, and peach orchards in the county remain in bearing for a period of twenty-five or thirty years. Tobacco produces a good texture of leaf upon this soil type, though the amount raised per acre is somewhat less than on heavier soils. In especially dry seasons the plants are more liable to "fire" on Windsor sand than on soils more retentive of moisture. The Windsor sand is well adapted to the production of early truck crops. Increased rapid transportation facilities should permit of the more general introduction of such crops on this and other light soil types in the county.

The inability of so light and porous a type of soil to maintain a sufficient amount of soil moisture for plant growth during periods of drought may be corrected in part by the more general use of green manures plowed under, crimson clover and cowpeas being well adapted to such uses.

The coarseness of the grains forming this soil is indicated by the analyses of typical soil and subsoil:

Mechanical analyses of Windsor sand.

No.	Locality.	Description.	Organic matter, and loss.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
5167	1 mile E. of Prince Frederick.	Coarse sand and gravel, 0 to 12 inches.	0.97	10.31	34.75	23.06	13.95	4.52	9.85	2.65
5168	Subsoil of 5167	Coarse sand and gravel, 12 to 40 inches.	1.02	8.88	30.92	20.62	13.68	5.10	15.28	4.55

NORFOLK SAND.

Norfolk sand is found along the sides of all the deeper stream cuts in the southern part of the county, and it occupies about 50 per cent of the land surface in the northern half of the county, covering slopes and upland alike, except where other upland soil types still exist in fragmentary areas.

The surface of this formation, when it occurs along stream valleys, is generally quite steeply inclined and often precipitous. As a result, most of the areas of this type in southern Calvert County are occupied by growths of pine, being too steep to permit agricultural operations. In the northern part of the county and along certain stream terraces, like those in the Hunting Creek Valley, Norfolk sand forms one of the most important soil types.

Norfolk sand, as a soil type, owes its origin to three different methods of derivation. The greater number of the areas of this soil found in Calvert County are derived from the outcrops of layers of sandy material deposited under water during Neocene and Pleistocene time. Two of the subdivisions of the Neocene sediments consist largely of medium-grained sands, interspersed with thin strata of clay and layers of shell marl. One member of the Pleistocene, found lying above the Neocene in many places, consists of a medium-grained sand containing small pebbles and considerable iron crust. Where these different layers of sandy material have been exposed at the surface through stream erosion, the various agencies of weathering, such as frost, percolating rain water, and organic growth, have modified the originally infertile sands so that they are capable of sustaining vegetation and have become true soils. So areas of the resulting Norfolk sand are found in the stream beds where these layers outcrop, and

over the upland part of the county where overlying materials have been removed.

This process of soil formation has occupied a long period, and while part of the sandy material was being worked over into soil where it lay, part of it was carried away by the streams and dropped along the stream courses and at tide water wherever the current was not swift enough to continue to carry its load of sand. The present shore line lies considerably below the level of the position it occupied when this action began, so the first deposits of this transported sand was in the form of terraces built far above the present mouths of the streams. With the relative lowering of the water level these terraces have been exposed to the agencies of the atmosphere, and these sands have come to form soils almost identical with the ones directly derived from the outcrops of the original material. Such terraces may be seen near Hunting Creek Bridge, along Lyons Creek, and in many other localities. Part of the sand was also carried down as far as the areas now occupied by the foreland portion of the county along the Patuxent River, and areas of Norfolk sand are found about 1 mile south of Deep Landing and just north of Ferry Landing. They represent a terrace built by the Patuxent, in most respects similar to those built by the smaller streams. A common peculiarity of all these terraces is that the sand is coarser and the gravel more abundant as one goes up the stream. This is due to the diminished strength of stream currents near their mouths and the consequent diminution of the size of the particles transported.

In the northwestern part of the county and; in general, north of the latitude of Huntingtown the sands of this soil type are not so coarse as farther to the south, and a sticky, clayey subsoil is reached at a less depth. This is due to the fact that the lowest division of the Neocene, the Calvert clay and infusorial earth, comes out at the surface, and the sandy materials which once covered it have been more completely removed. However, the sandy layers are still represented by small areas on the higher uplands, and the long continued and constant rain wash has spread a thin layer of sand even over the heaviest subsoils. This action is still in progress, and many acres of this soil type consist of rain-washed materials which have accumulated in hollows and valleys. The agricultural values of these different accumulations remain remarkably constant; so they have been classed as a single soil type, though varying considerably in origin and in geologic age.

Norfolk sand is a yellowish sandy loam of medium coarseness, containing a scattering of gravel in some instances and often mingled with broken fragments of iron crust. The soil has an average depth of about 9 inches, and is usually succeeded by a slightly heavier yellow sandy loam which may extend to a depth of many feet, as in the case of the areas weathered out from outcropping strata, or which may be

underlaid at various depths by much finer-grained material, as is frequently the case in northern Calvert County.

The natural timber growth is pitch pine, chestnut, and oak. The soil is one largely used for the cultivation of tobacco, and some of the best tobacco farms in the area are located on this type. On the other hand, a few farms located near the Patuxent River on this type are reported as not so successful in the production of the crop; for, while a large growth is secured, the quality is not of the best.

Norfolk sand, as represented by the finer-grained grades of northern and northwestern Calvert County, produces good crops of tobacco, and the type in general is also well adapted to the production of truck crops. The peaches raised upon this soil are of good color and bring good returns. Wheat and corn are raised on this soil in regular rotation with tobacco, but the Norfolk sand is a type distinctly too sandy for the production of the best grain crops. It is not sufficiently retentive of water to maintain the continuous growth necessary to bring grains, especially wheat, to maturity.

The increased facilities for rapid transportation, recently acquired in northern Calvert County, should lead to a more general use of this soil for market gardening purposes. It is one of the typical truck soils of the Atlantic seaboard.

The slight gradation in the texture of this soil type is well shown by the following analyses. The finest-grained soils are found toward the northern extremity of Calvert County, while the coarsest sands are found near its southern end. The intermediate texture of the Hunting Creek sample is quite marked.

Mechanical analyses of Norfolk sand.

No.	Locality.	Description.	Organic matter, and loss.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
5169	One-fourth mile N. of St. Leonard.	Medium brown sandy loam, 0 to 10 inches.	1.42	1.06	6.08	10.06	51.44	10.84	15.40	3.65
5171	1 mile E. of Hunting Creek Bridge.	Orange sandy loam, 0 to 9 inches.	1.33	.58	2.49	6.28	48.36	20.99	16.33	3.51
5176	One-half mile N. of Mount Harmony.	Yellow sandy loam, 0 to 9 inches.	1.70	Tr.	1.33	2.36	47.38	26.20	16.95	3.68
5170	Subsoil of 5169	Orange sandy loam, 9 to 30 inches.	2.11	.70	4.00	7.08	51.98	7.27	16.51	10.66
5172	Subsoil of 5171	....do	1.11	Tr.	3.06	6.09	49.73	17.16	16.14	6.26
5177	Subsoil of 5176	Yellow sandy loam, 9 to 30 inches.	1.48	0.00	Tr.	2.40	43.33	26.59	19.65	6.59

SASSAFRAS LOAM.

No large single areas of Sassafras loam are found, but many small tracts occur over almost the entire county. They are found more numerously and in larger areas in the northern part of the county than in the southern.

Sassafras loam in Calvert County is derived from two separate sources. The lowest member of the Chesapeake group, the Calvert, is made up of beds of infusorial earth and clay, and where these reach the surface the resulting soil is a slightly sandy loam derived directly through the action of atmospheric agencies upon the clay and infusorial earth strata. The areas of soil thus formed are found along the slopes of stream valleys and are usually merely long narrow strips of a heavier soil, separating the higher sandy soils from low sandy terraces or from meadow lands in the stream bottoms. Frequently the horizon, which would be occupied by this soil type, forms a steep cliff of clayey material unadapted for agricultural purposes. This zone of Sassafras loam does not always show the soil formation in its most typical character, since it lies in a position to catch much of the sandier material washed down by rains from higher levels. In these cases the soil is more sandy than in type localities, but the subsoil is the usual heavy clay found elsewhere throughout this formation.

Lying along the stream valleys and along the Patuxent slope are flat-topped terraces, built up in recent geologic times from materials which have been derived from the Calvert clays and reworked into later deposits. So far as soil values are concerned these materials form the same soil types as when they composed part of the Neocene strata, though they now occur as terrace forms. A terrace of this character is well developed at about 80 feet elevation just west of the head of tide water on St. Leonard Creek, another is found just southwest of Dares Wharf, and many more examples could be cited from localities along the Patuxent. The region lying just east of Lower Marlboro presents an area where the Sassafras loam terrace of later age rests against the outcrop of Neocene material, giving rise to the same soil type, and the resulting occurrence of Sassafras loam is one of the largest found in Calvert County.

The influence of this heavy clay material, as it occurs at Neocene horizons, is felt in the northern areas of Norfolk sand. The clay comes near the surface, under the covering of sandy soil, and in some cases forms sticky bands of small extent in fields otherwise uniformly covered by Norfolk sand.

The topography of the surface of this soil varies with its manner of occurrence. In the terrace areas it is flat topped or gently sloping, while in the outcrop areas it is more steeply sloping or even precipitous and considerably gullied by stream action.

The soil itself consists of a silty to fine sandy yellow or brown loam,

having a depth of about 10 inches. This soil is uniformly underlaid by a yellow loam of a finer texture than the soil, usually to a depth of 40 or 50 inches. In the outcrop areas of this type the subsoil grades down into the unweathered bluish clay of the Calvert formation, while in the terrace areas, as at Dares Wharf, the subsoil is underlaid by cross-bedded sands.

Sassafras loam is a type of soil well adapted to general farming purposes, and if it occurred in larger areas would form a marked class of farming lands. It produces some of the best corn crops raised in the county, and produces fair wheat yields. It is also cultivated in tobacco with good results. In other regions than Calvert County this soil supports excellent pear orchards and furnishes good crops of tomatoes and asparagus.

The following analyses give an indication of the texture of the Sassafras loam. The percentage of clay in this soil is less than that in either the Norfolk or Leonardtown loam.

Mechanical analyses of Sassafras loam.

No.	Locality.	Description.	Organic matter, and loss.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
5180	1 mile W. of St. Leonards.	Yellow silty loam, 0 to 20 inches.	2.67	0.84	4.07	4.38	6.48	12.72	60.72	7.80
5182	One-fourth mile S. of Dares Wharf.	Yellow loam, 0 to 9 inches.	2.35	.46	3.01	6.55	25.10	15.29	36.15	10.74
5181	Subsoil of 5180.....	Yellow loam, 20 to 36 inches.	2.07	.49	3.94	3.78	4.36	8.17	54.67	22.39
5183	Subsoil of 5182.....	Yellow loam, 9 to 30 inches.	2.37	.31	2.08	4.67	21.58	15.37	32.86	20.53

SASSAFRAS SANDY LOAM.

Sassafras sandy loam lies chiefly along the low forelands which border the Patuxent River, and is also represented by small areas near Plumpoint and along the lower course of Fishing Creek. The surface of this formation is usually flat and only gently sloping. It lies at an elevation of from 15 to 35 feet above tide level, and its location near tide water, together with its altitude and its crop values, makes it one of the most desirable soil types in the region. It forms a portion of the area included in the most recent geologic formations of the region and represents a deposition of fine sand, silt, and organic matter in the shallower waters of the latest stage of land submersion. A very similar process is being carried on at present along the coast line, where lagoons and stream mouths are being silted up after each rain storm. The present marsh areas along the Patuxent, with their

abundant growth of aqueous vegetation, serve as a filter, which entangles the sediment carried by the river and retains it, mingled with decaying vegetation, to form a soil much like the Sassafras sandy loam when a change in comparative land elevations shall expose these areas as portions of the land. So in former times, along the river shores, in the embayments formed by tributary streams, and where sand bars sheltered areas of shallow water, the materials of the Sassafras sandy loam were accumulated, and they now form a portion of the land well known for its fertility. Small areas of especially sandy soil lying within the boundaries of this type, notably near Point Patience, are still in the process of formation. The wind sweeping along a sandy shore line and against a low cliff picks up sand from the beach, and, when the direction of its current is changed by the cliff, eddies are set up which allow part of the sand to drop on the near-by fields. Small patches of a few acres in extent are made excessively sandy and their adaptation to crops is materially changed by this process.

Sassafras sandy loam may be defined as consisting of a medium to fine brown sandy loam, having an average depth of a foot or more. It is underlaid by a heavier type of yellow sandy loam to an average depth of about 4 feet, and this is often, though not always, succeeded by a gray or drab clay loam. This combination of soil textures gives rise to an easily worked soil sufficiently retentive of moisture to favor the production of grain crops, but not so heavy and wet as to exclude the cultivation of late truck crops and fruit. Tobacco is also raised on this soil, though it is not so well suited to tobacco culture as are other sandier types located in the county. Stock raising and dairying are carried on upon this soil type in a few localities in the southern part of Calvert County, while the cultivation of crops for canning factories is undertaken upon this type of soil in other localities. The natural forest growth has been removed from the Sassafras sandy loam, and almost the entire extent of the formation is under cultivation.

The following analyses of a typical sample of the soil and subsoil of this type show the sandy character of this loam:

Mechanical analyses of Sassafras sandy loam.

No.	Locality.	Description.	Organic matter, and loss.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand; 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
5184	One-half mile N. of Point Patience.	Brown sandy loam, 0 to 14 inches.	2.98	0.66	3.10	5.52	31.94	20.92	29.63	6.30
5185	Subsoil of 5184.....	Yellow fine sandy loam, 14 to 30 inches.	1.76	.48	3.08	5.30	26.16	20.24	33.29	9.54

MEADOW.

The signification of the word meadow varies so greatly in different localities that it may be well to define its use in this report as referring only to low-lying, generally rather wet areas, having an approximately flat surface and best adapted to the production of grasses and to grazing.

In Calvert County, meadow areas are found along the bottoms of the larger stream valleys and on the lower-lying portions of the forelands bordering the Patuxent River. The chief difference between these areas is found in their extent. The stream valleys are narrow and steep walled, and the level or gently rolling portions of their bottoms are the only parts of the upland forming typical meadows. Even portions of these stream bottoms are so wet and ill drained as to fall in the general classification of swamps, as is the case with the lower courses of Fishing Creek, Parker Creek, and other large streams.

The meadow lands of the stream valleys owe their origin primarily to the action of the streams themselves. Channels have been and are being cut into the unconsolidated materials which constitute the region, and the changing locations of the larger streams have broadened these valleys. Then, too, local material contributed by every storm is carried part way from the upland to the sea and is left temporarily at different points along the valley. In some cases deposits of sand and gravel are formed; in others, clay and silt are deposited, and an irregular soil results. The common characteristic of this entire soil mass is its moist condition, resulting entirely from its position relative to stream drainage.

Upon these meadow areas a rank growth of poplar, sweet gum, alder, and a few pines and oaks are found, generally overgrown by climbing vines and interspersed in the more open portions by banks of ferns and areas of coarse, rank grasses. The position, altitude, and moisture conditions are not favorable to the cultivation of crops, and the only real use made of these lands is to turn farm animals upon them to graze. The open winters of the region permit of almost constant grazing, though some of the meadow areas are frequently flooded to such an extent that they become inaccessible.

The meadow lands lying along the forelands are somewhat different. They comprise low-lying areas which, on account of the fine texture of the soil or because of their position near water level, are not so valuable for general agricultural purposes as the prevailing soil type. However, these meadow lands are frequently cleared and fair crops, especially grain crops, can be raised on this soil.

The foreland meadows owe their origin to the deposition of fine silt and clay when the area was submerged and to the partial establishment of natural drainage since they became a part of the land area. They are flat or gently rolling, and there is no marked rise in elevation

in passing from the meadow land to the Sassafras sandy loam. There is, however, a marked change in soil texture in most cases.

The foreland meadows generally have a depth of about 1 foot of gray or drab-colored silty or clayey loam underlaid by 3 or 4 feet of drab clay. This is frequently succeeded by gravel and sands extending downward to sea level. The clay, though tough and plastic when wet, will leach out and fall apart if long exposed to the action of the rain and frost. This same soil type, if lying farther above permanent water level, would correspond closely in texture and crop values to Sassafras loam. These meadow lands are largely covered with growths of sweet gum, water oak, and other water-loving trees. Where cultivated they produce a fair crop of wheat or grass, but are not adapted to the culture of fruit, truck, or tobacco. One peach orchard seen on this soil type looked sickly and the fruit was not well colored.

Artificial underdrainage and a resort to liming would improve this land and help to bring it into a fair state of productiveness. Wheat, corn, and grass should be its chief crops. The valley meadows, on the other hand, are only adapted to grazing, and the wild grasses now produced are not particularly nourishing.

SWAMP.

The mouths of nearly all the larger streams in Calvert County are marked by areas of marshy land. This condition is brought about through two chief causes. In the first place sand and clay derived from the upland are being deposited near the mouths of all the streams, and the land area is growing slowly. The first step in this growth is the shallowing of water areas through deposition, then vegetation gains a foothold, and swamp areas grown up to reeds, calamus, and marsh grasses are formed. But this building up is impeded to a slight extent through this region by the slow sinking of the land. However, the silting up of streams is progressing so rapidly that areas which once permitted navigation by small boats now form tide flats and marshes. This is notably the case along the lower course of Hunting Creek and at the mouths of streams flowing into the Patuxent. Along the bay shore the waves are cutting away the coast line so rapidly that marshes are not formed so extensively. The mouth of Fishing Creek and that of Parker Creek are swampy, and the sand bar built up by wave action at Covepoint incloses a marshy lagoon.

These swampy areas and the more extensive marshes formed by the silting up of the Patuxent River do not form a part of the agricultural area of the county. In some places diking and drainage might reclaim parts of the swamp areas. The swamps could be made to furnish a supply of muck and peat for composting with stable manures and lime, which would form a very desirable fertilizer. In their present state the muck and peat are not sufficiently decomposed to furnish an immediate supply of plant food.

CONDITIONS OF AGRICULTURE.

The consideration of the possibilities of development of any agricultural region must depend upon the soil, the climate, and the transportation facilities, combined with the physical and mental energy of its inhabitants, and upon the social and industrial conditions.

The soils of Calvert County were first brought under cultivation when the entire area farmed in the present limits of the United States constituted but a narrow fringe along the tide-water portion of the Atlantic seaboard. They have been tilled continuously for nearly two hundred years under various conditions and with varying success. The early colonists began the cultivation of tobacco with their first season's work; it was planted to the exclusion of food crops, and an early enactment of the colony provided that 2 acres of corn must be planted for each person in the colonist's family, in order that they should have a grain crop to live upon. This indicates the extent to which the tobacco crop held sway even at the beginning of the history of the county. Calvert County, in common with the other southern Maryland counties, remained a tobacco-raising region of eminence for nearly two centuries. The crop was cultivated by means of slave labor, and large plantations were the rule rather than small farms. During this period the type of tobacco was developed which has secured a place in the trade world under the name of Maryland pipe tobacco. This tobacco is in demand for the French export trade, and the region is called upon at present to furnish from 15,000 to 18,000 hogsheads of about 800 pounds weight each year. Of late years increasing quantities of Ohio tobacco have come in competition with the Maryland product.

The civil war brought about an entire change in the social and economic relations in the county, and consequently in its agricultural activities. Many plantations which were admirably tilled by large forces of hands speedily deteriorated, since the labor necessary for their cultivation became very scarce, and at times even could not be hired. The large plantations were either mortgaged heavily in an effort to keep them under cultivation, or else portions of them were allowed to go out of cultivation. Even the sale of land which was no longer needed under the new order of affairs was difficult, since the great majority of the community suffered from the same causes. At the same time the tide of Western immigration carried settlers past the eastern seaboard to cheap Government lands in the West, and very few men of means came in from other localities to aid in the further development of this region.

As the Western country was settled its enormous grain crops, produced at a minimum expense for fertilizing and cultivation, came into direct competition with the corn and wheat crops of the East. Thus, the crops which, in the absence of abundant hand labor, could

be produced to best advantage came upon a market fully stocked with grain produced under less costly conditions.

These conditions of labor and of market have tended to discourage and dishearten even the most capable and energetic. On the other hand, the natural advantages of climate and abundant food supply have encouraged improvidence on the part of the wage-earners and laborers. Where wants are few and easily supplied the tendency toward energy of plan and action is dwarfed. Thus, some of those most in need of advancement have contented themselves with a bare existence when abundance might have followed from better directed and more sustained efforts.

The low productive power of many areas besides the one under consideration may be ascribed to the same general causes. Methods of agriculture must be improved, the intensive rather than the extensive system of farming followed, a sustained effort for the production of special crops undertaken, and the adaptation of special soils to special crops must be better understood and more fully practiced.

The large markets of the East are accessible by boat and rail communication. Only a single one is at present patronized to any extent by the producers of Calvert County. Using the peach crop as an example, instances have been known where large and fine crops of peaches have been marketed at a loss on a single market which was glutted, while other markets only a little less accessible were far from being stocked.

Such changes as will enhance the value and productiveness of the county must come slowly, supported by the experience of the most progressive and best equipped inhabitants. Such changes are in progress, and some of them have passed the experimental stage. Others have been planned but not undertaken. It is to be hoped that increased knowledge of the conditions both within and without the county may enable its inhabitants to realize the opportunities which they possess and from which they may profit.

CLIMATE.

The following table of climatic elements, compiled from the Maryland Weather Service, Vol. I, gives an indication of the average conditions to be expected in Calvert County. The station at Solomons represents conditions near sea level and near large bodies of water; that at Jewell represents the upland conditions.

Climatological data for Calvert County.

SOLOMONS.

Month.	Mean monthly and annual temperature.	Mean maximum temperature.	Greatest departure above.	Greatest departure below.	Mean minimum temperature.	Greatest departure above.	Greatest departure below.	Mean daily range.	Highest recorded temperature.	Lowest recorded temperature.	Mean monthly and annual precipitation.	Maximum monthly and annual precipitation.	Minimum monthly and annual precipitation.
	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	*In.*	*In.*	*In.*
January	34	41	+7	−7	28	+6	−10	13	66	4	2.6	5.1	1.5
February	36	43	+2	−7	28	+2	− 9	15	67	− 5	4.0	6.4	1.3
March	44	52	+6	−4	35	+6	− 8	17	82	18	3.2	4.7	1.2
April	53	62	+2	−2	45	+2	− 4	17	88	28	3.5	5.5	1.2
May	65	74	+5	−3	56	+5	− 2	18	100	41	3.9	4.6	2.4
June	74	83	+2	−3	66	+4	− 2	17	99	49	3.3	5.7	0.9
July	78	86	+2	−2	70	+1	− 3	16	99	57	4.2	7.4	2.3
August	78	86	+4	−2	70	+2	− 2	16	98	59	3.2	7.9	1.0
September	72	80	+5	−4	64	+3	− 2	16	98	46	2.0	3.2	0.5
October	59	68	+1	−2	50	+4	− 4	18	89	35	3.2	5.4	0.7
November	49	56	+6	−3	41	+4	− 2	15	77	23	3.0	4.7	1.9
December	39	46	+4	−4	32	+2	− 2	14	65	11	2.6	3.3	0.9
Annual	57	65	------	------	49	------	------	16	100	− 5	38.6	43.5	32.1

The last killing frosts in the spring have occurred as follows at Solomons: On April 20, 1897 and on April 28, 1898.

The first killing frost in the fall has occurred as follows at Solomons: On November 13, 1897.

JEWELL.

Month.	Normal monthly and annual temperature.	Highest recorded temperature.	Lowest recorded temperature.	Mean monthly and annual precipitation.	Maximum monthly and annual precipitation.	Minimum monthly and annual precipitation.
	° *F.*	° *F.*	° *F.*	*Inches.*	*Inches.*	*Inches.*
January	34	64	1	2.8	5.1	1.3
February	36	66	14	3.6	5.6	1.2
March	42	80	11	4.8	8.4	2.8
April	55	94	23	4.0	12.2	1.2
May	64	95	38	5.1	7.3	4.2
June	73	99	45	3.7	5.7	1.0
July	76	99	53	7.0	19.9	2.5
August	76	97	50	3.4	6.9	0.9
September	70	95	41	3.7	9.2	0.9
October	55	83	28	3.7	6.2	0.4
November	46	78	21	3.3	6.6	0.8
December	38	68	8	2.9	5.6	Trace.
Annual	55	99	−14	47.9	65.7	36.2

The last killing frosts in the spring have occured as follows at Jewell: On April 20, 1897, and April 6, 1898.

The first killing frosts in the fall have occurred as follows at Jewell: On October 19, 1896; November 13, 1897, and October 28, 1898.

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