Series 1960, No. 23

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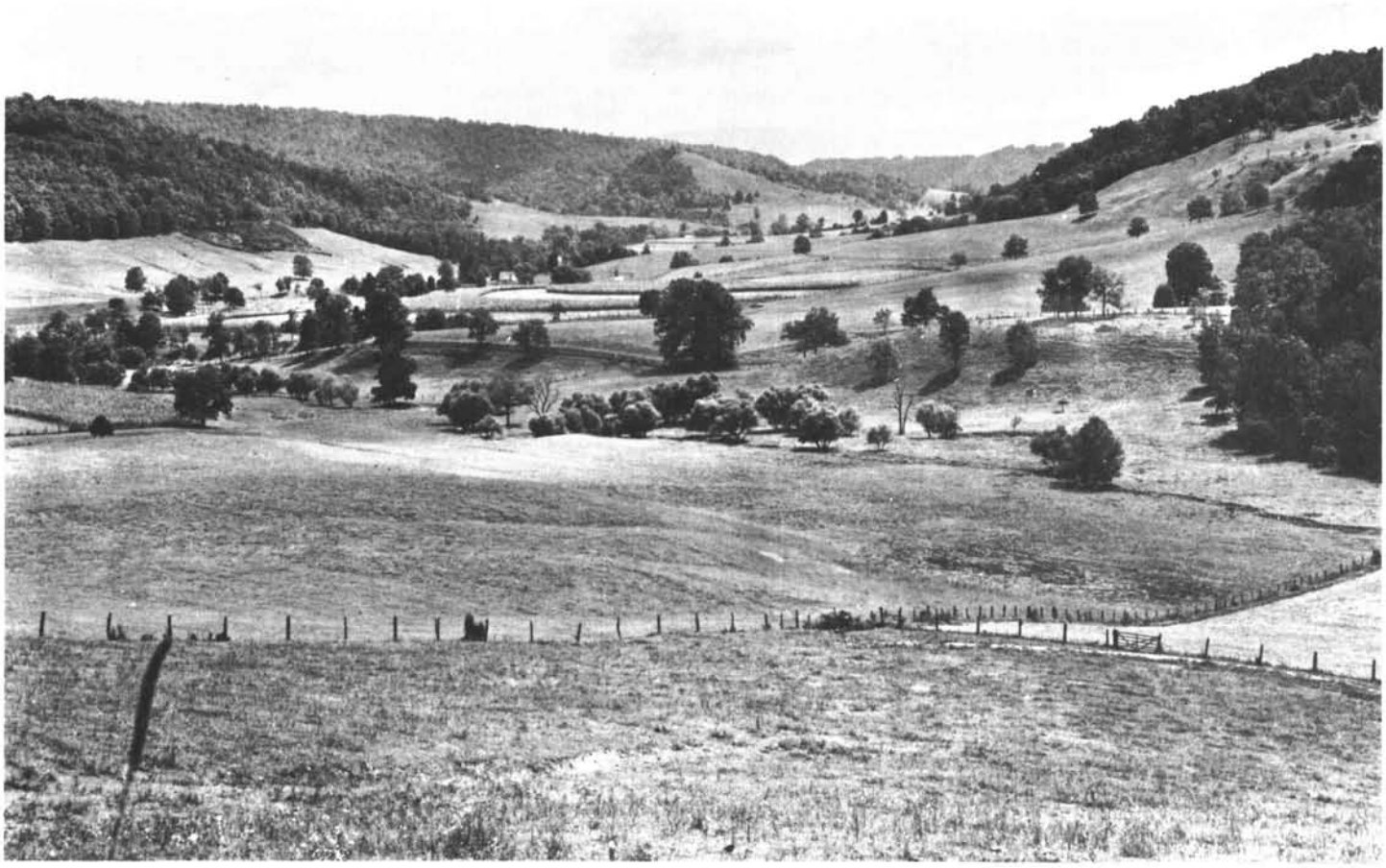
SOIL SURVEY

Monroe County, West Virginia



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
WEST VIRGINIA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Monroe County, W. Va., will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodlands; and add to our knowledge of soils.

Locating soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

Finding information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units" at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the county, and the page where each is described. It also lists, for each soil and land type, the capability unit and woodland suitability group, and the pages where each of these is described.

Foresters and others interested in woodlands can refer to the subsection "Use of Soils for Woodland." In that section the soils in the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

Engineers and builders will want to refer to the subsection "Engineering Applications." Tables in that section show characteristics of the soils that affect engineering.

Scientists and others who are interested will find information about how the soils were formed and how they were classified in the section "Formation and Classification of Soils."

Local planning boards will find valuable information about the location, extent, and limitations of soils for various rural and urban uses.

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in Monroe County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

* * * *

Fieldwork for this survey was completed in 1959. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time. The soil survey of Monroe County, W. Va., was made as part of the technical assistance furnished by the Soil Conservation Service to the Greenbrier Soil Conservation District.

Cover picture—Dissected plateau in the western part of Monroe County. Left skyline shows characteristic ridge. Shaly Litz soils on side slopes. Clarksburg soils on gentle foot slopes.

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SOIL SURVEY OF MONROE COUNTY, WEST VIRGINIA

BY JOHN L. GORMAN AND LEONARD S. NEWMAN, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE
WEST VIRGINIA AGRICULTURAL EXPERIMENT STATION

MONROE COUNTY is in the southeastern part of West Virginia (fig. 1). It has a total area of 473 square miles, or 302,720 acres. It is bounded on the west by Summers County and on the north by Greenbrier County. Three counties in Virginia are along its southern and eastern boundaries. The crests of Peters and Potts Mountains form most of the southern boundary. Union, the county seat, is located in the geographical center of the county. Alderson, in the extreme northwestern part, is the only town in the county that is served by a railroad. In 1960, the population of the county was about 11,500.

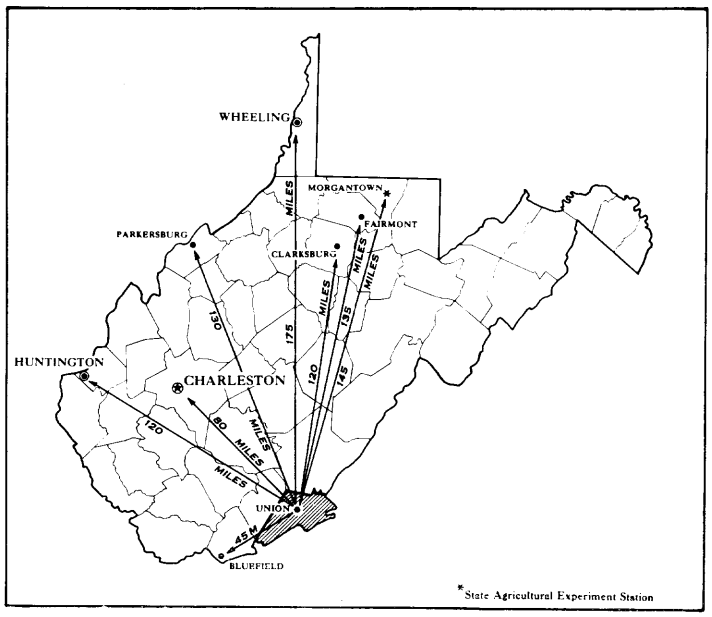

Figure 1.—**Location of Monroe County in West Virginia.**

The county is principally agricultural, but there are large forested tracts in the southern and eastern parts. The principal farm enterprises are raising beef cattle, sheep, and poultry, and dairying. Most of the cash income is derived from selling livestock or livestock products.

About 40 percent of the land in farms is pasture, and most of the cultivated crops grown are used to feed livestock. Corn, oats, wheat, and hay are the principal crops. A small acreage is in burley tobacco. One large commercial orchard is located near Sinks Grove. Most forest products are marketed as pulpwood at Covington, Va., or as mine timber in Mercer County and in adjoining counties to the west and south, where coal mining is extensive. A few small sawmills normally operate in the county.

How Soils Are Named, Mapped, and Classified

Soil scientists made this survey to learn the kinds of soils that are in Monroe County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down to the rock material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Pickaway and Lindside, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many series contain soils that differ in the texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Dekalb channery loam and Dekalb fine sandy loam are two soil types in the Dekalb series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases.

The name of a soil phase indicates a feature that affects management. For example, Dekalb fine sandy loam, 5 to 12 percent slopes, is one of several phases of Dekalb fine sandy loam, a soil type that has a slope range of 5 to 35 percent.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. The photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The detailed soil map in the back of this report was prepared from the aerial photographs.

The areas shown on the soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientist has a problem of delineating areas where different kinds of soils are so intricately mixed or occur in such small individual tracts that it is not practical to show them separately on the map. Therefore, he shows this mixture of soils as one mapping unit and calls it a soil complex. Ordinarily, a soil complex is named for the major soil series in it, for example, the Teas-Calvin-Litz complex. Occasionally, two or more recognized soils, which are not regularly associated geographically, may be mapped as a single unit, if their differences are not significant to the purpose of the survey or to soil management. Such a unit is called an undifferentiated mapping unit. A good example is the Frederick and Dunmore very rocky soils. Also, in most mapping, there are areas to be shown that are so rocky, so shallow, or so frequently worked by water that they cannot be called soils. These areas are shown on a soil map, but they are given descriptive names, such as Steep rock land or Sloping eroded land, shale materials, and are called land types rather than soils.

Only part of the soil survey was done when the soil scientist had named and described the soil series and mapping units, and had shown the location of the mapping units on the soil map. The mass of detailed information he had recorded then needed to be presented in different ways for different groups of users, among them farmers, managers of woodlands, and engineers.

To do this efficiently, he had to consult with persons in other fields of work and jointly prepare with them groupings that would be of practical value to different users. Such groupings are the capability classes, subclasses, and units, designed primarily for those interested in producing the short-lived crops and tame pasture; woodland suitability groups, for those who need to manage wooded tracts; and the classifications used by engineers who build highways or structures to conserve soil and water.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. The nine soil associations in Monroe County are shown on the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but patterns of soils, in each of which there are several different kinds of soils.

Each soil association is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

The general map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

1. Frederick-Duffield-Dunmore association

Deep, well-drained soils of the limestone valley

This association occupies the large, rolling, limestone valley in the north-central part of the county. It consists dominantly of deep, well-drained, moderately permeable soils. The surface is irregular because of the presence of rocky areas and shallow sinkholes (fig. 2). Drainage is largely through the sinkholes into underground streams, but there are a few surface streams. Most of the area is moderately eroded, and some small areas are severely eroded. This association makes up about 12 percent of the total area of the county.

The Frederick soils were derived from rather pure limestone. Their subsoil generally is yellowish-red silty clay. The depth to limestone bedrock commonly is from 5 to 10 feet, but in places ledges of limestone are almost at the

Figure 2.—**View across edge of the limestone valley northwest of Union, looking toward "the knobs." In left foreground are Frederick and Dunmore very rocky soils. Duffield soils are in distant fields.**

surface. In some places there are many chert fragments on the surface and in the soil. The Duffield soils were derived from silty limestone, locally called "soapstone." Their subsoil is yellowish-brown silty clay. The depth to the limestone commonly is from 3 to 6 feet, but in places there are outcrops of the soft soapstone.

The Frederick and Dunmore very rocky soils are fairly common in the limestone valley, especially on the steeper slopes. The rocks occur as ledges, boulders, and massive outcrops of limestone. Strips and patches of soils similar to the nonstony Frederick and Dunmore soils occur between the rocks. The Frederick soils are most common. In most places the soils are sloping, but in some places, especially adjacent to streams, they are steep or very steep. Sinkholes are common.

Small areas of the Chilhowie-Tumbez very rocky soils occur throughout this association. The Chilhowie soils are yellowish brown. The Tumbez soils are dark gray to black. These very rocky soils are shallow, somewhat droughty, fine textured, and readily eroded. They are naturally high in lime. Also in the association are small areas of the Pickaway and Guthrie soils on uplands and of the Huntington, Lindside, and Melvin soils on bottom lands.

Most of the acreage in this association is in well-managed, good-sized, highly productive farms. Raising beef cattle and sheep are the principal enterprises. Dairying is also important. The Frederick and Duffield soils are used for all crops commonly grown in the area and for hay and pasture. The Frederick and Dunmore very rocky soils are used mostly for pasture.

This association is noted for its extensive productive bluegrass pastures. Farm woodlots make up only about 10 percent of the land area and generally are accessible to livestock. Improved roads traverse the area, and U.S. Highway No. 219 crosses it from north to south. Union, the county seat, and Pickaway and Sinks Grove are in this association.

2. *Dunmore-Murrill-Laidig association*

Deep, well-drained soils of limestone valleys and lower mountain slopes

This association forms a long, narrow belt that extends from the northeastern to the southwestern parts of the county. It occurs mostly in valleys that extend southwest of Sweetsprings and Zenith and on the northwest foot slopes of Peters Mountain. A smaller area is on the northwest slope of Potts Mountain, along the headwaters of Ewin Run. This association consists of deep, well-drained, mostly gently sloping to strongly sloping soils underlain by cherty limestone, sandstone colluvium, and sandstone. It makes up about 11 percent of the county.

The Dunmore soils, which are dominant, are deep and productive. They have a clayey, yellowish-red subsoil. The Murrill soils are deep, well drained, and loamy. They have a dark-brown subsoil. Both the Dunmore and the Murrill soils are underlain by limestone. Most areas have a few sinkholes.

The Laidig soils are deep and well drained. They have a yellowish-brown, stony subsoil. They were derived from deposits of sandstone fragments and soil materials that have accumulated at the base of Peters Mountain. Scattered on the surface and throughout the profile are fragments of white, gray, and purple sandstone that range from channery fragments to large boulders in size.

The Bodine soils make up a small part of this association. They have a yellowish-brown subsoil and are deep and very cherty. Other soils in the association are the lime-influenced Litz soils, which formed in material weathered from shale; the Landisburg soil, which formed in colluvium weathered from sandstone and cherty limestone; the poorly drained Guthrie soil, which formed in colluvium and residuum; the Huntington, Lindside, and Melvin soils, which are on flood plains; and some steep, very stony Dekalb soils.

The gently sloping to moderately steep Dunmore and Murrill soils are used chiefly for growing corn, small grain, and hay. Mixtures of alfalfa and tall grass also grow well. Cleared areas of the Laidig soils and of the steeper Dunmore and Murrill soils are used mainly for pasture. Some Bodine soils are suitable only for hay, pasture, or woods because of the number of chert fragments on the surface and throughout the profile. These fragments commonly interfere with tillage and with mowing.

Raising beef cattle is the principal enterprise in this association, but many farmers raise sheep, and a few specialize in dairying. Timber and pulpwood are harvested from the steep slopes.

Controlling erosion and maintaining fertility are the chief problems of soil management. Many soils are too stony for any use except trees. Woodland management, including fire prevention, is important.

Roads generally are in the lower lying areas along streams, or they cross the smaller hills in the southern part of the association. State Highway No. 3, the main road in the northern part, is joined by a secondary road that runs southwestward. Most farmsteads are near these roads. Many farms are narrow and extend across the association and up Peters Mountain.

3. *Shaly Litz-shaly Montevallo-Clarksburg association*

Shallow soils on shale

This association is made up of shallow, shaly soils that have been influenced by lime, and a small acreage of deep, moderately well drained, colluvial soils. It occupies the dissected shale and sandstone plateau in the west-central part of the county. It covers about 10 percent of the county and consists of a fairly broad area that extends from Greenville to just west of Willow Bend and of narrow bands that extend northwestward to Alderson and southwestward to just east of Peterstown. Swoopes Knobs and Flattop Mountain are in this association.

Numerous drainageways have cut far back into the shale hills and have caused the formation of many narrow, rounded ridgetops that have steep side slopes. Some small, smooth benches occur along the drainageways. Outcrops of limestone are fairly common and occur mostly as narrow ledges across the slope or as ribs up and down the slope.

The shaly Litz soils are yellowish brown, medium textured, shallow, well drained, and periodically droughty. These gently sloping to very steep soils developed in material weathered from calcareous shale and limestone. They contain many small, flat pieces of shale and are readily eroded. The shaly Montevallo soils are similar to the shaly Litz soils, except that they have been severely

eroded and are more shallow and more droughty. Bare spots on which there are outcrops of shaly bedrock are common in most pastures.

The Clarksburg soils are moderately well drained, yellowish-brown, silty soils that developed in colluvium weathered from the shaly Litz soils. They occur on gentle to moderate slopes at the base of shale hills that contain some thin limestone veins. There is an extensive area south of Lindside, along U.S. Highway No. 219.

The minor soils in this association are the Frederick and Duffield soils, which are the dominant soils in association 1; the Captina and Robertsville soils, which are on terraces above overflow; and the Huntington, Lindside, and Melvin soils, which are on flood plains. The Melvin and Robertsville soils need to be drained if they are used for crops.

The farms are mainly general farms. The gentle slopes are used for row crops and hay, and the steeper slopes and eroded areas are used mainly for pasture. Erosion has been active in a number of fields, and many of these fields have been abandoned and are reforesting to Virginia pine, hardwoods, and redcedar. Forested areas are fairly extensive and are mostly on the steeper slopes. Generally, they have been cutover for mine timber and in many places are understocked.

Farms are fairly well distributed and are well served with all-weather roads. Greenville and Alderson are in this association, and Indian Creek flows through the area.

4. Teas-Calvin-Litz association

Shallow to moderately deep, reddish-brown and brown soils of the dissected shale plateau

This association occupies two areas east of Hillsdale, one small area north of Sinks Grove, and a large area in the southwestern part of the county. It consists of a thoroughly dissected plateau with numerous ridges and valleys and a few wide, flat areas. The ridges are mostly narrow and are capped with hard sandstone. The slopes from the ridges generally are steep and are broken at intervals by narrow sandstone ledges. The valleys are from 300 to 500 feet deep. In some places the slopes are severely eroded, and gullies have formed. Bedrock consists of interbedded layers of red and gray siltstone, shale, and sandstone of the Mauch Chunk formation. This association makes up about 21 percent of the county.

The Teas soils are well-drained, shallow to moderately deep, gently sloping to very steep, dark reddish-brown silty soils that developed in material weathered from weakly calcareous, red shale and siltstone.

The Calvin soils are shallow to moderately deep, well-drained soils that developed in material weathered from acid, reddish-brown siltstone and shale.

The Litz soils are well-drained, shallow to moderately deep, gently sloping to steep, yellowish-brown silt loams that developed in material weathered from acid and weakly calcareous, gray shale and siltstone.

In many areas the Teas, Calvin, and Litz soils occur together in such intricate patterns that it was not practical to map them separately, and they were mapped together in a complex. Many of these areas are severely eroded. In some places the shale is exposed, and there are numerous small gullies. Many fields that were once used for crops or pasture have been abandoned and are reverting to brush and pine.

The minor soils in this association are the Tilsit, Hartsells, Wellston, and Dekalb soils, which are in the flatter areas of the uplands; the Clarksburg soils, which are on foot slopes; the Captina and Robertsville soils, which are on high terraces; and the Huntington, Lindside, and Melvin soils, which are on flood plains.

Most farms in this association are used for general farming. The smoother slopes and bottom lands are used principally for raising beef cattle and for dairying. A few farmers grow burly tobacco.

Homesteads are commonly near streams or are on ridges. They are well served with gravel and improved roads. Orchard, Red Sulphur Springs, and Wayside are in this association.

5. Tilsit-Dekalb-Hartsells and Wellston association

Slightly wet soils and shallow or deep loamy soils, on ridges

This association occupies the broad, irregular, gently sloping sandstone and shale ridge near Ballard, Bozoo, and Cashmere, in the extreme southwestern part of the county. It makes up only about 3 percent of the county. It consists of slightly wet soils that have a firm subsoil, and of shallow to deep loamy soils that formed in material weathered from sandstone.

The Tilsit soils, which make up most of the association, are deep, silty, moderately well drained, and moderately productive. They have a grayish-brown surface layer and a yellowish-brown subsoil. At a depth of about 2 feet, there is a firm layer that resticts drainage.

The moderately deep Dekalb soils and the deep Hartsells and Wellston soils are easy to till but may be slightly droughty.

The Teas, Calvin, and Litz soils are the minor soils in this association. They occur in intricate patterns on the steep breaks between smoother areas.

Most of this association is used for crops or pasture. Dairying and the raising of beef cattle and sheep are the principal enterprises, but there are some general farms. Some farmers operate on a part-time basis and work in Narrows, Va., or in Princeton.

Farmsteads are mostly in the level areas near roads. State Highway No. 12 traverses the association, and other all-weather roads help serve the area.

6. Dekalb-Tilsit association

Shallow or moderately deep loamy soils and slightly wet soils, on ridges

This association consists of shallow to moderately deep loamy soils and of slightly wet soils that have a firm subsoil. It occupies broad, gently sloping sandstone ridges that are on Flattop Mountain, near Alderson; on Swoopes Knobs, west of Union; and on Daniels and Eads Ridges, near Hollywood. Near Hollywood, the slopes are steeper than in the other two areas. Pocono sandstone underlies the area near Hollywood, and sandstone of the Mauch Chunk formation underlies the other two areas. About 7 percent of the county is in this association.

The Dekalb soils make up most of this association. These soils are loamy or sandy, shallow to moderately deep, somewhat droughty, and only moderately produc-

tive. They occur on smooth slopes and on steep and very steep breaks between the smooth areas. On the steep and very steep breaks, they generally are stony.

The Tilsit soils occur in nearly level areas and are silty or loamy. The moderately well drained Tilsit soils are similar to those described in association 5 but are not nearly so extensive.

Other soils that occur to a limited extent in this association are the Teas, Calvin, and Litz soils, which are mapped in a complex, and the shaly Litz soils. Near Hollywood, there are some Montevallo soils and some rocky soils that developed in limestone material.

The smoother areas in this association are used mostly for general farming. Some beef cattle and sheep are raised. The growing season generally is a little shorter than in the nearby lower lying limestone and shale areas. Most of the steeper slopes are in forest.

This association is not thickly settled. Most farmsteads are along the few gravel and improved roads that traverse the ridges.

7. *Dekalb-Lehew-Summers association*

Very stony, steep, brown and red soils

This association occupies the ridgetops and side slopes of Peters, Potts, and Fork Mountains and other mountains in the southern part of the county. It occurs at elevations of 2,500 to 4,000 feet and consists of shallow to moderately deep, well-drained, very stony soils, a few cliffs, and some very rocky areas. It makes up about 18 percent of the total area of the county.

The Dekalb soils are yellowish brown, shallow to moderately deep, well drained, and loamy. They are strongly sloping to very steep. Large fragments of white and gray sandstone are scattered on the surface and throughout the profile. Associated with the Dekalb soils are smaller areas of Lehew and Summers soils.

The Lehew soils developed in material weathered from red sandstone. They have a reddish-brown, loamy subsoil and are moderately deep and well drained. Fragments of red and gray sandstone are scattered on the surface and throughout the profile.

The Summers soils occur in narrow bands and in small pockets, mainly on the ridgetops of Peters and Potts Mountains. They are similar to the Dekalb soils, except that their surface layer is black, is high in content of organic matter, is as much as a foot thick, and is less acid than that of the Dekalb soils.

Except for a few farms and some areas that are used for pasture, all of this association is in forest. The trees produce a considerable amount of pulpwood and a moderate amount of saw timber. A few gravel roads cross the mountains, and the area is within short hauling distance of a papermill at Covington, Va.

8. *Montevallo-Leadvale association*

Shallow, shale and sandstone soils on mountain slopes

This association occupies the middle and lower parts of slopes in the eastern part of the county. It occurs mainly on the slopes of Brushy, Cove, Middle, and Gap Mountains, but a long, narrow band extends along Little Mountain from Zenith to the Virginia State line, and another area occurs at the base of Peters and Potts Mountains in the Potts Creek Valley. This association makes up about 16 percent of the county. It is bordered by most of the other associations in the county.

The Montevallo soils make up more than three-fourths of this association. They developed in material weathered from folded, acid, gray silty shale and sandstone, and there are many small fragments of sandstone on the surface and throughout the profile. These soils are yellowish brown, medium textured, mostly shallow, somewhat droughty, and low in productivity. They are sloping to steep, and the lower part of the slopes is somewhat rounded. Numerous drainageways have cut far back into the slopes and have caused the formation of narrow ridges and narrow, V-shaped valleys.

The Leadvale soils are deep and are moderately well drained. These soils formed in colluvial material from uplands of acid, gray sandstone. They occur in narrow bands below the Montevallo soils. Their total acreage is small.

Other soils in this association are the deep, well drained Laidig soils, which are on the lower part of slopes; the moderately well drained Monongahela soils, which are on terraces; and the well drained Pope soils, the moderately well drained Philo soils, and the poorly drained Atkins soils, all of which are on bottom lands.

Most of this association is in forest. The trees produce a moderate amount of sawtimber and a large amount of pulpwood. The Montevallo soils are poor to medium sites for the production of wood crops. Many abandoned fields are reforesting to Virginia pine, pitch pine, and some white pine.

The farms are used for general farming and commonly have a large acreage in woodland. The soils on the lower lying terraces and bottom lands generally are cropped; the soils on poorly drained bottom lands and sloping hillsides are used mostly for pasture. Many of the Montevallo soils that were cropped are now severely eroded. Farmsteads are not numerous and are generally on the valley roads. Gravel roads are most common.

9. *Monongahela-Atkins-Philo association*

Soils of flood plains and terraces

This association consists of deep, moderately well drained to poorly drained, acid soils on flood plains and terraces. It occupies a rather narrow area along Potts Creek in the southeastern part of the county and is characterized by nearly level areas and steep slopes. Potts Creek drains the valley between Peters and Potts Mountains. This association makes up only about 2 percent of the county.

The Monongahela soils are the most extensive. These soils are on terraces above the flood level. They consist of deep, slightly wet soils that have a firm layer at a depth of about 2 feet.

The poorly drained Atkins soils and the moderately well drained Philo soils are on flood plains and are subject to overflow. The Atkins soils are extensive and tend to be swampy.

The Pope, Laidig, Leadvale, and Montevallo soils are the minor soils in the association. The Pope soils are well drained. They occur on flood plains along Potts Creek and are subject to overflow. The Laidig and Leadvale soils formed in colluvium from the higher lying Dekalb and Montevallo soils. The Laidig soils are deep, well

drained, and generally stony; the Leadvale soils are deep but are only moderately well drained. The Montevallo soils are shallow and droughty. They developed in material weathered from acid, gray shale and occur on the uplands and on some of the steep side slopes between the flood plains and the high terraces.

Most of the soils in this association are used to grow corn and small grain; the steep, stony, and poorly drained soils are used for pasture.

A secondary road along Potts Creek bisects the valley and is the connecting link between Paint Bank, Va., and Ripplemead, Va. Gravel roads cross Potts and Peters Mountains to points in Virginia and to other parts of Monroe County, but most farmsteads are near the valley road. The area is sparsely settled.

Use and Management of Soils

This section has six main parts. The first part is a general discussion of soil management in the county; the second groups the soils into capability units and explains the capability classification used by the Soil Conservation Service to show the relative suitability of the soils for various uses; the third consists mainly of a table giving the estimated yields under two levels of management; the fourth groups the soils into woodland suitability groups; the fifth shows the suitability of the soils for wildlife habitats; and the sixth consists of soil engineering data and interpretations.

Management of the Soils for Crops and Pasture

Discussed here are some of the practices of management that apply to practically all of the soils in the county when used for the crops commonly grown. Management of a given crop on a particular soil or group of soils, of course, varies. This management is discussed in the subsection "Capability Groups of Soils."

Most soils in Monroe County are acid and require applications of limestone or marl. Fertilizers are necessary for best yields. The soils are medium to low in available phosphorus and respond well to applications of phosphate. Some of the soils are very low in available potassium. Soil tests and past experience are the best guides for applying enough potash. The soils are also low in content of organic matter. Organic matter needs to be applied in the form of manure or crop residues if good tilth is to be preserved.

The crops commonly grown in the county are tilled crops, small grain, tall grass for hay and pasture, and bluegrass and other grasses for permanent pasture. Corn is the principal tilled crop. Burley tobacco and sorghum are grown on a small acreage. The small grains are winter wheat, spring oats, and barley. Alfalfa, red clover, alsike clover, ladino clover, orchardgrass, timothy, smooth bromegrass, and tall fescue are grown for hay and tall-grass pasture. A limited acreage is in soybeans and sweet sudangrass for hay or ensilage. The permanent pasture plants are principally bluegrass and white clover, but orchardgrass is grown in some bluegrass pastures to increase yields.

Practices of management differ, of course, according to the kinds of crops grown. Following are some comments on these practices.

Crops:

Tilled crops and, to a somewhat less extent, small grain require the most intensive management, and, therefore, the practices they need are discussed in considerable detail in the subsection that follows on capability units.

Long-term hay and tall-grass pasture:

1. Alfalfa or ladino clover is appropriate for many soils in the county for hay and tall-grass pasture. A mixture of one of these legumes and a grass is better than an all-legume stand. Suitable grasses to plant with a legume are orchardgrass, timothy, or smooth bromegrass.
2. Legumes need heavy applications of potash to produce good yields. Stands of alfalfa and grass or of ladino clover and grass need annual applications of a fertilizer that contains phosphate and potash to remain productive for several years.
3. Red clover and alsike clover can be grown in a rotation in which hay is grown for 1 year.
4. Alfalfa and ladino clover grow best if the soil is almost neutral (pH of 6.5 to 7.0). Red clover can be grown on soils that are slightly more acid. Before legumes are seeded, lime should be applied to correct the soil acidity to the pH range for the selected legume.
5. In fields that are used for pasture only or for pasture following the harvesting of hay or silage, plants should be allowed a recovery growth of 8 to 10 inches, and livestock should be rotated to other areas when alfalfa is grazed to about 4 inches.

Permanent pasture:

1. Bluegrass and white clover are well suited. Bluegrass reseeds naturally and lasts for many years, even with little management. It provides most of the permanent pasture.
2. The most favorable pH range for bluegrass and white clover is 6.0 to 6.5. Limestone or marl should be applied before commercial fertilizer.
3. The soils in the county generally are low in available phosphorus, and applications of phosphate should be given priority in a planned pasture-improvement program.
4. Pasture plants, particularly those in severely eroded areas, respond to applications of manure.
5. Applications of straight nitrogen fertilizer encourage the early growth of plants in spring and slightly increase yields. However, since nitrogen affects the growth of grasses more than it does legumes, it should be applied to good grass sods that contain few legumes, and to bluegrass and white clover to provide grazing early in spring.
6. Livestock should not be allowed to graze in spring until the ground is firm and the grass has made a growth of 3 or 4 inches. Livestock should be removed in fall soon after the first freeze.

7. Distribution of water is a problem in most pastures. Consequently, the development of springs and the construction of ponds are important.
8. Mowing helps discourage the growth of weeds and woody vegetation and increases the growth of bluegrass.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels—the capability class, the subclass, and the unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter—*e*, *w*, *s*, or *c*—to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIe–4.

Soils are classified in capability classes, subclasses, and units according to the degree and kind of their permanent limitations, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in Monroe County, are described in the list that follows. However, the soils were assigned to capability units on a statewide basis. Consequently, the numbering of the units in this report is not consecutive, because only part of the capability units in the State are represented in this county. For example, there are no soils in capability unit IIe–2 in Monroe County. Therefore, this unit is not discussed in this report.

Class I.—Soils that have few limitations that restrict their use.
- Unit 1–6: Deep, well-drained, nearly level, silty and loamy soils on bottom lands.

Class II.—Soils that have some limitations that reduce the choice of plants or that require moderate conservation practices.
- Subclass IIe: Gently sloping soils that have moderate risk of erosion and that require protection if cultivated.
  - Unit IIe–1: Deep, well-drained, gently sloping, silty and cherty soils that are underlain by limestone.
  - Unit IIe–4: Deep, well-drained, gently sloping, loamy soils that developed in material weathered from sandstone and shale.
  - Unit IIe–11: Shallow to moderately deep, gently sloping, silty soils that are underlain by red or gray shale and siltstone that contain some calcareous material.
  - Unit IIe–13: Deep, moderately well drained, gently sloping, strongly acid soils that have a clayey subsoil, or fragipan.
  - Unit IIe–14: Deep, moderately well drained, gently sloping, silty soils that developed in limestone material, and that have a clayey subsoil, or fragipan.
- Subclass IIw: Soils that have slightly impeded drainage that makes them seasonally wet and that restricts their use for some crops.
  - Unit IIw–1: Deep, nearly level, moderately well drained, strongly acid soils that have a fragipan.
  - Unit IIw–2: Deep, nearly level, moderately well drained, lime-influenced soils that have a fragipan.
  - Unit IIw–7: Deep, nearly level, moderately well drained, silty soils on bottom lands.

Class III.—Soils that have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.
- Subclass IIIe: Gently sloping to strongly sloping soils that erode if not protected.
  - Unit IIIe–1: Deep, well-drained, gently sloping to strongly sloping, silty and cherty soils that are underlain by limestone.
  - Unit IIIe–4: Deep, well-drained, strongly sloping, loamy soils that developed in sandstone and shale material.
  - Unit IIIe–11: Shallow to moderately deep, sloping and strongly sloping soils that are underlain by red or gray shale that contains some calcareous material.
  - Unit IIIe–12: Moderately deep to shallow, loamy soils that developed in material weathered from acid, gray sandstone.

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Unit IIIe–13: Deep, strongly sloping, moderately well drained soils that have a strongly acid subsoil that contains a fragipan.

Unit IIIe–14: Deep, strongly sloping, moderately well drained, lime-influenced soils that have a clayey subsoil, or fragipan.

Unit IIIe–31: Shallow, somewhat droughty, shaly soils that are underlain by shale that contains some calcareous material.

Subclass IIIw: Soils seriously limited by excess water.

Unit IIIw–1: Nearly level, poorly drained soils on bottom lands.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe: Strongly sloping to moderately steep soils that are subject to severe erosion if not protected.

Unit IVe–1: Deep, well-drained, strongly sloping to moderately steep, silty and cherty soils that are underlain by limestone.

Unit IVe–2: Shallow to moderately deep, well-drained, strongly sloping to moderately steep soils that are underlain by red or gray shale and siltstone that contain some calcareous material.

Unit IVe–3: Deep, well-drained, moderately steep, loamy soils that developed in colluvial material weathered from acid, gray sandstone.

Unit IVe–5: Moderately deep to shallow, slightly droughty, loamy soils that formed in material weathered from acid, gray sandstone.

Unit IVe–31: Shallow, droughty, gently sloping to strongly sloping, shaly soils that are underlain by gray shale and siltstone that contain some calcareous material.

Unit IVe–32: Shallow, droughty, strongly sloping, silty soils that are underlain by acid, gray shale and sandstone, and that are very low in plant nutrients.

Subclass IVw: Soils severely limited by excess water.

Unit IVw–1: Nearly level, somewhat poorly drained to poorly drained soils that have a slowly to very slowly permeable, clayey subsoil.

Subclass IVs: Soils that have very severe limitations of stoniness, low moisture capacity, or other soil features.

Unit IVs–26: Deep, sloping to moderately steep soils that contain many fragments of chert.

Class V.—Soils that are not likely to erode but that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover. (There are no class V soils in Monroe County.)

Class VI.—Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe: Soils that have a severe hazard of erosion if not protected, or that are severely eroded.

Unit VIe–1: Deep, moderately steep to steep, silty and cherty soils that are underlain by limestone.

Unit VIe–2: Shallow to moderately deep, moderately steep, severely eroded soils that developed in material weathered from red or gray shale that contained some calcareous material.

Unit VIe–4: Shallow to moderately deep, somewhat droughty, moderately steep soils that developed in material weathered from acid, gray sandstone.

Unit VIe–31: Shallow, erodible, strongly sloping and moderately steep, droughty, gray, shaly soils that are underlain by shale that contains some calcareous material.

Unit VIe–32: Shallow, droughty, strongly sloping and moderately steep, silty soils that developed in material weathered from gray sandstone and shale, and that are very low in plant nutrients.

Subclass VIw: Soils very severely limited by excess water.

Unit VIw–1: Nearly level soils on bottom lands that are frequently flooded.

Subclass VIs: Soils that are stony, rocky, droughty, shallow, or low in fertility.

Unit VIs–1: Gently sloping to moderately steep, very stony, cherty, or very rocky soils that are underlain by limestone.

Class VII.—Soils that have very severe limitations that make them unsuitable for cultivation, without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe: Soils subject to severe erosion or that are eroded if not protected.

Unit VIIe–2: Shallow to moderately deep, steep and very steep soils that developed in material weathered from red or gray shale and siltstone that contain some calcareous material.

Unit VIIe–3: Shallow, droughty, moderately steep to very steep soils that are underlain by shale, siltstone, and some sandstone.

Unit VIIe–4: Severely eroded, shallow soils and land types that are underlain by red and gray shale and siltstone that contain some calcareous material.

Subclass VIIs: Soils that are rocky and stony.

Unit VIIs–1: Very rocky or very stony, steep and very steep soils that developed in material weathered from or influenced by limestone.

Unit VIIs–2: Very stony, strongly sloping to very steep, shallow to moderately deep soils that developed mainly in material weathered from acid sandstone.

Class VIII.—Land that is unsuitable for the commercial production of crops, for pasture, or for woods but valuable as wildlife and recreational areas.

Subclass VIIIs: Rock or soil materials having little potential for production of vegetation.

Unit VIIIs–1: Steep or very steep rock land, useful mainly as scenic spots and as landmarks.

Capability unit I–6

This unit consists of deep, nearly level, well-drained, silty and loamy soils on bottom lands. These soils are occasionally flooded, but this does not restrict their use.

With good management, they can be used intensively. The soils in this unit are—

Huntingdon silt loam.
Pope fine sandy loam.

The Huntington soil is neutral or only slightly acid. It has high available moisture capacity and is highly productive. The Pope soil is acid, has moderate available moisture capacity, and is moderately to highly productive. Both soils are mellow, easily tilled, and not readily eroded. They are well suited to all crops commonly grown in the county, and they respond well to fertilization. Most of the acreage is used for growing crops, and some is used for pasture.

Some suitable cropping systems are as follows: (1) a row crop each year, followed by a winter cover crop; (2) 1 year of a row crop, 1 year of a small grain, and 1 year or more of hay; and (3) permanent bluegrass pasture.

Crops.—Yields of corn and small grain are high if adequate amounts of lime and fertilizer are used. Cover crops should be grown during winter. Manure helps to maintain organic matter. These soils are suitable for irrigation.

Long-term hay and tall-grass pasture.—Alfalfa mixed with orchardgrass, timothy, or bromegrass grows well. For tall-grass pastures, ladino clover should be added to the hay mixture. Careful management of grazing is necessary to maintain tall-grass pastures. Fertilizer should be applied annually. A mixture of red clover and grass can be used for 1 year of hay in a rotation with a row crop.

Permanent pasture.—Bluegrass grows well but is not so productive as tall grasses. A permanent cover of bluegrass and white clover is particularly desirable in a few small, narrow areas that are frequently flooded. To keep bluegrass pastures productive, lime should be applied according to need as indicated by soil tests, and phosphate should be added every 4 years.

Capability unit IIe-1

This unit consists mainly of deep, well-drained, silty and cherty soils that are underlain by limestone. These soils occur mainly on short, irregular but smooth slopes, both in the broad limestone valley north of Union and in the long, narrow limestone valley southwest of Sweetsprings. Shallow depressions or sinkholes occur in a few places. The soils in this unit are—

Duffield silt loam, 3 to 10 percent slopes.
Dunmore cherty silt loam, 3 to 8 percent slopes.
Dunmore silt loam, 3 to 8 percent slopes.
Frederick cherty silt loam, 3 to 8 percent slopes.
Frederick silt loam, 3 to 8 percent slopes.
Murrill channery loam, 3 to 8 percent slopes.

The Murrill soil developed in colluvium over limestone. All of the soils have a strongly acid surface layer. They have high available moisture capacity and are productive but generally need phosphate and potash. The organic-matter content is low, but good tilth can be maintained if management is good. Surface runoff is moderate, and the hazard of erosion is moderate. However, there are a few severely eroded soils around the rim of sinkholes.

These soils are well suited to all crops grown in the county. They are used for rotation crops, long-term hay, and permanent pasture. A few small areas of woodland are maintained, mostly as shade for cattle.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 1 year or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—Corn and small grain grow well. Contour stripcropping, contour cultivation, and minimum tillage, in addition to suitable rotations, are needed to control erosion. Waterways should be maintained in sod. Fertilizer should be applied according to soil tests. These soils may be very low in potassium.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of red clover and grass is well suited for hay, silage, or pasture. On most of these soils, ladino clover added to the alfalfa-grass mixture will increase pasture yields. Management of grazing and annual fertilization are essential for long-lived stands.

Permanent pasture.—These soils are excellent for bluegrass-white clover stands. Bluegrass often seeds naturally, crowding out alfalfa and tall grasses. To keep bluegrass pastures productive, lime should be applied according to need as indicated by soil tests, and phosphate should be added every 4 years. For continued good yields, pasture management should include mowing at least once a year, providing adaquate water for livestock, and removing livestock early in fall.

Capability unit IIe-4

This unit consists of deep, well-drained, loamy soils on gentle slopes. The soils in this unit are—

Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes.
Laidig channery loam, 3 to 8 percent slopes.

The Hartsells and Wellston soils occur on sandstone flats, mainly on Flattop Mountain and on Swoopes Knobs. The Laidig soil, which developed in sandstone colluvial material is on concave slopes at the base of Peters and Potts Mountains. This soil contains many small stones and receives some runoff and seepage from the higher slopes.

All of these soils are easy to work, have moderate to high available moisture capacity, are strongly acid, and are low in phosphorus and potassium. Except in places where the Laidig soil is subject to concentrated runoff from higher areas, they are only slightly to moderately susceptible to erosion. They are suitable for all crops commonly grown in the county, but are less well suited to bluegrass and white clover and may need additions of boron if alfalfa is grown. Most of the acreage is used for general farming.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 1 year or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—Corn and small grain grow well if adequate amounts of fertilizer are used. Crop residues help to maintain the organic-matter content if they are worked into the soil. Contour stripcropping is needed, and a cover crop or a small grain should follow a row crop. Diversion ditches are needed in places.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of red clover and grass is well suited for hay, silage, and pasture. Ladino clover added to the alfalfa-grass mixture increases pasture yields. Management of grazing is needed in tall-grass pastures to ensure

long-lived stands. Annual fertilization is essential for good yields.

Permanent pasture.—These soils tend to warm up early in spring and generally provide good spring pasture. Pasture plants respond especially well to applications of lime and phosphate. During droughty periods, however, shallow-rooted plants like bluegrass may wilt because of the lack of water.

Capability unit IIe-11

The soils in this unit are shallow to moderately deep, well-drained, gently sloping silt loams that are underlain by red or gray shale and siltstone that contain some calcareous material. The soils in this unit are—

Litz silt loam, 3 to 8 percent slopes.
Teas and Calvin silt loams, 3 to 8 percent slopes.
Teas-Calvin-Litz silt loams, 3 to 8 percent slopes.

These soils occur on fairly smooth slopes and are extensive in the western part of the county. They are easily tilled, have moderate to low available moisture capacity, and are mostly strongly acid. The hazard of erosion is moderate to moderately severe. A few small areas that are severely eroded were included in the areas mapped.

Most of the acreage is used for general farm crops. All crops commonly grown in the county are suitable, and yields are about average.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 1 year or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—Yields are about average, but crops may be damaged in droughty periods. Contour cultivation and stripcropping are needed to help control soil and water losses. Diversion ditches are needed on some long slopes.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of other common hay plants, including tall grass, is suitable if the soils are well managed.

Permanent pasture.—Bluegrass is fairly well suited but may wilt in droughty periods. Bluegrass responds to applications of lime and fertilizer.

Capability unit IIe-13

This unit consists of deep, moderately well drained, gently sloping soils that have a slowly permeable layer, or hardpan, in the lower part of the subsoil. These soils occur mainly on smooth flats in the southwestern part of the county, in the vicinity of Ballard and Bozoo. They are—

Leadvale silt loam, 3 to 10 percent slopes.
Monongahela silt loam, 3 to 8 percent slopes.
Tilsit fine sandy loam, 3 to 8 percent slopes.
Tilsit silt loam, 2 to 8 percent slopes.

The Leadvale soil occurs at the base of slopes and receives some runoff and seepage from the higher areas. The other soils occur on smooth ridgetops and on old stream terraces.

These soils have been strongly leached of plant nutrients and are particularly low in potassium. They are strongly or very strongly acid and have moderate to high available moisture capacity. If they are tilled when too wet, the surface layer runs together and cakes. Surface runoff is medium, and the hazard of erosion is moderate. Water moves readily through the upper layers but slowly through the lower layers. In wet periods, it may accumulate above the hardpan. Consequently, seeps are fairly common, and alfalfa and other deep-rooted plants may be damaged by winter heaving. Most of the acreage is used for general farming.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—Liberal applications of fertilizer are needed to produce good yields of the commonly grown crops, particularly on the Tilsit soils, which contain little organic matter and have been strongly leached of plant nutrients. Contour cultivation and stripcropping will help to protect the soils from soil and water losses. Diversion ditches are needed in places. Seepage spots need artificial drainage.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass is fairly well suited, but there may be some heaving. To ensure long-lived stands, liberal amounts of fertilizer high in potash should be applied, and lime should be applied according to need as indicated by soil tests. Boron may be needed occasionally on alfalfa stands.

Permanent pasture.—These soils are fairly well suited to bluegrass if they are limed and fertilized according to need as indicated by soil tests. The Tilsit soils particularly need lime and fertilizer for satisfactory yields. Additions of manure will increase pasture growth. Grazing should be delayed in spring until the ground is firm.

Capability unit IIe-14

This unit consists of deep, moderately well drained, lime-influenced, silty soils on gentle slopes. These soils have a dense brittle layer, or fragipan, at a depth of about 2 feet. Water moves readily through the surface layer, but slowly through this tight layer. In wet periods, the soil above the pan may remain saturated for some time. The soils in this unit are—

Captina silt loam, 3 to 8 percent slopes.
Clarksburg silt loam, 3 to 8 percent slopes.
Landisburg cherty silt loam, 3 to 10 percent slopes.
Pickaway silt loam, 3 to 10 percent slopes.

These soils developed in material weathered from limestone or in lime-influenced material that was deposited on toe slopes or old stream terraces. They are moderately leached, and generally they are low or medium in potassium and either low or medium in phosphorus. The surface layer is strongly acid, and the subsoil is medium to slightly acid. The available moisture capacity is medium to high. Surface runoff is medium, and normally the hazard of erosion is moderate, but in some places there are concentrations of runoff from higher areas. In wet periods, seepage spots are common on the Clarkesburg and Landisburg soils.

The soils in this unit occur mostly in small individual areas and are important for general farming and pasture. They are similar to the soils in capability unit IIe-13, except that they developed in material that contained some lime, and generally they are more productive. They can be used and managed in the same way as the soils in capability unit IIe-13.

Capability unit IIw-1

There is only one soil in this unit, Monongahela silt loam, 0 to 3 percent slopes. This soil occupies nearly level, old stream terraces along Potts Creek and other small streams. It is deep, moderately well drained, and strongly acid throughout. There is a dense, brittle, silty layer, or fragipan, at a depth of about 2 feet. This dense layer retards the movement of water and restricts the growth of plant roots. In wet periods, water may accumulate above the fragipan. Small seepage spots are fairly common.

The available moisture capacity of this soil is moderate to high. Surface runoff is moderate, except in low areas where water may stand for short periods. The hazard of erosion generally is slight.

This is not a productive soil. It is low in phosphorus and potassium and contains little organic matter.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—All tilled crops commonly grown in the county are suitable. For the best yields, however, seepage spots need to be artificially drained, and liberal applications of fertilizer and manure are necessary. Erosion is not a serious hazard, but in a few places diversion ditches are needed to control runoff from higher areas.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass is fairly well suited, but there may be some winter heaving. Plants that are not sensitive to slightly wet conditions, such as red clover, alsike clover, and orchardgrass, grow well. To ensure long-lived stands, liberal amounts of fertilizer high in potash should be applied annually, and lime should be applied according to need as indicated by soil tests. Boron may be needed occasionally on alfalfa stands.

Permanent pasture.—Bluegrass grows fairly well if lime and fertilizer are applied. Additions of manure will increase pasture yields. Grazing should be delayed in spring until the ground is firm.

Capability unit IIw-2

There is only one soil in this unit, Captina silt loam, 0 to 3 percent slopes. This is a deep, moderately well drained, lime-influenced soil that has a dense, brittle layer, or fragipan, at a depth of about 2 feet. It occupies nearly level, old stream terraces along Second Creek and other small streams. Water moves readily through the surface layer but slowly through the fragipan and may accumulate above the pan in wet periods. Seeps are fairly common.

This soil is moderately productive. It has moderate to high available moisture capacity and is only slightly susceptible to erosion. The surface layer, which has been strongly leached, is strongly acid and generally is low in potassium. The subsoil, however, is only moderately acid and is fairly high in plant nutrients.

This soil is similar to the soil in capability unit IIw-1, except that it formed in material that contained some lime and, consequently, may be more productive. It can be used and managed in the same way as the soil in capability unit IIw-1.

Capability unit IIw-7

This unit consists of deep, slightly to moderately wet, nearly level soils on bottom lands. The soils in this unit are—

Lindside silt loam.
Philo silt loam.

These soils are subject to overflow every 3 to 5 years, but generally they are not excessively scoured, and they seldom receive excessive deposits of new material. The lower part of the subsoil is often waterlogged in winter and early in spring.

These soils are late to warm up in spring. They are naturally productive but may need lime. Most of the acreage is used for pasture and for general crops.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 1 year or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—The crops commonly grown in the county are well suited, but crops are occasionally damaged by floods, and yields of corn may be less in wet years. Tile or open ditches generally are effective in draining these soils.

Long-term hay and tall-grass pasture.—A mixture of common hay plants, including tall grass, is suitable, but long-lived stands may be difficult to maintain. Red clover may be better suited than alfalfa, especially in wetter areas. Annual fertilization helps to ensure longer lived stands of alfalfa and grass. Tall-grass pastures should not be grazed when the ground is wet and soft.

Permanent pasture.—These soils hold moisture well during the growing season and are well suited to permanent pasture. If management is good, they are highly productive. To prevent damage to the sod and compaction of the soil, pastures should not be grazed when wet.

Capability unit IIIe-1

This unit consists of deep, well-drained, gently sloping to strongly sloping, silty and cherty soils that are underlain by limestone. These soils occur mainly on short, rather irregular slopes in the broad limestone valley north of Union and in the long, narrow limestone valley southwest of Sweetsprings. Some small severely eroded areas were included in the areas mapped, and there are some shallow depressions, or sinkholes. The soils in this unit are—

Duffield silt loam, karst, 3 to 10 percent slopes.
Duffield silt loam, 10 to 20 percent slopes.
Dunmore cherty silt loam, 8 to 15 percent slopes.
Dunmore silt loam, 8 to 15 percent slopes.
Frederick cherty silt loam, karst, 3 to 8 percent slopes.
Frederick cherty silt loam, 8 to 15 percent slopes.
Frederick silt loam, karst, 3 to 8 percent slopes.
Frederick silt loam, 8 to 15 percent slopes.
Murrill channery loam, 8 to 15 percent slopes.

The Murrill soil developed in colluvium over limestone. All of the soils have high available moisture capacity and are productive, but they are deficient in phosphorus and potassium. The surface layer is strongly acid. Runoff is medium to rapid, and the hazard of erosion is moderately severe.

Most of the acreage is used for crops and for permanent bluegrass pasture. Some small areas of woodland are pastured or are kept to provide shade for cattle. Good tilth can be maintained if management is good.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—Corn and small grain grow well, but manure should be added if a row crop is grown. Stripcropping, contour cultivation, and minimum tillage, in addition to suitable rotations, are needed to control erosion. Diversion terraces are needed on long slopes and on slopes that receive runoff from higher areas. Some small areas are too uneven to stripcrop on the contour. Field strips across the slope will provide some protection in these areas. If the areas are large enough to be farmed separately, however, a long rotation, without a row crop, will help to control runoff. Fertilizer should be applied according to need as indicated by soil tests. Waterways should be maintained in sod.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of red clover and grass is well suited for hay, silage, and pasture. Ladino clover added to the alfalfa-grass mixture will increase pasture yields on most of these soils, especially in the later years of the stand. Management of grazing and annual fertilization are essential for long-lived stands.

Permanent pasture.—These soils produce excellent stands of bluegrass and white clover. Bluegrass often seeds naturally, crowding out alfalfa and tall grasses. To keep bluegrass pastures productive, lime should be applied according to need as indicated by soil tests, and phosphate should be added every 4 years. For continued good yields pasture management should include mowing at least once a year, providing adequate water for livestock, and removing livestock early in fall.

Capability unit IIIe-4

In this unit are deep, well-drained, strongly sloping, loamy soils that developed in sandstone and shale material. These soils are—

Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes.
Laidig channery loam, 8 to 15 percent slopes.

The Hartsells and Wellston soils occur on sandstone flats, mainly in the western part of the county. The Laidig soil formed in colluvial material, at the base of Potts and Peters Mountains. It contains many small stones and a few large ones, and it receives considerable surface runoff and seepage from the higher areas.

The soils in this unit have moderate to high available moisture capacity, but they generally are low in phosphorus and potassium and are strongly acid. They are easy to work and tend to warm up early in spring. The hazard of erosion is moderate except in places where there is a concentration of runoff from higher areas onto the Laidig soil. Most of the acreage is cleared. All crops commonly grown in the county are suitable, but yields of bluegrass are only fair.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—Corn and small grain grow well if adequately fertilized. Crop litter worked into the soil will help to maintain the content of organic matter. Crops should be grown in contour strips to control erosion. Diversion ditches are needed in places to control runoff from higher areas. Natural drainageways should be maintained in sod.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of red clover and grass is suitable for hay, silage, and pasture. Ladino clover added to the alfalfa-grass mixture will increase pasture yields. Management of grazing is necessary on tall-grass pastures to ensure longer lived stands. Annual fertilization is essential for good yields.

Permanent pasture.—Shallow-rooted bluegrass tends to wilt in droughty periods. Pasture plants, however, respond especially well to lime and to fertilizers that contain phosphate and potash. These soils tend to warm up early in spring and generally provide good spring pasture.

Capability unit IIIe-11

This unit consists of shallow to moderately deep, well-drained, mostly strongly sloping silt loams that are underlain by red or gray shale and siltstone that contain some calcareous material. These soils occur on smooth slopes in the western part of the county. They are—

Litz silt loam, 8 to 15 percent slopes.
Teas and Calvin silt loams, 8 to 15 percent slopes.
Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded.
Teas-Calvin-Litz silt loams, 8 to 15 percent slopes.

These soils occur both as small or medium-sized individual areas and as complexes. They have moderate available moisture capacity and are mostly strongly acid. The hazard of erosion is moderate to severe. The Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded, has lost most of the original surface layer and generally is more shallow than the other soils in this unit.

The soils in this unit are easily tilled and are suited to all crops commonly grown in the county. Most of the acreage has been cleared. Some fields have been abandoned and are reverting to brush and trees.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; (3) permanent pasture; and (4) woodland.

Crops.—Most crops grow fairly well, but they may wilt in droughty periods. Contour cultivation and stripcropping are needed to help control soil and water losses. Diversion ditches are needed on some long slopes.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of the common hay plants, including tall grass, is well suited if management is good.

Permanent pasture.—Bluegrass is fairly well suited but may wilt in droughty periods. However, bluegrass responds to applications of lime and fertilizer. Small, bare, eroded spots may need to be mulched and seeded.

Woodland.—Much of the woodland is abandoned pasture that has been allowed to revert to trees. In many places the trees are of poor quality, or the areas are inadequately stocked.

Capability unit IIIe-12

This unit consists of sloping, moderately deep to shallow, somewhat droughty, loamy soils that developed in material weathered from acid, gray sandstone. These soils occur mainly on smooth ridgetops on Swoopes Knobs and Flattop Mountain and on ridges near Hollywood. Small fragments of sandstone are scattered on the surface

and thoughout the profile, but these stones do not seriously interfere with cultivation. The soils in this unit are—

Dekalb channery loam, 5 to 12 percent slopes.
Dekalb fine sandy loam, 5 to 12 percent slopes.

These soils warm up early in spring. They have a low content of organic matter, have low to moderate available moisture capacity, are low in phosphorus and potassium, and are strongly acid. The hazard of erosion is only slight to moderate. About three-fourths of the acreage has been cleared. Most of this acreage was formerly used for potatoes but is now used for general crops and pasture.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; (3) permanent pasture; and (4) woodland.

Crops.—Yields of corn and small grain are good if liberal amounts of fertilizer are applied. Potatoes are also well suited. It is especially important to maintain the content of organic matter in these soils. This can be done by adding manure and by growing hay and cover crops. Contour cultivation and stripcropping are needed to reduce soil and water losses.

Long-term hay and tall-grass pasture.—A mixture of the hay plants commonly grown, including tall grass, is suitable, but liberal amounts of fertilizer are necessary to establish and maintain the stands. Boron may be needed occasionally if alfalfa is grown. Lime is especially needed on these acid soils.

Permanent pasture.—Good yields of bluegrass cannot be expected on these droughty soils, but fair yields can be obtained if lime and fertilizer are applied. Deeper rooted tall grasses such as orchardgrass, which can be both pastured and cut for hay, will increase pasture yields.

Woodland.—These soils are well suited to trees.

Capability unit IIIe-13

This unit consists of deep, strongly sloping, moderately well drained silt loams that have a slowly permeable layer, or hardpan, in the lower part of the subsoil. The soils in this unit are—

Monongahela silt loam, 8 to 15 percent slopes.
Tilsit silt loam, 8 to 15 percent slopes.

The Monongahela soil occurs along Potts Creek and other small streams in the county, on smooth, old stream terraces that are above overflow. The Tilsit soil occurs in the southwestern part of the county, on smooth ridges that are underlain by sandstone and siltstone (fig. 3). Both soils are strongly or very strongly acid and are strongly leached of plant nutrients. The available moisture capacity is moderate to high. The surface layer is pale colored and tends to run together and cake if tilled when wet. Surface runoff is medium, and the hazard of erosion is moderate to severe. Most of the acreage is used for general crops.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—Liberal applications of fertilizer are needed, especially on the Tilsit soil, for good yields of the crops commonly grown in the county. Contour cultivation and stripcropping will lessen soil and water losses. Seepage spots should be artificially drained. Diversion ditches are

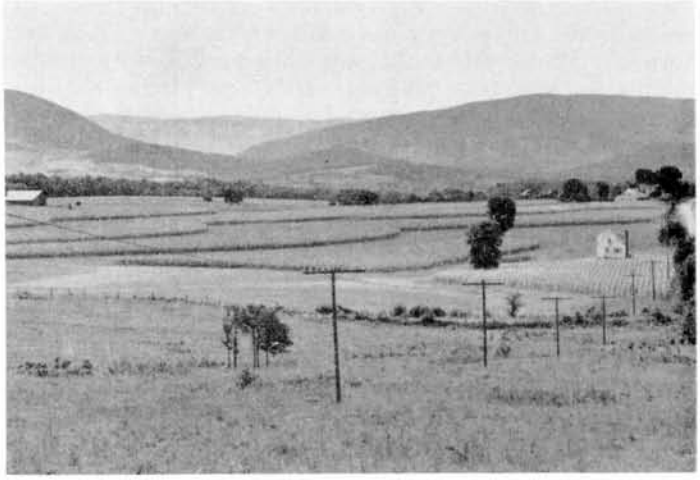

***Figure 3.*—Stripcropping on Tilsit silt loam, 8 to 15 percent slopes, on a broad ridge just north of Peterstown, W. Va.**

needed in some places on the Monongahela soil to control runoff from higher areas.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass is fairly well suited, but there may be some winter heaving. To ensure long-lived stands, liberal amounts of fertilizer high in potash should be applied annually, and lime should be applied according to need as indicated by soil tests. Boron may be needed occasionally on alfalfa stands.

Permanent pasture.—Bluegrass is fairly well suited if lime and fertilizer are applied according to need as indicated by soil tests. The Tilsit soils, in particular, need to be properly fertilized and limed for satisfactory growth of pasture plants. Additions of manure will increase pasture yields. Grazing should be delayed in spring until the ground is firm.

Capability unit IIIe-14

In this unit are deep, strongly sloping, moderately well drained silt loams on old stream terraces or toe slopes. These soils developed in material weathered from lime-influenced uplands. They have a dense, brittle layer, or fragipan, at a depth of about 2 feet. Water moves readily through the surface layer but slowly through this tight layer. In wet periods, water may accumulate above the pan, and seeps are fairly common. The soils in this unit are—

Captina silt loam, 8 to 15 percent slopes.
Clarksburg silt loam, 8 to 15 percent slopes.

Both soils are moderately leached of plant nutrients, and they have a strongly acid surface layer and a medium acid to slightly acid subsoil. They have medium to high available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe. In some places there are concentrations of runoff from higher slopes. Most of the acreage is used for general crops and pasture.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—All tilled crops commonly grown in the county are suitable, but in very wet years yields may be less than normal. Water and soil losses can be reduced by contour cultivation and stripcropping. Diversion ditches are needed in places to intercept water from higher areas. Seepage spots can be artifically drained.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass is fairly well suited, but there may be some winter heaving. To ensure long-lived stands, liberal amounts of fertilizer should be applied annually, and lime should be applied according to need as indicated by soil tests. Boron may be needed occasionally on alfalfa stands.

Permanent pasture.—Both soils are well suited to bluegrass, and the Clarksburg soil is especially well suited, even in droughty periods. However, adequate applications of fertilizer and lime are essential for good yields, particularly on the Captina soil.

Capability unit IIIe-31

This unit consists of only one soil, Litz shaly silt loam, 3 to 10 percent slopes. This is a shallow, somewhat droughty soil that developed in material weathered from gray shale and siltstone that contained some calcareous material. This soil occurs on smooth slopes in the southern and western parts of the county. It has a brown, mellow surface layer that contains some small pieces of shale, and a thin, yellowish-brown subsoil that contains numerous fragments of shale. In a few places there are outcrops of limestone. Water moves readily through the profile.

This soil occurs mostly on short slopes but is susceptible to severe erosion. It has low to medium available moisture capacity because of shallowness. Although droughty, it is fairly productive. Most of the acreage is used for crops and pasture.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—The crops commonly grown in the county are suitable. Stripcropping and contour cultivation will help to reduce loss of soil and water. Diversion ditches are needed in some places.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass is well suited if fertilizer is applied annually. Careful management of grazing is needed to prevent damage to the stands.

Permanent pasture.—Bluegrass is fairly well suited, but it wilts in droughty periods. To prevent erosion, a good sod should be maintained, and grazing should be carefully managed.

Capability unit IIIw-1

This unit consists of deep, nearly level, poorly drained soils on bottom lands that border the larger streams in the county. These soils are flooded about once every 2 or 3 years, but in some places they are flooded one or more times a year. The soils in this unit are—

Atkins silt loam.
Melvin silt loam.

The Atkins soil occurs mainly in the eastern part of the county, and the Melvin soil is mostly in the southwestern part. The Atkins soil developed in material that has been washed from uplands of acid sandstone and shale and is strongly acid. The Melvin soil developed in material that has been washed from uplands of limestone and limy shale and is slightly acid to neutral. These soils have a grayish-brown or dark-brown surface layer that is mellow when dry but somewhat sticky and easily compacted when wet. The subsoil is clayey, and water moves through it slowly.

If not drained, these soils support sedges and poor quality pasture grasses. However, they drain moderately well into tile and into open ditches, and if drained they are suitable for crops that will tolerate some wet periods. They are naturally productive but warm up late in spring.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 2 years or more of hay; (2) a small grain and 2 years or more of hay; and (3) permanent pasture.

Crops.—Both soils in this unit will compact and become hard if worked when wet. Corn and small grain are fairly well suited if the soils are drained either by tile or by open ditches (fig. 4). In some places tile or open ditches are needed along the base of adjoining slopes to intercept runoff and seepage from higher areas. Lime should be applied according to need as indicated by soil tests. The Atkins soil may need more than normal applications of lime.

***Figure 4.*—Tile drainage system being installed on Melvin silt loam, near Greenville.**

Long-term hay and tall-grass pastures.—Alfalfa is not well suited, but alsike clover, ladino clover, tall fescue, timothy, orchardgrass, and other water-tolerant plants generally can be grown successfully. These plants need about the same drainage as tilled crops. Fertilizer should be applied annually. Pastures should not be grazed when the ground is wet and soft.

Permanent pasture.—Bluegrass grows well if the soils are drained. Water for plants is readily available throughout the growing season. Grazing should be delayed in spring until the soils are firm, and it should be discontinued in fall before the soils become wet.

Capability unit IVe-1

In this unit are deep, strongly sloping to moderately steep, well-drained, silty and cherty soils that are underlain by limestone. These soils occur both in the broad limestone valley north of Union, and in the long, narrow valley southwest of Sweetsprings. The slopes are short and generally are irregular. In places there are shallow depressions or sinkholes. The soils in this unit are—

Duffield silt loam, karst, 10 to 20 percent slopes.
Duffield silt loam, 20 to 30 percent slopes.
Dunmore cherty silt loam, 15 to 25 percent slopes.
Dunmore silt loam, 15 to 25 percent slopes.
Frederick cherty silt loam, karst, 8 to 15 percent slopes.
Frederick cherty silt loam, 15 to 25 percent slopes.
Frederick silt loam, karst, 8 to 15 percent slopes.
Frederick silt loam, 15 to 25 percent slopes.
Murrill channery loam, 15 to 25 percent slopes.

These soils have a strongly acid surface layer. They have high available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is severe. However, good tilth and the organic-matter content can be maintained if management is good. Most areas are used for long-term hay or bluegrass pasture. Included in the pastured areas are many small patches of woodland. Some small severely eroded areas were included in mapping.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—Corn and small grain grow well, but if these crops are grown, the hazard of erosion is fairly severe. In some places contour tillage and contour stripcropping help to control erosion, but in most places these practices are difficult to apply because of the irregular slopes. Field strips across the slope and minimum tillage will protect the soils to some extent. Disking instead of plowing in preparation for reseeding of hay and grain will also help to prevent soil loss. Waterways should be kept in permanent sod.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or red clover and grass are well suited for hay, silage, or pasture. Ladino clover added to the alfalfa-grass mixture will increase pasture yields, especially in the later years of the stand. Management of grazing and annual fertilization are essential for long-lived stands.

Permanent pasture.—Excellent stands of bluegrass and white clover can be produced. Bluegrass often seeds naturally, crowding out alfalfa and tall grasses. To keep these pastures productive, lime should be applied according to need as indicted by soil tests, and phosphate should be added every 4 years. A management program should include mowing, providing adequate water for livestock, and removing livestock early in fall.

Capability unit IVe-2

This unit consists of shallow to moderately deep, strongly sloping to moderately steep, well-drained soils that developed in material weathered from red and gray shale and siltstone that contained some calcareous material. These soils, nevertheless, are mostly strongly acid. They are extensive in the western part of the county. The slopes are fairly smooth. The soils in this unit are—

Litz silt loam, 8 to 15 percent slopes, severely eroded.
Litz silt loam, 15 to 25 percent slopes.
Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded.
Teas and Calvin silt loams, 15 to 25 percent slopes.
Teas-Calvin-Litz complex, 8 to 15 percent slopes, severely eroded.
Teas-Calvin-Litz silt loams, 15 to 25 percent slopes.

The reddish Teas soils and the brownish Litz soils have a mellow surface layer, and water moves at a moderate rate through their subsoil. Where the Teas and Calvin soils are closely associated in a mixed pattern with the Litz soil in Monroe County, the soils were mapped as the Teas-Calvin-Litz complex. The more strongly sloping soils in this complex have had most of their original surface layer removed by erosion and are more shallow and generally more shaly than the other soils in the complex. The Teas soil is somewhat more severely eroded than the Litz soil, but all of the soils in this complex are susceptible to severe or very severe erosion.

Most of the acreage in this unit has been cleared at some time, but many fields have been allowed to revert to brushy woods.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; (3) permanent pasture; and (4) woodland.

Crops.—Suitable rotations, stripcropping, contour cultivation, and diversion ditches are needed if tilled crops are grown. Yields of small grain are good if the soils are properly fertilized. Water should be diverted from some soils that are actively eroding, and the soils should be mulched. Natural waterways should be kept in sod.

Long-term hay and tall-grass pasture.—A mixture of alfalfa and grass or of other common hay plants, including tall grass, is well suited. Long-term hay helps to control soil and water losses. If tilled, these soils need suitable rotations, stripcropping, contour cultivation, and diversion ditches. Tall-grass pastures need to be carefully managed to protect the sod and to control erosion.

Permanent pasture.—Bluegrass is fairly productive except in droughty periods. Liming and fertilizing help to keep the sod in good condition.

Woodland.—Some fields have been allowed to revert to woods. In places, however, the species are undesirable or the areas are poorly stocked.

Capability unit IVe-3

This unit consists of only one soil, Laidig channery loam, 15 to 25 percent slopes. This is a deep, well-drained, moderately steep soil that occurs mostly on concave slopes at the base of Peters and Potts Mountains. It formed in colluvial material weathered from acid, gray sandstone. Small fragments of sandstone occur on the surface and throughout the profile but do not seriously interfere with tillage. There are also a few large stones on the surface.

This soil has moderate available moisture capacity. There is considerable runoff from higher slopes, and small seeps occur in some places. The hazard of erosion is moderate to severe.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—An occasional row crop can be grown, but stripcropping and contour cultivation are needed to control soil and water losses. Diversion terraces are needed in places to intercept runoff from higher areas. Natural drainageways need to be kept in sod. Crops respond well to lime and fertilizer.

Long-term hay and tall-grass pasture.—A mixture of the common hay plants, including tall grass, is suitable. Liming and annual fertilization are especially important. Stands should be reseeded in contour strips.

Permanent pasture.—Yields of bluegrass are below average because of the high content of sandstone fragments on the surface of this soil. Bluegrass may wilt from lack of water. Pastures respond especially well to lime and fertilizer.

Capability unit IVe-5

In this unit are moderately deep to shallow, slightly droughty, loamy soils that formed in material weathered from acid, gray sandstone. These soils occur on sloping to moderately steep ridges on Swoopes Knobs and Flattop Mountain and on ridges near Hollywood. Small fragments of sandstone are scattered on the surface and throughout the profile, but these stones do not seriously interfere with tillage. The soils in this unit are—

Dekalb channery loam, 12 to 25 percent slopes.
Dekalb fine sandy loam, 12 to 25 percent slopes.

These soils warm up early in spring. They have a low content of organic matter, have low to moderate available moisture capacity, are low in phosphorus and potassium, and are strongly acid. The hazard of erosion is moderate. About three-fourths of the acreage has been cleared. The rest is in woods and is not accessible by road. The cultivated soils were formerly used mostly for potatoes but are now used for general crops and pasture.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; (3) permanent pasture; and (4) woodland.

Crops.—Liberal applications of fertilizer are needed for good yields of corn and small grain. Potatoes are well suited, but at the present time few potatoes are grown. It is especially important to maintain the content of organic matter in these soils. This can be done by adding manure and by growing hay and cover crops. Stripcropping and contour cultivation are needed to reduce soil and water losses.

Long-term hay and tall-grass pasture.—A mixture of the common hay plants, including tall grass, is suitable, but liberal amounts of fertilizer are necessary to establish and maintain the stands. Boron may be needed occasionally if alfalfa is grown. Lime is especially needed on these acid soils.

Permanent pasture.—Good yields of bluegrass cannot be expected on these droughty soils, but fair yields can be obtained if lime and fertilizer are applied. Such deep-rooted tall grasses as orchardgrass, which can be both pastured and cut for hay, will increase pasture yields.

Woodland.—These soils are good to excellent for trees. Most forested areas are not accessible by road, and generally there are more stones in these areas than in the cleared areas.

Capability unit IVe-31

This unit consists of shallow, droughty, gently sloping to strongly sloping soils that developed in material weathered from gray shale and siltstone that contained some calcareous material. These soils occur on short, fairly smooth slopes in the southern and western parts of the county. They have a mellow, brown surface layer that contains some small fragments of shale, and a thin, yellowish-brown subsoil that contains numerous fragments of shale. Water moves readily through the profile. The soils in this unit are—

Litz shaly silt loam, 10 to 20 percent slopes.
Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded.

The gently sloping Montevallo soil has had most of the surface layer removed by erosion, and it tends to be more shallow, more droughty, and more shaly than the less eroded, strongly sloping Litz soil. Both soils are susceptible to severe to very severe erosion. They have low to medium available moisture capacity because of shallowness and the high content of shale. Although droughty, they are fairly productive. Most of the acreage is used for crops and pasture, but many areas have been allowed to revert to brushy woods.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) permanent pasture; and (3) woodland.

Crops.—Because of droughtiness and the severe hazard of erosion, corn should be grown no more often than once in 5 or 6 years. Small grain grows well and matures before water becomes too limited.

Long-term hay and tall-grass pasture.—Common hay and tall-grass pasture mixtures can be seeded. Contour stripcropping, countour cultivation, and tillage by disking instead of plowing help to control soil and water losses. Diversion ditches are needed on long slopes. Natural drainageways should be kept in sod. Tall-grass pastures need to be well managed and fertilized to maintain a good stand and to control erosion.

Permanent pasture.—These droughty soils are not well suited to bluegrass, and adequate applications of lime and fertilizer are needed to maintain a tight sod. To control erosion, grazing should be managed so that the sod is not damaged, and the stands should be reseeded in contour strips.

Woodland.—Many areas, especially the steeper and more eroded areas, have been allowed to revert to woods. In many places the species are undesirable or the areas are poorly stocked.

Capability unit IVe-32

This unit consists of only one soil, Montevallo channery silt loam, 10 to 20 percent slopes. This is a shallow, strongly sloping, droughty soil on uplands of gray sandstone and shale in the eastern part of the county. This soil has a low content of organic matter, is low in plant nutrients, is very strongly acid, and has low available moisture capacity. It has a mellow, brownish surface layer and a thin, yellowish-brown subsoil that generally contains numerous small fragments of sandstone and shale. Water moves moderately rapidly through the profile. The hazard of erosion is severe. About half of the acreage is in woods.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; (3) permanent pasture; and (4) woodland.

Crops.—Corn and small grain can be grown if liberal amounts of fertilizer are applied. Corn may be seriously damaged, however, by lack of water. Contour stripcropping and contour cultivation are needed to conserve moisture and to prevent soil loss.

Long-term hay and tall-grass pasture. Hay and tall-grass pastures need annual applications of phosphate and potash. Lime should be applied according to need as indicated by soil tests. The deep-rooted legumes and tall grasses commonly grown in the county can utilize the moisture stored in the soil, but high yields cannot be expected. Stands should be reseeded in contour strips.

Permanent pasture.—This soil is too droughty for good yields of bluegrass, but the use of tall grasses should increase pasture yields. Applications of lime and of phosphate and potash are essential.

Woodland.—This soil is fair to good for trees.

Capability unit IVw-1

In this unit are deep, somewhat poorly drained to poorly drained, nearly level soils that developed partly in lime-influenced material. These soils occur both on old smooth terraces in the southern part of the county and in small, slightly depressed spots in the limestone valley. They have a grayish-brown surface layer that quickly becomes hard and cloddy if worked when wet, and a gray, clayey subsoil that is tough and sticky. Water moves slowly through the profile. The soils in this unit are—

Guthrie silty clay loam.
Robertsville silt loam.

These soils are wet a large part of the year, and water may stand on them in winter and early in spring. If not drained, they are too wet for most crops, and effective drains are difficult to establish. In places open ditches have been somewhat effective, particularly in intercepting water from higher areas. Tile can be used to a limited extent with open ditches to drain very wet spots.

These soils are used for pasture and some crops. If drained, they are suitable for plants that can tolerate some wetness.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—These soils need to be drained to make them suitable for corn or small grain. They are readily compacted and should not be tilled often or when wet.

Long-term hay and tall-grass pasture.—Some drainage is needed to make these soils suitable for hay and tall-grass pasture. Alfalfa is not suitable. Water-tolerant legumes, such as ladino clover, and water-tolerant grasses are suitable. Grazing should not be permitted if the ground is soft and wet.

Permanent pasture.—Bluegrass grows fairly well if surface water is removed. Although these soils are naturally productive for pasture, they should be fertilized and limed according to need as indicated by soil tests. Pastures should not be grazed if the ground is soft and wet.

Capability unit IVs-26

In this unit are deep, sloping to moderately steep, well-drained, rapidly permeable soils that occur in Sweet Springs Valley and just north of Peters Mountain in the southern part of the county. These soils contain numerous angular or square pieces of chert or flint that make plowing and tillage difficult. In places the chert fragments make up as much as two-thirds or more of the subsoil. These fragments are very hard and cause tillage implements to wear out quickly. The soils in this unit are—

Bodine very cherty silt loam, 5 to 12 percent slopes.
Bodine very cherty silt loam, 12 to 25 percent slopes.

These soils are very strongly acid. Although water moves rapidly through them because of the high content of chert, they are moderate in moisture-holding capacity. However, they tend to be somewhat droughty for shallow-rooted plants like bluegrass. The hazard of erosion is slight to moderate.

In the Potomac valley section of West Virginia, the Bodine soils have been used successfully for orchards. Before orchards are established on these soils in Monroe County, however, the risk of frost damage should be considered.

Some suitable cropping systems are as follows: (1) a row crop, a small grain, and 3 years or more of hay; (2) a small grain and 3 years or more of hay; and (3) permanent pasture.

Crops.—These soils are fairly well suited to the crops commonly grown in the county, but they are difficult to plow because of the high content of chert. Liberal applications of fertilizer are needed annually for good yields. Hay should be grown for as many years as possible because of the low content of organic matter and the difficulty in tilling. Stripcropping on the contour helps to prevent both soil and water losses.

Long-term hay and tall-grass pasture.—If fertilizer is applied, yields of deep-rooted legumes, such as alfalfa and tall grasses, are fairly good because these plants can use much of the moisture stored in the soil. Crops should be grown in contour strips to control erosion. Large pieces of chert may interfere to some extent with tillage and mowing. In some places the chert has been removed from the surface.

Permanent pasture.—Good yields of bluegrass cannot be expected on these soils, but fair yields can be obtained, particularly early in spring and in fall, if lime and fertilizer are applied.

Capability unit VIe-1

This unit consists of deep, well-drained, moderately steep to steep, silty and cherty soils that are underlain by limestone. These soils occur in the broad limestone valley north of Union and in the long, narrow limestone valley southwest of Sweetsprings. The slopes range from 15 to 45 percent but generally are less than 35 percent. Some areas have been severely eroded. The soils in this unit are—

Duffield silt loam, 20 to 30 percent slopes, severely eroded.
Duffield silt loam, 30 to 45 percent slopes.
Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded.
Frederick cherty silt loam, 25 to 45 percent slopes.
Frederick silt loam, 25 to 45 percent slopes.
Murrill channery loam, 25 to 45 percent slopes.

These soils have a strongly acid surface layer, are moderately permeable, and have high available moisture capacity. They are productive but generally need phosphate and potash. They are suitable for either permanent pasture or woods.

Permanent pasture.—These soils produce excellent stands of bluegrass and white clover. To keep bluegrass stands productive, however, lime and fertilizer should be applied according to need as indicated by soil tests. Pasture management should include proper stocking to prevent damage by overgrazing, removing animals early in fall, providing adequate water for livestock, and mowing to control weeds.

Woodland.—Although these soils are excellent sites for trees, most of the acreage is used for permanent pasture. Some small areas are maintained as woodland, but most of these areas are grazed. Protection from grazing will improve the growth and quality of the trees.

Capability unit VIe-2

This unit consists of shallow to moderately deep, moderately steep soils that developed in material weathered from red and gray siltstone and shale that contained some calcareous material. These soils have lost most of the original surface layer through erosion, and in places the raw shale is exposed. Included in the areas mapped are a few small areas of deep soils. The soils in this unit are—

Litz silt loam, 15 to 25 percent slopes, severely eroded.
Teas and Calvin soils, 15 to 25 percent slopes, severely eroded.
Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded.

These soils are medium textured and are moderately permeable. Except for the more shallow areas, they have fairly good available moisture capacity. They are suitable for either pasture or woods.

Permanent pasture.—These soils need careful management to control erosion. Pastures should be reseeded in contour strips. If practical, trash-mulched seedbeds should be prepared by disking. Gullies need to be sloped, mulched, and seeded. Diversion terraces are needed to control water on long slopes and to intercept runoff from higher slopes. Natural waterways should be left in sod when pastures are reseeded.

Woodland.—Many areas have been allowed to revert to brushy woods. Generally, these areas are poorly stocked with undesirable species. If well managed, these soils will produce average or better than average yields of wood crops.

Capability unit VIe-4

In this unit are shallow to moderately deep, moderately steep, somewhat droughty soils that developed in material weathered from acid, gray sandstone. These soils occur on ridgetops and side slopes, mainly on Swoopes Knobs and Flattop Mountain and on ridges near Hollywood. Small fragments of sandstone are scattered on the surface and throughout the profile, but these stones do not seriously interfere with tillage. The soils in this unit are—

Dekalb channery loam, 25 to 35 percent slopes.
Dekalb fine sandy loam, 25 to 35 percent slopes.
Laidig channery loam, 25 to 45 percent slopes.

These soils warm up early in spring. They have a low content of organic matter, have low to moderate available moisture capacity, are low in phosphorus and potassium, and are strongly or very strongly acid. The hazard of erosion is moderately severe, but severe erosion is not extensive. About two-thirds of the acreage is used for pasture. The most suitable use for these soils is permanent pasture or woods.

Permanent pasture.—Good yields of bluegrass cannot be expected on these droughty soils. If bluegrass is grown, lime should be applied according to need as indicated by soil tests, and phosphate and potash should be applied every 3 years. Deeper rooted tall grasses, such as orchardgrass, will increase pasture yields.

Woodland.—These soils are well suited to trees, but generally there are more and larger stones in the wooded areas than in the cleared areas.

Capability unit VIe-31

This unit consists of strongly sloping and moderately steep, shallow, droughty soils that developed in material weathered from gray shale that contained some calcareous material. These soils contain many shale chips, and they erode readily. The more strongly sloping soils have lost most of the original surface layer through erosion, and in many places shale is exposed. The soils in this unit are—

Litz shaly silt loam, 20 to 30 percent slopes.
Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded.

Because of the severe hazard of erosion, these soils are best suited to permanent pasture or woods.

Permanent pasture.—Good yields of bluegrass cannot be expected on these droughty soils. Orchardgrass and other deep-rooted grasses are better suited, and tall fescue can be grown in the more severely eroded areas. Pastures should be reseeded in contour strips. Trash-mulched seedbeds should be prepared by disking. Grazing needs to be well managed, and applications of lime and fertilizer are necessary to maintain a good sod. Diversion terraces help to control water on long slopes and to intercept runoff from higher areas. Actively eroding areas need to be mulched and seeded.

Woodland.—Many areas have been allowed to revert to brushy woods, but these areas generally are poorly stocked, and there are many undesirable species in the stands. Conifers, such as Virginia pine, are better suited to these shallow, droughty soils than oaks.

Capability unit VIe-32

This unit consists of shallow, infertile, strongly sloping and moderately steep, droughty soils that developed in material weathered from gray sandstone and shale. These soils occur on the smoother slopes in the mountainous areas in the eastern part of the county. Small fragments of sandstone occur both on the surface and throughout the profile, and water moves moderately rapidly through the profile. The soils in this unit are—

Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded.
Montevallo channery silt loam, 20 to 30 percent slopes.

These soils have a low or very low content of organic matter, are low or very low in plant nutrients, and are very strongly acid. They are susceptible to severe erosion, and the steeper soils have lost most of the original surface layer through erosion. They are best suited to permanent pasture or woods.

Permanent pasture.—These soils need lime and fertilizer to produce even moderate yields of bluegrass. Pasture yields will be higher if either orchardgrass or tall fescue is grown. Pastures should be reseeded in contour strips, and seedbeds should be prepared by disking. Diversion terraces are needed on some long slopes and in areas that receive runoff from higher slopes.

Woodland.—Some areas are wooded, and some fields that have been abandoned are reverting to brushy woods. However, yields of wood crops are below average.

Capability unit VIw-1

This unit consists of one miscellaneous land type, Alluvial land. This land occurs in nearly level areas along small streams throughout the county and is flooded several times each year. The soils are deep, are extremely variable in texture, and range from well drained to poorly drained. Additional sandy and cobbly material may be deposited by floodwaters.

In the eastern part of the county, this land generally is acid; in the southern and western parts, it is influenced by limy materials and is less acid. Because of the frequency and severity of overflow and the deposition of new materials, this land type is limited in use to pasture or woods.

Permanent pasture.—Bluegrass grows well in areas that are not too sandy or too wet. Liming and fertilizing will help to increase yields. The frequency of overflow determines largely how intensively Alluvial land can be managed for pasture.

Woodland.—Only a small part of the acreage is in woods. However, the potential productivity of this land for wood crops is high.

Capability unit VIs-1

This unit consists of shallow to deep, gently sloping to moderately steep, very stony, very rocky, or cherty soils that developed in material weathered from limestone or influenced by limestone. These soils occur in small individual patches throughout the limestone areas of the county. There are enough outcrops of rock, large loose stones, or chert on these soils to make much tillage impractical. The soils in this unit are—

- Bodine very cherty silt loam, 25 to 35 percent slopes.
- Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes.
- Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes.
- Duffield very rocky silt loam, 5 to 20 percent slopes.
- Duffield very rocky silt loam, 20 to 30 percent slopes.
- Frederick and Dunmore very rocky soils, 3 to 15 percent slopes.
- Frederick and Dunmore very rocky soils, 15 to 25 percent slopes.
- Murrill very stony loam, 8 to 15 percent slopes.
- Murrill very stony loam, 15 to 25 percent slopes.

The Duffield soils generally are smoother than some of the other soils in this unit, and in most places they have fewer outcrops of rock. The Bodine soil contains many large and medium-sized fragments of chert. On much of the acreage, farm machinery can be used for mowing and fertilizing. However, use of machines is somewhat restricted by the ledges and stones.

Except for the shallow Chilhowie-Tumbez soils, which are droughty, the soils in this unit have moderate to high available moisture capacity and are productive. They are susceptible to moderate erosion. Their best use is permanent pasture or woods.

Permanent pasture.—Good stands of bluegrass are produced even though these soils are difficult to mow and to fertilize. Bluegrass may wilt on the shallow or cherty soils because of the lack of water. Lime and fertilizers are beneficial and should be applied according to need as indicated by soil tests. Care should be taken not to overstock the areas, and livestock should not be allowed to graze during the winter months. Providing water for livestock will help to distribute grazing. Mowing, if practical, will help to control weeds.

Woodland.—These soils are excellent for trees, but the acreage in trees is not extensive. Many wooded areas are kept to provide shade for livestock.

Capability unit VIIe-2

This unit consists of steep and very steep, mostly shallow soils that developed in material weathered from red and gray siltstone and shale that contained some calcareous material. These soils occur extensively in the rougher, dissected western part of the county. They are—

- Litz silt loam, 25 to 45 percent slopes.
- Litz silt loam, 25 to 45 percent slopes, severely eroded.
- Litz silt loam, 45 to 60 percent slopes.
- Teas and Calvin silt loams, 25 to 45 percent slopes.
- Teas and Calvin soils, 25 to 45 percent slopes, severely eroded.
- Teas-Calvin-Litz silt loams, 25 to 45 percent slopes.
- Teas-Calvin-Litz complex, 25 to 45 percent slopes, severely eroded.
- Teas-Calvin-Litz complex, 45 to 55 percent slopes.

These soils are droughty, and they are susceptible to severe erosion. They can be used for woods or to a limited extent for permanent pasture. However, most areas are too steep or too eroded to be used for pasture (fig. 5).

Permanent pasture.—The less steeply sloping soils that are not eroded produce some native bluegrass, but reseeding should be done without breaking. If practical, they should be limed, fertilized, and mowed. Care should be taken not to overstock or overgraze these areas.

Woodland.—Much of the acreage that was formerly used for pasture has been allowed to revert to brushy woods. These areas need better than average woodland management. Suggestions for management are in the subsection "Use of Soils for Woodland."

***Figure 5.*—Typical erosion pattern on steeply sloping, severely eroded Teas-Calvin-Litz soils near Red Sulphur Springs, W. Va. In the foreground are gently sloping, colluvial Clarksburg soils.**

Capability unit VIIe-3

In this unit are moderately steep to very steep, shallow, droughty soils that are susceptible to severe or very severe erosion. The soils in this unit are—

Litz shaly silt loam, 30 to 45 percent slopes.
Litz shaly silt loam, 45 to 60 percent slopes.
Montevallo channery silt loam, 20 to 30 percent slopes, severely eroded.
Montevallo channery silt loam, 30 to 45 percent slopes.
Montevallo channery silt loam, 30 to 45 percent slopes, severely eroded.
Montevallo channery silt loam, 45 to 65 percent slopes.
Montevallo channery silt loam, 45 to 65 percent slopes, severely eroded.
Montevallo shaly silt loam, 20 to 30 percent slopes, severely eroded.
Teas-Calvin-Litz complex, 45 to 55 percent slopes, severely eroded.

The Montevallo soils occur mostly in mountainous areas in the eastern part of the county. They are strongly acid and are low in productivity. Most of the acreage is in woods. The lime-influenced Litz soils and the severely eroded Montevallo soil occur in rough areas in the western part of the county. They tend to be droughty and are subject to severe erosion. Because of the steep slopes and severe erosion, they are not suited to either crops or pasture. Many fields have been abandoned and are reverting to brushy woods. The best use for the soils in this unit is woods.

Woodland.—Much of the acreage is in woods, but these soils are only fairly productive of trees. Many areas that have been allowed to revert to woods are poorly stocked with undesirable species. The woodlands should be protected from fire and should not be grazed. Suggestions for woodland management are given in the subsection "Use of Soils for Woodland."

Capability unit VIIe-4

This unit consists mostly of severely eroded, shallow, droughty, strongly sloping to very steep soils and miscellaneous land types that are underlain by red and gray siltstone and shale that contain some calcareous material. The original surface layer of these soils has been removed by erosion, and in many places the shale is exposed. Shallow gullies are common. These severely eroded areas occur mostly as small eroded spots in pastures or in brushy areas in the western part of the county. Most of these areas are reverting to brushy woods, but natural regeneration is often very slow. These areas need to be established and maintained in woody cover to limit erosion and to prevent damage to areas around them. In this unit are—

Litz very rocky soils, 30 to 45 percent slopes, severely eroded.
Sloping eroded land, shale materials.
Steep eroded land, shale materials.

Woodland.—Difficulty may be experienced in establishing trees because of active erosion and droughtiness. In many places water needs to be diverted by means of diversion terraces. Special care is needed to select and plant only suitable species. Low to moderate yields of wood crops can be expected if the soils are stabilized. Suggestions for woodland management are given in the subsection "Use of Soils for Woodland."

Capability unit VIIs-1

This unit consists of very rocky or very stony, steep and very steep, shallow to deep soils that developed in material weathered from or influenced by limestone. These soils occur as small individual areas throughout the limestone sections of the county. Some small areas of moderately steep soils were included in mapping. The soils in this unit are—

Bodine very stony loam, 12 to 25 percent slopes.
Bodine very stony loam, 25 to 35 percent slopes.
Bodine very stony loam, 35 to 50 percent slopes.
Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes.
Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, severly eroded.
Duffield very rocky silt loam, 30 to 45 percent slopes.
Frederick and Dunmore very rocky soils, 25 to 45 percent slopes.
Frederick and Bodine very rocky soils, 45 to 60 percent slopes.
Litz very rocky soils, 10 to 30 percent slopes.
Litz very rocky soils, 30 to 45 percent slopes.
Litz-Rock land complex, 45 to 60 percent slopes.
Murrill very stony loam, 25 to 45 percent slopes.

These soils are susceptible to moderate or severe erosion. They are productive, and they have a fairly high available moisture capacity, but there are enough large loose stones on the surface and enough outcrops of rock to interfere with the use of farm machinery. These soils can be used for woods and to a limited extent for permanent pasture.

Permanent pasture.—Bluegrass can be grown on slopes of 35 percent or less, but only a limited amount of liming, mowing, and fertilizing can be done with farm machinery. The soils should not be broken. Pastures should be carefully stocked and should not be overgrazed.

Woodland.—Many of the wooded areas are used for pasture or as shade for cattle. These soils will produce good stands of merchantable timber if they are well managed and protected from fire and grazing. Suggestions for woodland management are given in the subsection "Use of Soils for Woodland."

Capability unit VIIs-2

This unit consists of very stony, strongly sloping to very steep, shallow to moderately deep soils that developed mainly in material weathered from acid sandstone. These soils occur in the rougher mountainous areas in Monroe County and occupy more than 70,000 acres. They are—

Dekalb very stony loam, 10 to 25 percent slopes.
Dekalb very stony loam, 25 to 35 percent slopes.
Dekalb very stony loam, 35 to 50 percent slopes.
Dekalb very stony loam, 50 to 70 percent slopes.
Laidig very stony loam, 3 to 15 percent slopes.
Laidig very stony loam, 15 to 25 percent slopes.
Laidig very stony loam, 25 to 45 percent slopes.
Lehew very stony loam, 25 to 35 percent slopes.
Lehew very stony loam, 35 to 50 percent slopes.
Summers very stony loam, 5 to 20 percent slopes.
Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes.
Teas-Calvin-Litz very stony complex, 25 to 45 percent slopes.
Teas-Calvin-Litz very stony complex, 45 to 60 percent slopes.

These soils are moderately productive, but large stones prevent the use of farm machinery. About 90 percent of the acreage is wooded. The most suitable use for these soils is woods, but some areas can be used to a very limited extent for unimproved pasture.

Permanent pasture.—The strongly sloping soils that have been cleared can be used for unimproved bluegrass pasture, but only limited yields can be expected. Liming or fertilizing is not practical, except in some very small areas.

Woodland.—These soils, which occur mostly as large or very large areas, are generally in a mixed forest of oaks, but they are also well suited to white pine and to other conifers. Yields of wood crops are moderate or better, but cutting should be selective to ensure satisfactory yields. The forested areas should be protected from fire and should not be grazed. Suggestions for management are given in the subsection "Use of Soils for Woodland."

Capability unit VIIIs-1

This unit consists of one miscellaneous land type, Steep rock land. This land occupies more than 400 acres in the county. It consists of massive outcrops of sandstone on ridges and bluffs in mountainous areas, mostly in the eastern part of the county. There is little or no soil material between the rocks. The individual areas are small, and they are steep or very steep. In places there are vertical cliffs.

This land supports little vegetation. It is useful mainly as scenic spots and as landmarks in the rough mountainous areas.

Estimated Yields Under Two Levels of Management [1]

The estimated yields of the principal crops grown in Monroe County are shown in table 1. Yields are estimated for two levels of management and are shown under columns A and B. Those in columns A are estimated for the common management now being used by farmers. Those in columns B are estimated for the best management feasible. These figures are averages for a 10-year period. In the future, new techniques may increase the average yields, but there is not likely to be much change in the relative response of the different soils.

The figures in columns A are based largely on known crop yields; on average yields calculated from United States census data for 1954 for Monroe County; and on available data from corn trials of the West Virginia Experiment Station on known soils. Where information was lacking, present yields were estimated, taking into consideration the properties of the soils involved.

On many of the soils in Monroe County, the present yields are well above the State average.

The figures in columns B are based mainly on experimental results secured from crop trials on soils occurring in Monroe County and on actual experience by farmers using the best management. They are based on present knowledge and on methods that can be practically used. The management needed to obtain these yields includes liming to the pH required for the crop, fertilizing according to need as determined by soil tests, using good rotations, and using necessary conservation practices. Manure is not used extensively, except on dairy farms. The management needed to obtain the yields estimated in columns B for pasture includes the use of enough fertilizer to provide phosphate and potash where needed and enough lime to maintain a pH of 6.0 to 6.5.

Yields for which data were not available were estimated. In making these estimates, the properties of the soils and local knowledge and experience were considered.

[1] FRANK W. GLOVER, assistant State soil conservationist, Soil Conservation Service, assisted in the preparation of this subsection.

TABLE 1.—*Estimated average acre yields of the principal crops under two levels of management*

[Yields in columns A are those obtained under common management; those in columns B are yields to be expected under improved management. Absence of figure indicates crop is not commonly grown. Soils that are severely limited by steep slopes, stoniness, rockiness, or severe erosion are considered not suitable for the crops listed and do not appear in the table]

Soil symbols	Soil	Corn		Wheat		Mixed hay [1]		Alfalfa-grass		Permanent pasture	
		A	B	A	B	A	B	A	B	A	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [2]	*Cow-acre-days* [2]
Ad	Alluvial land	----	----	----	----	----	----	----	----	60	110
At	Atkins silt loam	35	70	15	25	1.2	2.0	----	----	70	150
BcB	Bodine very cherty silt loam, 5 to 12 percent slopes	60	90	20	30	1.5	2.5	2.0	3.5	100	140
BcC	Bodine very cherty silt loam, 12 to 25 percent slopes	55	85	18	27	1.3	2.3	1.8	3.2	90	130
BcD	Bodine very cherty silt loam, 25 to 35 percent slopes	----	----	----	----	1.1	2.2	1.6	3.0	80	120
CaA	Captina silt loam, 0 to 3 percent slopes	45	85	20	30	1.8	2.8	2.0	[3] 3.2	100	160
CaB	Captina silt loam, 3 to 8 percent slopes	45	85	20	30	1.8	2.8	2.0	[3] 3.2	100	160
CaC	Captina silt loam, 8 to 15 percent slopes	40	80	15	25	1.6	2.5	1.8	[3] 3.0	55	140
CbC	Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes	----	----	----	----	----	----	----	----	60	90
CbD	Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes	----	----	----	----	----	----	----	----	55	85
CbE	Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	50	80
CkB	Clarksburg silt loam, 3 to 8 percent slopes	60	90	30	35	1.8	2.8	2.0	[3] 3.2	90	170
CkC	Clarksburg silt loam, 8 to 15 percent slopes	55	85	28	33	1.6	2.6	1.8	[3] 3.0	85	165

See footnotes at end of table.

TABLE 1.—*Estimated average acre yields of the principal crops under two levels of management*—Continued

Soil symbols	Soil	Corn		Wheat		Mixed hay [1]		Alfalfa-grass		Permanent pasture	
		A	B	A	B	A	B	A	B	A	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [2]	*Cow-acre-days* [2]
DaB	Dekalb channery loam, 5 to 12 percent slopes	50	75	20	30	1.5	2.0	1.8	3.0	50	120
DaC	Dekalb channery loam, 12 to 25 percent slopes	45	70	18	28	1.3	1.8	1.7	2.7	45	115
DaD	Dekalb channery loam, 25 to 35 percent slopes	40	65	16	26	1.2	1.7	1.6	2.6	40	110
DbB	Dekalb fine sandy loam, 5 to 12 percent slopes	50	75	20	30	1.5	2.0	1.8	3.0	50	120
DbC	Dekalb fine sandy loam, 12 to 25 percent slopes	45	70	18	28	1.3	1.8	1.7	2.7	45	115
DbD	Dekalb fine sandy loam, 25 to 35 percent slopes	40	65	16	26	1.2	1.7	1.6	2.6	40	110
DfB	Duffield silt loam, 3 to 10 percent slopes	75	115	30	40	1.8	2.8	2.3	4.2	120	180
DkB	Duffield silt loam, karst, 3 to 10 percent slopes	75	115	30	40	1.8	2.8	2.3	4.2	120	180
DfC	Duffield silt loam, 10 to 20 percent slopes	70	110	28	38	1.7	2.7	2.2	4.0	110	175
DkC	Duffield silt loam, karst, 10 to 20 percent slopes	70	110	28	38	1.7	2.7	2.2	4.0	110	175
DfD	Duffield silt loam, 20 to 30 percent slopes	65	100	25	35	1.5	2.5	2.0	3.7	105	165
DfD3	Duffield silt loam, 20 to 30 percent slopes, severely eroded	----	----	----	----	1.2	2.2	----	----	100	150
DfE	Duffield silt loam, 30 to 45 percent slopes	----	----	----	----	----	----	----	----	90	130
DrC	Duffield very rocky silt loam, 5 to 20 percent slopes	----	----	----	----	----	----	----	----	90	120
DrD	Duffield very rocky silt loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	85	115
DrE	Duffield very rocky silt loam, 30 to 45 percent slopes	----	----	----	----	----	----	----	----	75	105
DtB	Dunmore cherty silt loam, 3 to 8 percent slopes	75	115	30	40	1.8	2.8	2.3	4.2	120	170
DtC	Dunmore cherty silt loam, 8 to 15 percent slopes	70	110	28	38	1.7	2.7	2.2	4.2	115	170
DtD	Dunmore cherty silt loam, 15 to 25 percent slopes	65	105	25	35	1.5	2.5	2.0	4.0	110	160
DuD3	Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded	----	----	----	----	1.2	2.2	----	----	100	150
DvB	Dunmore silt loam, 3 to 8 percent slopes	75	115	30	40	2.0	3.0	2.5	4.5	130	180
DvC	Dunmore silt loam, 8 to 15 percent slopes	70	110	28	38	1.8	2.8	2.3	4.2	125	170
DvD	Dunmore silt loam, 15 to 25 percent slopes	65	105	25	35	1.5	2.5	2.0	4.0	120	160
FcB	Frederick cherty silt loam, 3 to 8 percent slopes	75	115	30	40	2.0	3.0	2.5	4.5	130	180
FkB	Frederick cherty silt loam, karst, 3 to 8 percent slopes	75	115	30	40	2.0	3.0	2.5	4.5	130	180
FcC	Frederick cherty silt loam, 8 to 15 percent slopes	70	110	28	38	1.8	2.8	2.3	4.2	125	170
FkC	Frederick cherty silt loam, karst, 8 to 15 percent slopes	70	110	28	38	1.8	2.8	2.3	4.2	125	170
FcD	Frederick cherty silt loam, 15 to 25 percent slopes	65	100	25	35	1.5	2.5	2.0	4.0	120	170
FcE	Frederick cherty silt loam, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	100	150
FdB	Frederick silt loam, 3 to 8 percent slopes	75	115	30	40	2.0	3.0	2.5	4.5	130	190
FmB	Frederick silt loam, karst, 3 to 8 percent slopes	75	115	30	40	2.0	3.0	2.5	4.5	130	190
FdC	Frederick silt loam, 8 to 15 percent slopes	70	110	28	38	1.8	2.8	2.3	4.2	125	180
FmC	Frederick silt loam, karst, 8 to 15 percent slopes	70	110	28	38	1.8	2.8	2.3	4.2	125	180
FdD	Frederick silt loam, 15 to 25 percent slopes	65	100	25	35	1.5	2.5	2.0	4.0	120	170
FdE	Frederick silt loam, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	100	150
FsC	Frederick and Dunmore very rocky soils, 3 to 15 percent slopes	----	----	----	----	----	----	----	----	70	110
FsD	Frederick and Dunmore very rocky soils, 15 to 25 percent slopes	----	----	----	----	----	----	----	----	65	100
Gu	Guthrie silty clay loam	30	65	18	22	1.5	2.0	----	----	80	140
HaB	Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes	55	80	23	33	1.6	2.6	1.9	3.5	60	140
HaC	Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes	50	75	20	30	1.4	2.4	1.7	3.2	55	135
Hu	Huntington silt loam	80	120	25	40	2.5	3.5	3.0	4.5	130	200
LaB	Laidig channery loam, 3 to 8 percent slopes	50	90	20	30	1.5	2.3	1.8	3.5	70	130
LaC	Laidig channery loam, 8 to 15 percent slopes	45	85	18	28	1.3	2.1	1.5	3.2	65	125
LaD	Laidig channery loam, 15 to 25 percent slopes	40	80	15	25	1.1	1.9	1.3	3.0	60	120
LaE	Laidig channery loam, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	55	100
LbC	Laidig very stony loam, 3 to 15 percent slopes	----	----	----	----	----	----	----	----	50	80
LbD	Laidig very stony loam, 15 to 25 percent slopes	----	----	----	----	----	----	----	----	40	70
LcB	Landisburg cherty silt loam, 3 to 10 percent slopes	45	85	18	28	1.3	2.3	1.8	[3] 2.9	75	140
LdB	Leadvale silt loam, 3 to 10 percent slopes	60	85	20	27	1.7	2.7	2.5	[3] 3.0	75	140
Ln	Lindside silt loam	75	115	25	37	2.0	3.5	2.5	[3] 3.5	90	190
LsB	Litz shaly silt loam, 3 to 10 percent slopes	50	80	20	25	1.5	2.5	2.0	3.0	60	100
LsC	Litz shaly silt loam, 10 to 20 percent slopes	40	70	18	22	1.3	2.3	1.8	2.8	50	85
LsD	Litz shaly silt loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	40	75
LtB	Litz silt loam, 3 to 8 percent slopes	65	95	22	30	1.8	3.0	2.2	3.5	70	130
LtC	Litz silt loam, 8 to 15 percent slopes	60	90	20	28	1.6	2.8	2.0	3.2	65	120
LtC3	Litz silt loam, 8 to 15 percent slopes, severely eroded	55	80	18	25	1.4	2.6	1.8	3.0	60	110

See footnotes at end of table.

TABLE 1.—*Estimated average acre yields of the principal crops under two levels of management*—Continued

Soil symbols	Soil	Corn		Wheat		Mixed hay [1]		Alfalfa-grass		Permanent pasture	
		A	B	A	B	A	B	A	B	A	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [2]	*Cow-acre-days* [2]
LtD	Litz silt loam, 15 to 25 percent slopes	55	80	18	25	1. 4	2. 6	1. 8	3. 0	60	105
LtD3	Litz silt loam, 15 to 25 percent slopes, severely eroded	----	----	----	----	----	----	----	----	55	95
LtE	Litz silt loam, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	50	85
Mb	Melvin silt loam	35	80	18	25	1. 5	2. 3	----	----	90	150
MgA	Monongahela silt loam, 0 to 3 percent slopes	40	85	20	28	1. 7	2. 7	1. 9	[3] 3. 0	55	135
MgB	Monongahela silt loam, 3 to 8 percent slopes	40	85	20	28	1. 7	2. 7	1. 9	[3] 3. 0	55	135
MgC	Monongahela silt loam, 8 to 15 percent slopes	35	80	18	26	1. 5	2 5	1. 7	[3] 2. 8	50	130
MoC	Montevallo channery silt loam, 10 to 20 percent slopes	35	70	15	20	1. 5	2. 0	1. 5	2. 5	50	75
MoC3	Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded	----	----	----	----	1. 3	1. 8	1. 3	2. 2	40	65
MoD	Montevallo channery silt loam, 20 to 30 percent slopes	----	----	----	----	1. 3	1. 8	1. 3	2. 2	40	65
MsB3	Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded	40	60	18	22	1. 3	2. 3	1. 8	2. 8	50	85
MsC3	Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded	----	----	----	----	----	----	----	----	45	80
MuB	Murrill channery loam, 3 to 8 percent slopes	60	100	25	35	1. 8	2. 2	2. 0	3. 5	80	150
MuC	Murrill channery loam, 8 to 15 percent slopes	55	95	22	32	1. 5	2. 0	1. 8	3. 2	75	140
MuD	Murrill channery loam, 15 to 25 percent slopes	50	90	20	30	1. 3	1. 8	1. 6	3. 0	70	130
MuE	Murrill channery loam, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	65	120
MvC	Murrill very stony loam, 8 to 15 percent slopes	----	----	----	----	----	----	----	----	65	110
MvD	Murrill very stony loam, 15 to 25 percent slopes	----	----	----	----	----	----	----	----	60	100
MvE	Murrill very stony loam, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	50	90
Ph	Philo silt loam	60	110	20	37	2. 0	3. 0	2. 0	[3] 3. 2	100	180
PkB	Pickaway silt loam, 3 to 10 percent slopes	70	100	25	35	1. 8	2. 8	2. 0	[3] 3. 5	100	160
Po	Pope fine sandy loam	70	110	25	37	2. 0	3. 0	2. 5	4. 0	80	160
Ro	Robertsville silt loam	30	70	18	22	1. 5	2. 0	----	----	80	150
SvC	Summers very stony loam, 5 to 20 percent slopes	----	----	----	----	----	----	----	----	50	110
TaB	Teas and Calvin silt loams, 3 to 8 percent slopes	65	95	22	30	1. 8	3. 0	2. 2	3. 5	70	130
TaC	Teas and Calvin silt loams, 8 to 15 percent slopes	60	90	20	28	1. 6	2. 8	2. 0	3. 2	65	120
TaC3	Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded	55	80	18	25	1. 4	2. 6	1. 8	3. 0	60	110
TaD	Teas and Calvin silt loams, 15 to 25 percent slopes	55	80	18	25	1. 4	2. 6	1. 8	3. 0	60	105
TaE	Teas and Calvin silt loams, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	50	85
TcD3	Teas and Calvin soils, 15 to 25 percent slopes, severely eroded	----	----	----	----	----	----	----	----	55	95
TlB	Teas-Calvin-Litz silt loams, 3 to 8 percent slopes	65	95	22	30	1. 8	3. 0	2. 2	3. 5	70	130
TlC	Teas-Calvin-Litz silt loams, 8 to 15 percent slopes	60	90	20	28	1. 6	2. 8	2. 0	3. 2	65	120
TlD	Teas-Calvin-Litz silt loams, 15 to 25 percent slopes	55	80	18	25	1. 4	2. 6	1. 8	3. 0	60	110
TlE	Teas-Calvin-Litz silt loams, 25 to 45 percent slopes	----	----	----	----	----	----	----	----	50	85
TmB3	Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded	60	90	21	29	1. 9	2. 9	2. 1	3. 0	67	125
TmC3	Teas-Calvin-Litz complex, 8 to 15 percent slopes, severely eroded	55	80	18	25	1. 4	2. 6	1. 8	2. 8	60	110
TmD3	Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded	----	----	----	----	----	----	----	----	55	95
TrC	Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes	----	----	----	----	----	----	----	----	50	75
TsB	Tilsit fine sandy loam, 3 to 8 percent slopes	40	85	17	27	1. 6	2. 7	1. 8	[3] 3. 0	55	135
TtB	Tilsit silt loam, 2 to 8 percent slopes	40	85	17	27	1. 6	2. 7	1. 8	[3] 3. 0	55	135
TtC	Tilsit silt loam, 8 to 15 percent slopes	35	80	16	25	1. 5	2. 6	1. 7	[3] 2. 8	50	130

[1] Mainly a mixture of clover and grass.
[2] The number of days in 1 year that a mature animal (cow, horse, or steer) can graze an acre without injury to the pasture.
[3] Winter damage is likely if alfalfa is grown, and stands may be short lived.

Use of Soils for Woodland[2]

Woodland in Monroe County occupies slightly more than 160,000 acres, or about 54 percent of the total land area. Woodland is prominent in all parts of the county except the limestone valley. The largest continuous tracts are on Peters Mountain, on Potts Mountain, and in the area north and east of Gap Mills. Oak and associated hardwoods and pine are the dominant species, but the composition of the forests and the quality and condition of the sites vary widely.

Grazing damage has been heaviest in small scattered woodlots in the limestone valley (fig. 6). Fire damage has been heaviest in the mountainous areas. Repeated cuttings for pulpwood and mine timber have been heavy in mountainous areas and on foot slopes.

***Figure 6.*—Typical open grazed woodlot on Frederick soils.**

Following are the forest types common in the county, and the sites on which they occur (*11*).[3]

Scarlet oak type occurs on the more shallow soils and on slopes that have south and west aspects.

Chesnut oak type commonly occurs on the upper part of mountain slopes, on dry ridges, and on slopes that have south and west aspects (fig. 7).

Eastern redcedar type occurs on very rocky soils that are underlain by limestone or by limy shale. It occupies small areas, mostly in eroded pastures.

Black locust type occurs in abandoned fields and on rocky soils that are underlain by limestone or by limy shale.

White pine-chestnut oak type occurs on the drier mountain sites and on foothills. Pure and nearly pure stands of pine occur in old fields and in burned areas. Both species also occur in mixed stands with oaks.

Yellow poplar-white oak-northern red oak type is common in the limestone valley.

[2] Ross H. Melinger, woodland conservationist, Soil Conservation Service, assisted in the preparation of this subsection.

[3] Italic numbers in parentheses refer to Literature Cited, p. 110.

***Figure 7.*—Poor woodland site; poorly stocked stand of chestnut oak on Dekalb very stony loam.**

White oak-red oak-hickory type occurs in the limestone valley and on mountain slopes that have north and east aspects.

Beech-sugar maple type occurs on colluvial slopes and in coves in mountainous areas.

Soil properties affect tree growth, species adaptation, and forest management practices (*12*, *15*). The ability to supply moisture and the ability to supply plant nutrients are the properties that most affect growth. Thus, plants grow faster in a deep, fertile, limestone soil with high available water capacity, such as the Frederick or Duffield, than in a shallow, droughty, infertile soil, such as the Montevallo. Steepness of slopes may also influence

moisture relationships. Depth to hard bedrock, to a fragipan, or to clayey subsoil affects water-supplying ability and root growth. A high water table also influences root growth and species adaptation. Other soil characteristics also affect forest management (*16*). Some soils have features that limit equipment use—for example, stoniness, rockiness, steep slopes, or clayey subsoil. Some soils erode more readily than others when tree crops are harvested. Brush, grass, or weeds provide intense competition for new seedlings on some soils.

Woodland suitability grouping

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect growth of trees and management of the stands. For this reason, the soils of Monroe County have been placed in 12 woodland suitability groups. Each group consists of soils that have about the same suitability for wood crops, require about the same management, and have about the same potential productivity. Site quality and some of the limitations and hazards that affect management are explained in the following paragraphs.

SITE QUALITY. A site index for a given soil and a given species of tree is the average height, in feet, of the dominant and codominant trees in a stand, at 50 years of age. Site index indicates the potential productivity of a soil for a particular tree species. Only a few site index measurements have been made in Monroe County. Therefore, the values shown are mostly estimates based on measurements made on the same or similar soils in nearby areas. Site quality is rated *excellent*, *good*, *fair*, and *poor*. The site quality and the corresponding site index for the common tree species in the county are shown in table 2.

TABLE 2.—*Site quality and estimated corresponding site index for the common tree species*

[The site index rating may represent a different site quality for different species of trees. For example, a site index of 80 indicates excellent site quality for upland oaks, but only good site quality for yellow-poplar or white pine. Dashes indicate the species is not common on sites of the specified quality. A site index rating of 90 represents a range of 85 to 94; a rating of 80, a range of 75 to 84; a rating of 70, a range of 65 to 74; a rating of 60, a range of 55 to 64; and a rating of 50, a range of 45 to 54]

Species	Site quality and corresponding site index			
	Excellent	Good	Fair	Poor
Yellow-poplar	90	80	----------	----------
White pine	90	80	70	60
Upland oaks	80	70	60	50
Virginia pine	----------	70	60	50

Site quality varies on some soils because of aspect, steepness of slope, position on slope, or a combination of these features. Where it applies, this information is shown in the woodland group and in table 3. Aspect, or the compass direction in which the slope faces, is shown as north and south. Slopes facing north or east of a line drawn from true northwest to true southeast are considered to have a north aspect; those facing south or west of this line are considered to have a south aspect.

On long steep hillsides, tree growth is influenced by position on the slope. Where this is a factor, position is determined by dividing the slope into three equal parts: (1) upper; (2) middle; and (3) lower. The slope may extend from the ridgetop to a stream; from the ridgetop to the edge of a flood plain; or from the ridgetop to the edge of a colluvial soil.

PLANT COMPETITION. Each woodland group carries a rating for plant competition. This is an estimate of the effect of brush, grass, vines, or other undesirable plants on the establishment and early growth of desirable tree seedlings. Expected competition from other plants is rated *slight*, *moderate*, or *severe*. Slight means that competition is no special problem. Moderate means that plant competition develops but does not generally prevent establishment of desirable seedlings. Severe means that the natural restocking of desired species cannot be relied on and that even planted trees may be choked out unless special measures are taken to control competition.

SPECIES SUITABILITY. Named in the description of each woodland group are the species generally preferred in natural stands and those preferred for planting for wood crops,[4] for Christmas trees,[4] and, if needed, for farmstead windbreaks. The species named grow well on the soils listed in each group. They have a higher relative value than others not named, but they are not named in order of priority. For wood crops on poor and fair sites, the conifers commonly will produce more wood in less time than hardwoods. In new plantings, hardwoods are more difficult to establish and normally are less successful than conifers.

White pine is named as a preferred species even though the white-pine weevil is a pest in Monroe County. The high value of this species both for Christmas trees and for wood crops may offset the cost of control measures. White-pine blister rust is under control in Monroe County, but extensive areas to be planted to white pine should be inspected for ribes, the alternate host plant for this disease.

EQUIPMENT LIMITATION. Some of the soil characteristics and topographic features that restrict the use of equipment are internal drainage, steepness of slope, and the number and size of stones. *Slight* limitation means that there are few or no restrictions on the kind of equipment used or on the time of year that it can be used; that a seasonal water table does not seriously interfere with the use of equipment; and that slopes are less than 15 percent. *Moderate* limitation means that there are less than 3 months during the year when the use of equipment is limited by wetness, or that the slopes are 15 to 35 percent. *Severe* limitation means that there are more than 3 months during the year when heavy equipment cannot be used because of wetness; that large and numerous stones interfere seriously with cultural and harvesting work; or that slopes are more than 35 percent.

EROSION HAZARD. Erosion hazard is rated on the basis of risk of erosion incurred in managing or harvesting the tree crop. The risk of erosion generally is related to

[4] Other suitable species are listed by soil characteristics and topographic features in PLANTING SITES IN THE NORTHEAST, Sta. Paper #157. Northeastern Forest Expt. Sta., Forest Service, Upper Darby, Pa. 1961.

layout, use, and care of wood roads and skid trails or to cultural practices that expose the mineral soil. *Slight* erosion hazard means that there are no serious erosion problems. Disturbed areas normally are stabilized within 2 years after logging if ordinary hauling and skidding practices are used and if layouts for roads and trails are good. *Moderate* erosion hazard means that the soils need to be managed to prevent unnecessary erosion damage. Roads and trails should be carefully laid out on moderate grades and "put to bed" after logging. Diversion of water is necessary. *Severe* erosion hazard means that there are serious gully problems. Roads and

TABLE 3.—*Woodland suitability groups of soils, their estimated site potential,*

[Absence of an entry indicates that information

Woodland suitability group and soil series	Map symbol	Species	Slope	
			Aspect [1]	Position
Group 1. Deep, well-drained, fertile, mostly gently sloping to strongly sloping, nonrocky soils that are underlain by limestone.				
Bodine, Duffield, Dunmore, Frederick	BcB, BcC, BcD, BrC, BrD, BrE, DfB, DkB, DfC, DkC, DfD, DfD3, DfE, DtB, DtC, DtD, DuD3, DvB, DvC, DvD, FcB, FkB, FcC, FkC, FcD, FcE, FdB, FmB, FdC, FmC, FdD, FdE,	Upland oaks	All	All
		Yellow-poplar	All	All
Group 2. Deep, well drained and moderately well drained, acid and lime-influenced, colluvial soils.				
Clarksburg, Laidig, Landisburg, Leadvale, Murrill.	CkB, CkC, LaB, LaC, LaD, LaE, LbC, LbD, LbE, LcB, LdB, MuB, MuC, MuD, MuE, MvC, MvD, MvE.	Upland oaks	All	All
		Yellow-poplar	All	All
		White pine	All	All
Group 3. Deep, moderately well drained soils that have a fragipan.				
Captina, Monongahela, Pickaway, Tilsit	CaA, CaB, CaC, MgA, MgB, MgC, PkB, TsB, TtB, TtC.	Upland oaks	All	All
		Yellow-poplar	All	All
		Virginia pine	All	All
Group 4. Shallow to moderately deep, somewhat droughty channery soils that developed in material weathered from acid shale and sandstone.				
Montevallo	MoC, MoC3, MoD, MoD3, MoE, MoE3, MoF, MoF3.	Upland oaks, Virginia pine.	North [2]	All
			South [2]	All
			North [3]	All
			South [3]	All
		White pine	North [2]	All
			South [2]	All
			North [3]	All
			South [3]	All
Group 5. Moderately deep, mostly steep and stony soils that developed in material weathered from red and gray sandstone.				
Dekalb, Lehew, Summers, except on narrow, rocky ridgetops.	DaB, DaC, DaD, DbB, DbC, DbD, DeC, DeD, DeE, DeF, LhD, LhE, SvC.	Upland oaks, Virginia pine.	North	Lower
				Middle
				Upper
			South	Lower
				Middle
				Upper
		Yellow-poplar, white pine.	North	Lower
				Middle
				Upper
			South	Lower
				Middle
				Upper
Hartsells, Wellston	Hab, HaC	Upland oaks, Virginia pine.	All	All
		Yellow-poplar, white pine.	All	All
Narrow, rocky ridgetops on Dekalb, Lehew, Summers.		Upland oaks		
Group 6. Shallow, severely eroded, droughty shaly soils that developed in material weathered from slightly lime-influenced shale.				
Montevallo, Litz	MsB3, MsC3, MsD3, LsB, LsC, LsD, LsE, LsF.	Upland oaks, Virginia pine.	North	All
			South	All
		White pine	North	All
			South	All

See footnotes at end of table.

trails should be on grades of less than 10 percent; water diversion measures are needed during logging; and seeding and mulching generally are needed to supplement other measures.

Listed in table 3, and also described in the text, are the 12 woodland suitability groups in the county. Table 3 gives the estimated site quality rating for various kinds of trees in each group and rates the hazards and limitations that affect management.

Potential yields for upland oaks, yellow-poplar, white pine, and Virginia pine by site quality are shown in tables 4, 5, 6, and 7.

and ratings for major limitations and hazards that affect management

is not available or the factor does not apply]

Estimated site potential		Plant competition	Equipment limitations	Erosion hazard
Site quality	Average site index and range			
Excellent	80 (75 to 84)	Severe	Moderate	Moderate to severe.
Excellent	90 (85 to 94)	Severe	Moderate	Moderate to severe.
Good to excellent	70 to 80 (65 to 84)	Slight	Slight to moderate	Slight to moderate.
Good to excellent	80 to 90 (75 to 94)	Slight	Slight to moderate	Slight to moderate.
Good to excellent	80 to 90 (75 to 94)	Severe	Slight to moderate	Slight to moderate.
Good	70 (65 to 74)	Slight	Moderate	Slight.
Good	80 (75 to 84)	Slight	Moderate	Slight.
Good	80 (75 to 84)	Moderate	Moderate	Slight.
Good	70 (65 to 74)	Slight to moderate	Slight to severe	Slight to moderate.
Fair	60 (55 to 64)			
Fair	60 (55 to 64)			
Poor	50 (45 to 54)			
Good	80 (75 to 84)	Moderate to severe	Slight to severe	Slight to moderate.
Fair	70 (65 to 74)			
Fair	70 (65 to 74)			
Poor	60 (55 to 64)			
Excellent	80 (75 to 84)	Slight for oak; moderate to severe for pine.	Moderate to severe	Slight to moderate.
Good	70 (65 to 74)			
Good	70 (65 to 74)			
Good	70 (65 to 74)			
Fair	60 (55 to 64)			
Poor	50 (45 to 54)			
Excellent	90 (85 to 94)	Slight for yellow-poplar; moderate to severe for white pine.	Moderate to severe	Slight to moderate.
Good	80 (75 to 84)			
Good	80 (75 to 84)			
Good	80 (75 to 84)			
Fair [4]	70 (65 to 74)			
Poor [4]	60 (55 to 64)			
Good	70 (65 to 74)	Slight for oak; moderate to severe for pine.	Moderate to severe	Slight to moderate.
Good	80 (75 to 84)	Slight for poplar, moderate to severe for pine.	Moderate to severe	Slight to moderate.
Poor	Less than 54	Slight	Moderate to severe	Slight.
Fair	60 (55 to 64)	Slight for oak; slight to moderate for pine.	Slight to severe	Moderate.
Poor	Less than 54			
Fair	70 (65 to 74)			
Poor	64 or less			

TABLE 3.—*Woodland suitability groups of soils, their estimated site potential,*

Woodland suitability group and soil series	Map symbol	Species	Slope	
			Aspect [1]	Position
Group 7. Shallow to moderately deep, well-drained silty soils that developed in material weathered from gray and red shale that contained some calcareous material.				
Litz, Teas, Calvin	LtB, LtC, LtC3, LtD, LtD3, LtE, LtE3, LtF, TaB, TaC, TaC3, TaD, TaE, TcD3, TcE3, TlB, TlC, TlD, TlE, TmB3, TmC3, TmD3, TmE3, TmF, TmF3, TrC, TrE, TrF.	Upland oaks, Virginia pine.	North	All
			South	All
		Yellow-poplar, white pine.	North	All
			South	All
Group 8. Very shallow, very droughty, severely eroded soils that are underlain by shale.				
Sloping eroded land, shale materials; Steep eroded land, shale materials.	SoD, SpE	White pine, Virginia pine.	All	All
Group 9. Very rocky, fertile soils that range in depth to limestone, or that are influenced by lime.				
Chilhowie, Tumbez, Duffield, Frederick, Bodine, Dunmore, Litz, Rock land.	CbC, CbD, CbE, CbE3, DrC, DrD, DrE, FrF, FsC, FsD, FsE, LvD, LvE, LvE3, LxF.	Upland oaks	All	All
Group 10. Deep, well drained and moderately well drained soils on bottom lands.				
Pope, Philo, Huntington, Lindside	Po, Ph, Hu, Ln	Upland oaks	----------	----------
		Yellow-poplar, white pine.	----------	----------
Group 11. Deep, poorly drained to moderately well drained soils on bottom lands, terraces, and uplands.				
Alluvial land, Atkins, Guthrie, Melvin, Robertsville.	Ad, At, Gu, Mb, Ro	Not classified by species.	----------	----------
Group 12. Steep and very steep land consisting of massive outcrops of sandstone and small vertical cliffs.				
Steep rock land	SrF	Upland oaks, Virginia pine.	All	All

[1] Aspects facing north or east of a line drawn from true northwest to true southeast are shown as north; those facing south or west of this line are shown as south.

[2] Slopes of 0 to 30 percent.

and ratings for major limitations and hazards that affect management—Continued

Estimated site potential		Plant competition	Equipment limitations	Erosion hazard
Site quality	Average site index and range			
Good	70 (65 to 74)	Slight for oak; moderate to severe for pine.	Moderate to severe	Moderate to severe.
Fair	60 (55 to 64)			
Good	80 (75 to 84)	Slight for poplar; moderate to severe for white pine.	Moderate to severe	Moderate to severe.
Fair [4]	70 (65 to 74)			
Poor	Less than 54	Slight	Severe	Severe.
Fair to excellent	60 to 80 (55 to 84)	Severe	Severe	Moderate.
Excellent	80 (75 to 84)	Severe	Moderate [5]	Slight.
Excellent	90 (85 to 94)	Severe	Moderate [5]	Slight.
Variable	Variable	Severe	Severe [6]	Slight.
Poor	Less than 54	Slight	Severe	Severe.

[3] Slopes of 30 to 65 percent.
[4] White pine only.
[5] Occasionally flooded and ponded.
[6] Frequently flooded and ponded.

TABLE 4.—*Estimated yields per acre for even-aged, fully stocked stands of upland oak (10)*

Site quality	Site index	Age	Total merchantable volume		
		Year	*Cu. ft.*[1]	*Cords*[2]	*Bd. ft.*[3]
Poor	50	30	540	6	350
		40	1, 090	13	1, 400
		50	1, 600	19	3, 250
		60	2, 080	25	5, 600
		70	2, 510	30	8, 150
		80	2. 900	34	10, 450
Fair	60	30	880	10	850
		40	1, 580	19	3, 200
		50	2, 230	26	6, 300
		60	2, 800	33	9, 700
		70	3, 290	39	12, 800
		80	3, 730	44	15. 650
Good	70	30	1, 270	15	1, 750
		40	2, 090	25	5. 500
		50	2, 830	33	9, 750
		60	3, 480	41	13, 900
		70	4, 030	47	17, 700
		80	4, 510	53	21, 200
Excellent	80	30	1, 690	20	3, 350
		40	2, 610	31	8, 600
		50	3, 450	41	13, 750
		60	4, 160	49	18, 600
		70	4, 770	56	23, 100
		80	5, 340	63	27, 250

[1] Yield per acre in cubic feet merchantable stems, including bark, to a top diameter of 4 inches outside bark.
[2] Figures rounded off to nearest cord. Merchantable stems to a top diameter of 4 inches outside bark.
[3] To a top diameter of 5 inches inside bark, including all trees having at least one 16-foot log. International ⅛-inch rule.

TABLE 5.—*Estimated yields per acre for second-growth yellow-poplar (8)*

Site quality	Site index	Age	Total merchantable volume		
		Year	*Cu. ft.*	*Cords*[1]	*Bd. ft.*[2]
Good	80	30	1, 800	21	5, 500
		40	2, 690	32	11, 230
		50	3, 570	42	17, 620
Excellent	90	30	2, 300	27	8, 710
		40	3, 390	40	16, 300
		50	4, 480	53	24, 400

[1] Approximate values for unpeeled wood based on conversion factor of 85 cubic feet per cord. Values rounded to nearest cord.
[2] To a top diameter of 6 inches inside bark. International ⅛-inch rule.

TABLE 6.—*Estimated yields per acre for even-aged, fully stocked natural stands of Virginia pine*

[Empirical data based on field experience and preliminary studies]

Site quality	Site index	Age	Merchantable volume of unpeeled wood
			Standard cords
Poor	50	30	15
		40	20
		50	25
Fair	60	30	21
		40	28
		50	35
Good	70	30	30
		40	40
		50	50

TABLE 7.—*Estimated yields per acre for fully stocked, natural stands of white pine*

[Empirical data based on field experience and preliminary studies]

Site quality	Site index	Age	Merchantable volume[1]
			Bd. ft.
Poor	50	40	2, 900
		50	8, 300
		60	14, 300
		70	20, 200
		80	26, 400
Fair	60	40	7, 600
		50	16, 600
		60	26, 400
		70	35, 500
		80	42, 700
Good	70	40	11, 200
		50	25, 000
		60	37, 300
		70	47, 800
		80	55, 700
Excellent	80	40	14, 700
		50	31, 400
		60	43, 100
		70	55, 000
		80	63, 800

[1] Includes trees more than 7 inches in diameter at breast height to a top diameter of 5 inches inside bark. International ¼-inch rule.

WOODLAND SUITABILITY GROUP 1

This group consists of deep, well-drained, medium-textured, mostly gently sloping to strongly sloping soils that developed in material weathered from limestone. Limestone or limestone ledges crop out in places. These soils occupy most of the smooth limestone valley north of Union and the rolling limestone valley south of Sweetsprings. They are fertile, and most of them are high in available moisture capacity. They are used mainly for crops or pasture. Woodlots are small, and many contain mature or overmature oaks. Some woodlots are grazed. The soils in this group are—

(BcB)	Bodine very cherty silt loam, 5 to 12 percent slopes.
(BcC)	Bodine very cherty silt loam, 12 to 25 percent slopes.
(BcD)	Bodine very cherty silt loam, 25 to 35 percent slopes.
(BrC)	Bodine very stony loam, 12 to 25 percent slopes.
(BrD)	Bodine very stony loam, 25 to 35 percent slopes.
(BrE)	Bodine very stony loam, 35 to 50 percent slopes.
(DfB)	Duffield silt loam, 3 to 10 percent slopes.
(DkB)	Duffield silt loam, karst, 3 to 10 percent slopes.
(DfC)	Duffield silt loam, 10 to 20 percent slopes.
(DkC)	Duffield silt loam, karst, 10 to 20 percent slopes.
(DfD)	Duffield silt loam, 20 to 30 percent slopes.
(DfD3)	Duffield silt loam, 20 to 30 percent slopes, severely eroded.
(DfE)	Duffield silt loam, 30 to 45 percent slopes.
(DtB)	Dunmore cherty silt loam, 3 to 8 percent slopes.
(DtC)	Dunmore cherty silt loam, 8 to 15 percent slopes.
(DtD)	Dunmore cherty silt loam, 15 to 25 percent slopes.
(DuD3)	Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded.
(DvB)	Dunmore silt loam, 3 to 8 percent slopes.
(DvC)	Dunmore silt loam, 8 to 15 percent slopes.
(DvD)	Dunmore silt loam, 15 to 25 percent slopes.
(FcB)	Frederick cherty silt loam, 3 to 8 percent slopes.
(FkB)	Frederick cherty silt loam, karst, 3 to 8 percent slopes.
(FcC)	Frederick cherty silt loam, 8 to 15 percent slopes.
(FkC)	Frederick cherty silt loam, karst, 8 to 15 percent slopes.
(FcD)	Frederick cherty silt loam, 15 to 25 percent slopes.
(FcE)	Frederick cherty silt loam, 25 to 45 percent slopes.
(FdB)	Frederick silt loam, 3 to 8 percent slopes.
(FmB)	Frederick silt loam, karst, 3 to 8 percent slopes.
(FdC)	Frederick silt loam, 8 to 15 percent slopes.
(FmC)	Frederick silt loam, karst, 8 to 15 percent slopes.
(FdD)	Frederick silt loam, 15 to 25 percent slopes.
(FdE)	Frederick silt loam, 25 to 45 percent slopes.

These soils are rated excellent as sites for trees, particularly high-quality hardwoods.

Trees to favor in natural woodlots are the more valuable hardwoods, such as red oak, white oak, black oak, yellow-poplar, basswood, white ash, black walnut, and black locust.

The species suitable for planting for wood crops are yellow-poplar, white pine, Japanese larch, red pine, black locust, black walnut, and red oak. Black walnut and red oak can be established by seeding. Yellow-poplar, black walnut, and red oak are better suited where the sod cover is light or controlled and there is some scattered brush.

Scotch pine, white pine, Norway spruce, and Douglas-fir are preferred for Christmas trees. They can be grown on nonstony soils that have slopes of less than 25 percent.

White pine, red pine, hemlock, and Norway spruce make good windbreaks.

Plant competition is severe. Large openings in the tree canopy encourage the growth of grass that sometimes prevents the establishment of desired seedlings. Undesirable trees and shrubs often take over such openings. Grass sod, annual weeds, and brush seriously compete with planted seedlings in old fields. Site preparation that includes scalping, furrowing, or chemical control is required in such areas. Natural seeding generally cannot be relied on to stock large open areas with suitable trees.

Limitations on the use of heavy equipment normally are moderate. The Bodine soils are rated slight, however, because of the high content of chert. In winter and early in spring, logging should be restricted to times when the ground is frozen. When the ground thaws it is soft and the clayey, sticky subsoil will not support equipment.

The erosion hazard is moderate to severe on slopes of more than 15 percent if roads are built. Seeding and diversion of water may be necessary to stabilize roads after logging.

WOODLAND SUITABILITY GROUP 2

This group consists mainly of deep, well-drained, acid and lime-influenced, colluvial soils. These soils occur on foot slopes at the base of hills or mountains. They are mostly moderately fertile and have moderate to high available moisture capacity. Seeps are fairly common. The soils in this group are—

(CkB)	Clarksburg silt loam, 3 to 8 percent slopes.
(CkC)	Clarksburg silt loam, 8 to 15 percent slopes.
(LaB)	Laidig channery loam, 3 to 8 percent slopes.
(LaC)	Laidig channery loam, 8 to 15 percent slopes.
(LaD)	Laidig channery loam, 15 to 25 percent slopes.
(LaE)	Laidig channery loam, 25 to 45 percent slopes.
(LbC)	Laidig very stony loam, 3 to 15 percent slopes.
(LbD)	Laidig very stony loam, 15 to 25 percent slopes.
(LbE)	Laidig very stony loam, 25 to 45 percent slopes.
(LcB)	Landisburg cherty silt loam, 3 to 10 percent slopes.
(LdB)	Leadvale silt loam, 3 to 10 percent slopes.
(MuB)	Murrill channery loam, 3 to 8 percent slopes.
(MuC)	Murrill channery loam, 8 to 15 percent slopes.
(MuD)	Murrill channery loam, 15 to 25 percent slopes.
(MuE)	Murrill channery loam, 25 to 45 percent slopes.
(MvC)	Murrill very stony loam, 8 to 15 percent slopes.
(MvD)	Murrill very stony loam, 15 to 25 percent slopes.
(MvE)	Murrill very stony loam, 25 to 45 percent slopes.

The Laidig and Murrill soils make up most of this group. They occur extensively at the base of Peters and Potts Mountains, near large wooded areas of Dekalb soils, which are on the mountain slopes. More than half the acreage is stony, and fairly large areas are wooded. The dominant species are upland oaks, sugar maple, yellow-poplar, and hickory.

The soils in this group are capable of producing high yields of good-quality hardwoods. Site quality ranges from good to excellent, and the best sites generally have a north aspect.

The preferred species for managing in natural stands are yellow-poplar, red oak, white oak, black oak, basswood, white ash, sugar maple, black locust, and black walnut. White pine also grows well on these soils, but it does not reproduce well because of the severe competition from hardwoods.

The species suitable for planting for wood crops are white pine, Japanese larch, red pine, yellow-poplar, black locust, red oak, and black walnut. Red oak and black walnut can be established by seeding. Yellow-poplar, red oak, and black walnut are better suited for planting where the sod is light or controlled and there is some scattered light brush.

Scotch pine, white pine, Norway spruce, and Douglas-fir are suitable for Christmas trees. They can be grown on nonstony soils that have slopes of less than 25 percent.

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To reduce damage from frosts late in spring, Douglas-fir should be grown on north-facing slopes.

In natural stands, plant competition is slight for hardwoods, and generally only simple weeding of undesirable seedlings and saplings is needed to release the most valuable hardwood species. The regeneration of pine may be too costly because of the severe competition from hardwoods.

Most areas are accessible, and normally the use of heavy equipment is only slightly limited. However, on some steep slopes or in areas that contain large stones, the harvesting of tree crops may be moderately difficult. Numerous small stones and channery fragments help to support logging equipment during winter months.

Generally, the hazard of erosion is slight if logging roads are constructed on gentle grades and simple water diversions are used. The hazard of erosion is moderate on steep slopes.

WOODLAND SUITABILITY GROUP 3

In this group are deep, moderately well drained, mostly gently sloping soils that have a firm layer, or fragipan, at a depth of about 2 feet. This layer is slowly permeable and restricts the penetration of roots. Water accumulates above the pan in wet periods, and seepage spots are fairly common. These soils occur on terraces that border streams or on flats on the uplands. They are low to medium in fertility and have moderate available moisture capacity. Most of the acreage is used for general farming. The woods occur mainly as small farm woodlots. The soils in this group are—

(CaA)	Captina silt loam, 0 to 3 percent slopes.
(CaB)	Captina silt loam, 3 to 8 percent slopes.
(CaC)	Captina silt loam, 8 to 15 percent slopes.
(MgA)	Monongahela silt loam, 0 to 3 percent slopes.
(MgB)	Monongahela silt loam, 3 to 8 percent slopes.
(MgC)	Monongahela silt loam, 8 to 15 percent slopes.
(PkB)	Pickaway silt loam, 3 to 10 percent slopes.
(TsB)	Tilsit fine sandy loam, 3 to 8 percent slopes.
(TtB)	Tilsit silt loam, 2 to 8 percent slopes.
(TtC)	Tilsit silt loam, 8 to 15 percent slopes.

These soils are rated good as sites for trees. Both hardwoods and pine grow well. Virginia pine, pitch pine, and some white pine reseed naturally in abandoned fields.

The species to favor in natural stands are red oak, white oak, black oak, yellow-poplar, white ash, black locust, and white pine. Virginia pine produces high yields of pulpwood if grown to an age of 30 to 40 years.

The species suitable for planting for wood crops are white pine, red pine, Japanese larch, yellow-poplar, and red oak. Yellow-poplar and red oak are established by seeding and are better suited for planting where the sod is light or controlled and there is some scattered light brush.

Scotch pine, white pine, Norway spruce, and Douglas-fir are preferred for Christmas trees.

White pine, red pine, Norway spruce, and hemlock are suitable for windbreaks.

Plant competition is slight for hardwoods. Only simple weeding of undesirable species is needed to regenerate hardwood stands. If pine is planted, moderate competition from hardwoods can be expected. In old fields, competition from sod ranges from slight to severe, depending on the level of fertility. Severe competition to planted trees can be expected in areas that have been limed and fertilized for agricultural crops. In these areas, chemical control of sod is desirable before trees are planted. Pines will reseed naturally in these areas if there is a source of seed nearby and if the mineral soil is exposed by plowing or disking.

The use of equipment is restricted in winter and early in spring because of the accumulation of water above the fragipan. In winter, equipment for the harvesting or tending of tree crops should be operated only when the ground is frozen hard.

Because most slopes are gentle and roads generally are not needed, the hazard of erosion is slight.

WOODLAND SUITABILITY GROUP 4

This group consists mostly of shallow, droughty soils that developed in material weathered from acid shale and sandstone. These soils are medium textured, have a high content of small stones, have low to medium available moisture capacity, and are low in fertility. They range from strongly sloping to very steep but are mostly steep and very steep. They occupy more than 40,000 acres in the county and are extensive in the eastern and southern parts. Much of the acreage has remained in woods. Some areas that were formerly cultivated are now severely eroded. Tree growth generally is slow, except in the small coves and hollows. The species are oaks in association with hickory, Virginia pine, white pine, pitch pine, and Table-Mountain pine. The soils in this group are—

(MoC)	Montevallo channery silt loam, 10 to 20 percent slopes.
(MoC3)	Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded.
(MoD)	Montevallo channery silt loam, 20 to 30 percent slopes.
(MoD3)	Montevallo channery silt loam, 20 to 30 percent slopes, severely eroded.
(MoE)	Montevallo channery silt loam, 30 to 45 percent slopes.
(MoE3)	Montevallo channery silt loam, 30 to 45 percent slopes, severely eroded.
(MoF)	Montevallo channery silt loam, 45 to 65 percent slopes.
(MoF3)	Montevallo channery silt loam, 45 to 65 percent slopes, severely eroded.

The site quality of these soils is strongly affected by aspect and by steepness of slope. On slopes of less than 30 percent, north aspects generally are good sites, whereas south aspects are only fair. On slopes of 30 percent or more, north aspects are fair sites, whereas south aspects are poor. In the numerous small hollows and coves, the species are mainly yellow-poplar, white ash, basswood, and red oak. These included areas are rated good to excellent as sites for trees.

The species to be favored for wood crops in natural stands vary according to the quality of the site. Sites rated good will grow high-quality red oak, white ash, white oak, black oak, and white pine. Those rated fair can be used to grow white oak, black oak, chestnut oak, white pine, Virginia pine, pitch pine, and Table-Mountain pine. Pine is the best species for poor sites, but chestnut oak is also productive.

The species favored for planting for wood crops are white pine, Virginia pine, and red pine. Virgina pine, grown in a short rotation of 30 to 40 years, is preferred for pulpwood, particularly if it is planted on slopes that have a south aspect. It should be planted at elevations of less than 2,500 feet.

Christmas trees can be grown on slopes of less than 30 percent. Scotch pine, white pine, Douglas-fir, and Norway spruce are suitable. However, Douglas-fir and Norway spruce are better suited to the soils that have a north aspect.

Plant competition is slight for hardwoods. The regeneration of conifers on poor to fair sites is moderately difficult because of the competition from hardwood brush. Competition from hardwoods is severe in the coves and hollows.

The limitation on the use of equipment is slight on slopes of less than 15 percent, moderate on slopes of 15 to 35 percent, and severe on slopes of more than 35 percent. Because of the steep slopes, logging roads are needed to harvest wood crops. However, once roads are properly installed, seasonal restrictions on the use of equipment is slight.

The hazard of erosion is slight to moderate if logging roads are properly installed and simple water-diversion measures are used.

WOODLAND SUITABILITY GROUP 5

This group consists of moderately deep, well-drained to somewhat droughty soils that are underlain by acid, red and gray sandstone. These soils are loamy or sandy, have moderate available moisture capacity, and are low to medium in fertility. They make up about 60,000 acres in the county, and more than three-quarters of this acreage is stony and steep or very steep. Most stony areas have never been cleared. Some of the smooth, nonstony soils are used for general farming.

These soils are extensive in mountainous areas, particularly on the middle and upper parts of slopes on Peters and Potts Mountains (fig. 8). Sugar maple, birch, black birch, red oak, and basswood are dominant on the lower part of north-facing slopes and in coves. Scarlet oak, chestnut oak, black oak, white oak, white pine, Virignia pine, pitch pine, and Table-Mountain pine are common on south-facing slopes and ridgetops. The soils in this group are—

(DaB) Dekalb channery loam, 5 to 12 percent slopes.
(DaC) Dekalb channery loam, 12 to 25 percent slopes.
(DaD) Dekalb channery loam, 25 to 35 percent slopes.
(DbB) Dekalb fine sandy loam, 5 to 12 percent slopes.
(DbC) Dekalb fine sandy loam, 12 to 25 percent slopes.
(DbD) Dekalb fine sandy loam, 25 to 35 percent slopes.
(DeC) Dekalb very stony loam, 10 to 25 percent slopes.
(DeD) Dekalb very stony loam, 25 to 35 percent slopes.
(DeE) Dekalb very stony loam, 35 to 50 percent slopes.
(DeF) Dekalb very stony loam, 50 to 70 percent slopes.
(HaB) Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes.
(HaC) Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes.
(LhD) Lehew very stony loam, 25 to 35 percent slopes.
(LhE) Lehew very stony loam, 35 to 50 percent slopes.
(SvC) Summers very stony loam, 5 to 20 percent slopes.

Fires were common in the past on these mountain soils, and as a result old cull trees are numerous.

Although information on site quality is not complete, aspect and position on the slope apparently influence site quality. Site quality ranges from good to excellent on north aspects and from good to poor on south aspects. The poorest sites are on the upper part of south-facing slopes. The Dekalb soils that are on narrow ridgetops are less productive than those on side slopes. In these narrow areas, which are seldom more than 200 feet wide along the tops of mountains, the site quality generally is poor. On the ridgetops and on the upper fourth of slopes on Peters and Potts Mountains, tree growth is also affected by ice glaze from ice storms. This results in shorter trunked trees, lower yields, and poorer quality hardwoods.

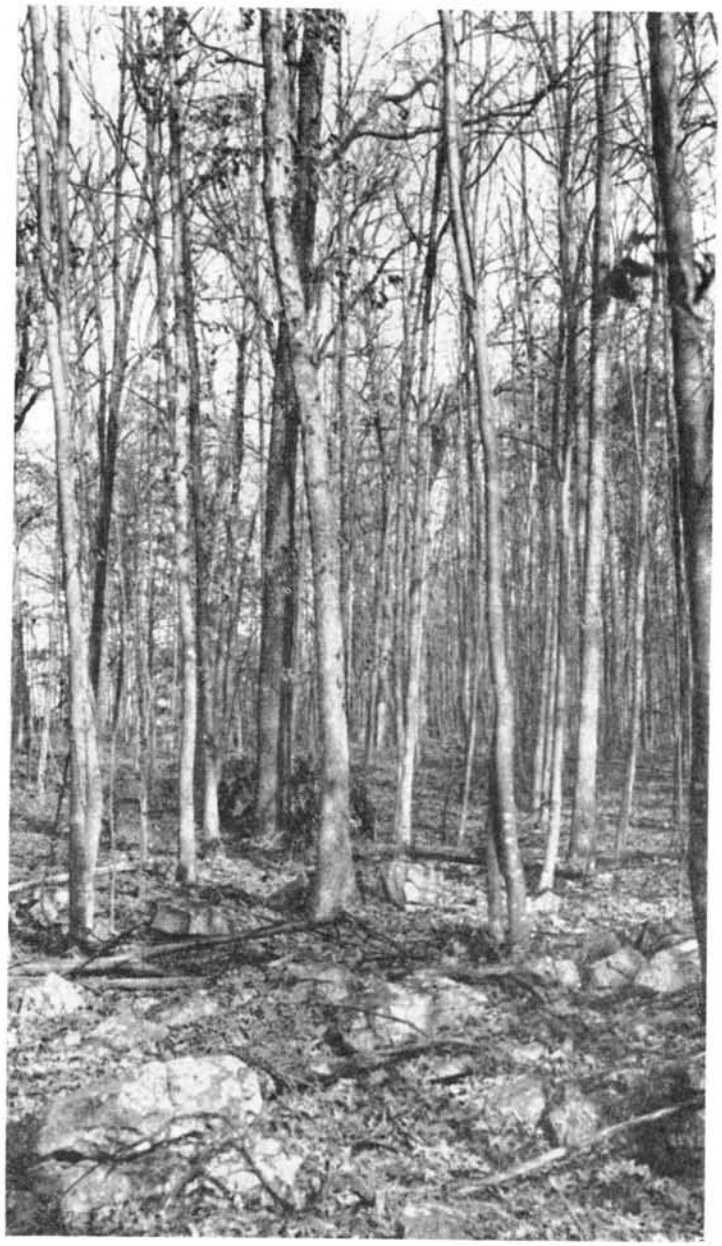

Figure 8.—**Excellent woodland site on north-facing slope, showing mixed, well-stocked stand of oak and associated hardwoods on Dekalb very stony loam.**

The species to favor in natural stands on good and excellent sites are red oak, white oak, black oak, sugar maple, black cherry, basswood, white ash, black locust, black walnut, and yellow-poplar. White pine, white oak, black oak, and chestnut oak are suitable for fair sites. Pitch pine, Table-Mountain pine, and Virginia pine can be grown for pulpwood. Virginia pine makes its best growth at elevations of less than 2,500 feet. Chestnut oak, white

pine, pitch pine, and Table-Mountain pine are suitable for poor sites.

There is little need for tree planting on these soils. Abandoned fields generally restock naturally if they border woodland. Red pine, Japanese larch, and white pine are suitable species if trees need to be planted.

The use of the Dekalb, Lehew, and Summers soils for growing Christmas trees is limited because of stoniness or steep slopes. Scotch pine, Douglas-fir, and Norway spruce are suitable for planting in smooth areas that have slopes of less than 25 percent. White pine can also be grown if the weevil is controlled.

Plant competition is slight for hardwoods, and generally only simple weeding is necessary for the regeneration of good-quality hardwoods. Competition is moderate to severe for the reproduction of pine, and the chemical control of hardwoods is usually necessary to release pine.

On soils that are steep and stony, the use of equipment is severely restricted, and logging roads are difficult to build. On soils that are not steep and stony, the use of equipment is only moderately restricted.

The hazard of erosion is slight to moderate. Roads and trails should be installed on acceptable grades, and simple water-diversion measures used.

WOODLAND SUITABILITY GROUP 6

In this group are shallow, gently sloping to very steep, droughty, shaly soils that developed in material weathered from lime-influenced shale. These soils are extensive in the western part of the county. They have a high content of fine shale, have low available moisture capacity, and are low to moderate in fertility. They are susceptible to erosion, and many areas that were formerly cultivated are now severely eroded and have been allowed to revert to woods. Virginia pine has seeded in many of the abandoned fields, but growth is slow because of droughtiness. The species that commonly grow on these soils are Virginia pine, white pine, pitch pine, redcedar, chestnut oak, and scarlet oak. The soils in this group are—

(LsB)	Litz shaly silt loam, 3 to 10 percent slopes.
(LsC)	Litz shaly silt loam, 10 to 20 percent slopes.
(LsD)	Litz shaly silt loam, 20 to 30 percent slopes.
(LsE)	Litz shaly silt loam, 30 to 45 percent slopes.
(LsF)	Litz shaly silt loam, 45 to 60 percent slopes.
(MsB3)	Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded.
(MsC3)	Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded.
(MsD3)	Montevallo shaly silt loam, 20 to 30 percent slopes, severely eroded.

Site quality is fair or poor. The better sites have a north aspect.

Virginia pine, grown in a short rotation of 30 to 40 years, is preferred for pulpwood. White pine is suitable for sawtimber. Chestnut oak and scarlet oak can be grown for cordwood.

The species suitable for planting for wood crops are white pine, red pine, and Virginia pine. Black locust can be used for erosion control.

Scotch pine and white pine are suitable species for Christmas trees. They can be grown on slopes of less than 30 percent.

Red pine, Scotch pine, and white pine make good windbreaks.

Hardwood brush interferes only slightly to moderately with the establishment of pine. Hardwoods can be regenerated with little or no competition from unwanted vegetation. Competition to planted seedlings from herbaceous vegetation in old fields is usually only slight unless the area has been limed and fertilized for farming.

The use of equipment to harvest or tend tree crops is restricted only by slope. The slopes range from gentle to very steep, and the limitations on the use of equipment range from slight to severe. However, logging roads are not difficult to build or to maintain.

The hazard of erosion is moderate where roads are built. Roads that are built on acceptable grades generally can be stabilized if water-diversion structures are installed.

WOODLAND SUITABILITY GROUP 7

This group consists of shallow to moderately deep, gently sloping to very steep, well-drained soils that developed in material weathered from red and gray shale that contained some calcareous material. These silty soils are moderately fertile and have moderate to high available moisture capacity. They occupy about 40,000 acres in the county and are extensive in the western part. About a quarter of the acreage is stony, and in many places erosion is severe.

Many of the smoother areas are used for general farming or pasture. Some eroded fields have been allowed to revert to Virginia pine and other volunteer growth. Most steep and very steep, stony areas have remained in woods. The dominant species on these soils are upland oaks and associated hardwoods, white pine, pitch pine, and Virginia pine. The soils in this group are—

(LtB)	Litz silt loam, 3 to 8 percent slopes.
(LtC)	Litz silt loam, 8 to 15 percent slopes.
(LtC3)	Litz silt loam, 8 to 15 percent slopes, severely eroded.
(LtD)	Litz silt loam, 15 to 25 percent slopes.
(LtD3)	Litz silt loam, 15 to 25 percent slopes, severely eroded.
(LtE)	Litz silt loam, 25 to 45 percent slopes.
(LtE3)	Litz silt loam, 25 to 45 percent slopes, severely eroded.
(LtF)	Litz silt loam, 45 to 60 percent slopes.
(TaB)	Teas and Calvin silt loams, 3 to 8 percent slopes.
(TaC)	Teas and Calvin silt loams, 8 to 15 percent slopes.
(TaC3)	Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded.
(TaD)	Teas and Calvin silt loams, 15 to 25 percent slopes.
(TaE)	Teas and Calvin silt loams, 25 to 45 percent slopes.
(TcD3)	Teas and Calvin soils, 15 to 25 percent slopes, severely eroded.
(TcE3)	Teas and Calvin soils, 25 to 45 percent slopes, severely eroded.
(TlB)	Teas-Calvin-Litz silt loams, 3 to 8 percent slopes.
(TlC)	Teas-Calvin-Litz silt loams, 8 to 15 percent slopes.
(TlD)	Teas-Calvin-Litz silt loams, 15 to 25 percent slopes.
(TlE)	Teas-Calvin-Litz silt loams, 25 to 45 percent slopes.
(TmB3)	Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded.
(TmC3)	Teas-Calvin-Litz complex, 8 to 15 percent slopes, severely eroded.
(TmD3)	Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded.
(TmE3)	Teas-Calvin-Litz complex, 25 to 45 percent slopes, severely eroded.
(TmF)	Teas-Calvin-Litz complex, 45 to 55 percent slopes.
(TmF3)	Teas-Calvin-Litz complex, 45 to 55 percent slopes, severely eroded.
(TrC)	Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes.
(TrE)	Teas-Calvin-Litz very stony complex, 25 to 45 percent slopes.
(TrF)	Teas-Calvin-Litz very stony complex, 45 to 60 percent slopes.

Site quality generally is fair on soils that have a south aspect and good on soils that have a north aspect. However, the coves and hollows on these soils are excellent sites for hardwoods.

Many valuable hardwoods can be grown on slopes that have a north aspect and in the coves and hollows. The species to favor on these sites are yellow-poplar, black walnut, basswood, sugar maple, red oak, white oak, black oak, black cherry, white ash, and black locust. The species to favor on slopes that have a south aspect are red oak, white oak, black oak, white pine, Virginia pine, and pitch pine. White pine is especially well suited to these sites and is the most productive.

The species suitable for planting for wood crops are white pine, red pine, and Japanese larch. Yellow-poplar and black walnut can be planted on soils that have a north aspect, particularly if the sod is light and there is some scattered light brush.

Scotch pine, white pine, Norway spruce, and Douglas-fir can be grown for Christmas trees on nonstony soils that have slopes of less than 30 percent. Norway spruce and Douglas-fir are best suited to soils that have a north aspect.

Norway spruce, hemlock, red pine, and white pine are suitable for windbreaks.

Plant competition is only slight for the reproduction of hardwoods but is generally severe for the regeneration of pine. In old fields that are to be reforested, competition from sod and invading brush is moderate.

The use of equipment is limited mostly by slope, but in some areas it may be restricted by stoniness. The limitation ranges from moderate to severe. However, even steep slopes can be made accessible by properly constructed logging roads and skid trails. Construction can be expected to be moderately difficult on slopes of more than 40 percent.

There is moderate to severe hazard of erosion on logging roads and skid trails. Therefore, careful layout of logging roads and skid trails is necessary, and attention to drainage and water diversions during logging is advisable. Water should be diverted from the roads and trails immediately after logging, and critical slopes need to be seeded to control erosion effectively and to keep the roads passable.

WOODLAND SUITABILITY GROUP 8

This group consists of sloping to steep land that is underlain by shale, which may contain some calcareous layers. Nearly all the original soil material has been removed by erosion, and shallow gullies are common. This eroded land occurs as small areas in larger areas of the Teas, Calvin, Litz, or Montevallo soils, where runoff concentrates during rains. These areas are very droughty, runoff is very rapid, and a vegetative cover is difficult to establish. Many of the areas are now used for pasture. In this group are—

(SoD) Sloping eroded land, shale materials.
(SpE) Steep eroded land, shale materials.

The species that commonly volunteer in these areas are black locust, Virginia pine, pitch pine, and redcedar. The site quality is poor.

Virginia pine is preferred because it is well suited to droughty sites, controls erosion quickly, and produces a wood crop in a short time. White pine and red pine are also suitable. If erosion control is the primary objective, black locust should be planted.

Pine can be planted or regenerated with only slight competition from hardwood brush, grasses, or weeds.

The use of equipment is severely restricted by the steep slopes and gullies. The hazard of erosion is severe.

WOODLAND SUITABILITY GROUP 9

This group consists of well-drained to excessively drained, very rocky soils that developed in material weathered from limestone and from lime-influenced shale and sandstone. These soils range from shallow to deep within short distances, and there are many outcrops of limestone. Slopes range from gentle to very steep but are mostly moderately steep or steep.

These soils occupy about 30,000 acres in the county and are scattered throughout the limestone valleys. Much of the acreage is cleared and used for pasture. Woodlots occur mainly in the steeper areas and are commonly grazed. The species common to the area are upland oaks and associated hardwoods. The soils in this group are—

(CbC) Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes.
(CbD) Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes.
(CbE) Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes.
(CbE3) Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, severely eroded.
(DrC) Duffield very rocky silt loam, 5 to 20 percent slopes.
(DrD) Duffield very rocky silt loam, 20 to 30 percent slopes.
(DrE) Duffield very rocky silt loam, 30 to 45 percent slopes.
(FrF) Frederick and Bodine very rocky soils, 45 to 60 percent slopes.
(FsC) Frederick and Dunmore very rocky soils, 3 to 15 percent slopes.
(FsD) Frederick and Dunmore very rocky soils, 15 to 25 percent slopes.
(FsE) Frederick and Dunmore very rocky soils, 25 to 45 percent slopes.
(LvD) Litz very rocky soils, 10 to 30 percent slopes.
(LvE) Litz very rocky soils, 30 to 45 percent slopes.
(LvE3) Litz very rocky soils, 30 to 45 percent slopes, severely eroded.
(LxF) Litz-Rock land complex, 45 to 60 percent slopes.

The Chilhowie-Tumbez soils are shallower, finer textured, and more droughty than the other soils in this group.

Site quality ranges from fair to excellent and varies considerably within short distances. The best sites are mostly on the Frederick and Dunmore soils.

The species to favor in natural stands are red oak, white oak, black oak, yellow-poplar, white ash, and black locust.

The trees suitable for planting for wood crops are red pine, white pine, Japanese larch, and black locust. Yellow-poplar is also suitable on the Frederick and Bodine soils if the sod is light or controlled and there is some scattered light brush.

Generally, Christmas trees are not well suited to these rocky soils, but Scotch pine, white pine, Norway spruce, and Douglas-fir can be grown in some small areas that are smooth.

The species suitable for windbreaks are red pine, Austrian pine, white pine, and Norway spruce.

Competition from grasses and weeds generally is severe for both the natural regeneration of hardwoods and for planted trees. Such site preparation as furrowing, scalping, or the chemical control of weeds is desirable if trees are planted.

The use of equipment is severely restricted during the winter and early in spring when the ground is soft. The hazard of erosion is moderate if roads are built.

WOODLAND SUITABILITY GROUP 10

This group consists of deep, nearly level, well drained and moderately well drained soils on bottom lands that are occasionally flooded. These soils developed in acid or lime-influenced material that has been washed from uplands. They are fertile and have moderate to high available moisture capacity. The potential for trees is high, but only a small acreage is used for trees. Most of the acreage is used for crops or pasture. The soils in this group are—

(Hu) Huntington silt loam.
(Ln) Lindside silt loam.
(Ph) Philo silt loam.
(Po) Pope fine sandy loam.

The Huntington and Lindside soils are slightly acid to neutral. The Pope and Philo soils are strongly acid.

If the soils in this group are used for wood crops, only such valuable species as white pine, yellow-poplar, and black walnut should be planted. Scotch pine, white pine, and Norway spruce are well suited for Christmas trees but should be grown only in areas that are not frequently flooded.

Competition from annual weeds and grasses is severe. Therefore, if trees are planted, enough space should be left between rows so that weeds and grasses can be controlled either by disking or by chemicals.

WOODLAND SUITABILITY GROUP 11

In this group are nearly level, mostly poorly drained soils that are on uplands, on terraces, and on flood plains. These soils are moderately to highly fertile and have moderate available moisture capacity. The water table is near the surface in winter. Most of the acreage is used for pasture or crops. Woodlots are small and generally are in the wettest areas. The species dominant in these areas are pin oak, sycamore, elm, and red maple. The soils in this group are—

(Ad) Alluvial land.
(At) Atkins silt loam.
(Gu) Guthrie silty clay loam.
(Mb) Melvin silt loam.
(Ro) Robertsville silt loam.

The Atkins soil formed in material that has been washed from uplands of acid sandstone and shale. The Melvin soil formed in material that was influenced by lime. Both soils occur on bottom lands and are occasionally flooded. Alluvial land is frequently flooded. The Guthrie soil occurs on concave slopes on the uplands, and the Robertsville soil is on terraces above overflow.

Site quality is not rated for any specific species. White pine is the only species suitable for planting, and it is suitable only if the site is improved by surface drainage or by ridge furrowing.

Competition for planted trees is severe. The use of equipment is severely restricted to periods when the ground is dry. The hazard of erosion is slight.

WOODLAND SUITABILITY GROUP 12

This group is made up of one miscellaneous land type, Steep rock land (SrF) This steep and very steep land consists of massive outcrops of sandstone and small vertical cliffs. It occurs on the crests of Potts and Peters Mountains and other mountains in the county and occupies about 400 acres.

The commercial production of trees is not practical on this land. Site quality is poor. Tree planting is not practical. Most areas are almost inaccessible.

Wildlife Habitats[5]

Wildlife is an important natural resource of Monroe County. Squirrel, cottontail rabbit, bobwhite, ruffed grouse, wild turkey, and white-tailed deer provide good hunting. Moncove Lake and many of the small streams and farm ponds are used for fishing.

Such soil properties as fertility, slope, and erodibility influence the use of the land. Most soils have characteristic stream patterns and specific possibilities as sites for farm ponds or impoundments (see table 9 in the section "Engineering Applications"). These factors largely control the amount of food, water, and cover available for wildlife and determine to some extent the kind and abundance of wildlife in an area.

A correlation can be made between the nine soil associations in the county and the wildlife habitats. The colored general soil map at the back of this report outlines the boundaries of the different soil associations. There are three general wildlife habitat areas in the county. Each is made up of one or more soil associations or parts of soil associations.

Wildlife habitat area 1.—This area consists of all of soil association 1, which occupies the broad, rolling, limestone valley in the north-central part of the county. Fertile, well-drained soils on limestone uplands characterize the area. The general elevation is about 2,200 feet.

All of this area is in farms. About 30 percent of the acreage is used for crops, about 60 percent is in permanent pasture, and the rest is in woods. Raising beef cattle is the most common agricultural enterprise, but dairying and raising sheep are also important. Corn, wheat, and hay are important crops.

There are few permanent surface streams in area 1. Drainage is largely through sinkholes into underground streams. Small ponds, commonly less than a quarter of an acre in size, furnish much of the water for livestock, but the soils are not well suited to the construction of large ponds and impoundments.

Cottontail rabbit, bobwhite quail, and fox squirrel are the main species that inhabit the area, but they are not numerous, because food and cover are limited. Mourning doves are becoming numerous, and woodchuck, opossum, and skunk are abundant. There are some gray squirrels.

The mechanical picking of corn and the combining of grain normally leave considerable grain for wildlife. Ragweed in grain stubble is a good source of food for quail. The trend toward grassland farming, however, has decreased the acreage in small grain and corn in this area. Clover and bluegrass in meadows and pastures furnish food for rabbits, but the well-managed pastures generally are clipped or grazed. The fences are mainly of wire,

[5] DAVID D. GILPIN, biologist, West Virginia Department of Natural Resources, assisted in the preparation of this subsection.

and they commonly are kept clean for ease of maintenance; consequently, they do not provide good cover. Most woodlands furnish poor cover because they are heavily grazed. Both food and good cover are supplied by the briers, hawthorn, and other shrubs that grow up in the small stony areas, the wet areas, and the sinkholes.

Hunting is restricted in area 1 because all of the acreage is fenced and permission from the owner is needed. The use of this area for hunting is likely to remain secondary to its use for farming. However, the soils generally are suitable for development of areas for hunting upland game. Food and cover plants that need fertile, well-drained soils are well suited.

There are no large impoundments in area 1. A few farm ponds are stocked with largemouth bass and bluegill, and the small streams furnish some pan fishing. Turkey Creek extends through a corner of the area, and Second Creek bounds the area on the north. These cool, fertile streams are stocked with trout.

Wildlife habitat area 2.—This area is made up of soil associations 3 and 5 and the parts of soil associations 4 and 6 that are west of Union. It consists of a dissected shale and sandstone plateau in the western part of the county.

Loamy or silty soils that are low or medium in fertility occur on the nearly level sandstone flats and are surrounded either by moderately fertile, sloping to steep soils over red and gray shale or by droughty, erodible, shaly soils over limy, gray shale. Stony soils occur in the area but are not extensive. Fertile soils border the larger streams, and wet soils are on many of the bottom lands. Much of the area is severely eroded, and small gullies and raw spots are common. The elevation ranges from about 1,600 feet on Indian Creek to about 3,000 feet on Swoopes Knobs.

About 50 percent of the acreage is in woods, 20 percent is in crops, and 30 percent is in permanent bluegrass pasture. Most farms are general farms. Pastures normally are not intensively managed. Consequently, many are gullied, and some have grown up in brush and broomsedge. There has been a marked trend toward abandonment of steep or eroded pastures to trees and brush.

This area has many permanent surface streams and numerous small intermittent streams. Springs are fairly common. Farm ponds, both for livestock and for recreational use, are also common. Many of the soils are suitable for the construction of ponds (see table 9), and there are a number of suitable sites for ponds.

Gray squirrel, cottontail rabbit, and quail are the principal species in the area. Fox squirrel, ruffed grouse, and doves are fairly common, and a few deer are to be found in the western part.

Intensive farming is limited to the flat areas. Consequently, corn and small grain are less widely distributed than in area 1. Woodland is fairly extensive, particularly on the steeper slopes, and many small pastures are reverting to brushy woods. The extensive cutting of trees for mine timber and pulpwood limits the supply of food for squirrels. However, because of the short cutting cycle, there are favorable habitats for deer and grouse.

Most of area 2 is fenced. Hunting is heavier than in area 1 because of the proximity of the cities of Bluefield and Beckley. Management of wildlife is incidental to farming and forest management. However, the soils generally are moderately well suited to development of hunting areas if slopes are not too steep. Food and cover plants for upland game will make satisfactory growth.

Some farm ponds, a quarter of an acre or more in size, are managed for bass and bluegill fishing. Indian Creek, Wolf Creek, Hands Creek, and other streams furnish rock bass and some bass fishing. Cool streams, such as Rich Creek and Dropping Lick, are stocked with trout. The streams in the area are clean and are not subject to serious pollution. The New River and the Greenbrier River, which border the area, furnish excellent bass, pike, and pan fishing.

Wildlife habitat area 3.—This area is made up of soil associations 2, 7, 8, and 9; part of soil association 6, in the vicinity of Hollywood; and a small valley in soil association 4. This area consists of parallel ridges and mountains and narrow intervening valleys in the eastern and southern parts of the county.

Shallow, infertile, shaly soils and loamy or stony soils over sandstone occur on the steep mountains and ridges; colluvial soils and fertile soils over limestone occur in Sweet Springs Valley and in the narrow Green Valley; and slightly wet to wet soils are on the bottom lands and terraces in the narrow Potts Valley. The area ranges in elevation from slightly more than 2,000 feet in the valleys to almost 4,000 feet on Peters Mountain. The local relief ranges from 500 to 1,000 feet.

Gray squirrel, cottontail rabbit, grouse, quail, deer, and turkey are the important species in area 3. Some woodcock have been seen on the wet soils in Potts Valley. Most quail and rabbits feed in open areas in the narrow valleys, but they travel freely to the wooded areas. The extensive forests are especially well suited to white-tailed deer and wild turkeys. The close cutting of trees for pulpwood provides favorable areas for deer to browse but limits the number of the larger trees that provide food for squirrels and turkeys. Deer, turkeys, and squirrels travel to the open areas for some of their food. Management of wildlife is largely incidental to farming and forest management.

Area 3 is especially well supplied with small streams. Second Creek, Potts Creek, Turkey Creek, Dropping Lick, and the headwaters of Rich Creek are the important streams. These streams are relatively cool and clear. Parts of these streams, totaling about 15 miles, are stocked with trout. Many soils in the area are suitable for farm ponds or impoundments (see table 9).

Turkey Creek is reported to be one of the few places in West Virginia where rainbow trout spawn successfully. Native brook trout occur in the headwaters of Potts Creek and in other small, cold streams. Successful private trout hatcheries have been established on Turkey Creek, Dropping Lick, and Rich Creek. Second Creek furnishes good fishing for rock bass. Some farm ponds are stocked with bass and bluegill and are also suitable trout ponds. Moncove Lake, which covers about 144 acres north of Gap Mills, was completed in 1959 and furnishes good fishing for largemouth bass.

The well drained and moderately well drained, gently sloping and moderately sloping soils in this area are well suited to the development of hunting areas. These soils are suitable for grain and cover plants for upland game. However, the areas generally are small and are widely scattered. The few poorly drained soils on bottom lands

could be developed to provide food and habitat areas for wetland wildlife.

Engineering Applications[6]

This section gives the engineering characteristics of the soils of Monroe County and points out the principal features that are likely to influence engineering practices. It is provided to help interpret for engineering uses the soil survey information contained in this report.

Information in this report can be used to—

(1) Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
(2) Make preliminary estimates of the engineering properties of soils that are significant in planning agricultural drainage and irrigation systems, farm ponds, and terraces.
(3) Make preliminary evaluations of soil and site conditions that will aid in selecting highway, airport, pipeline, and cable locations.
(4) Locate probable sources of road and highway construction materials.
(5) Correlate performance of engineering structures with soils and thus gain information that will be useful in designing and maintaining the structures.
(6) Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
(7) Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
(8) Develop other preliminary estimates for construction purposes pertinent to the particular area.

This report does not eliminate the need for sampling and testing soils at the site chosen for construction. The mapping and the description of the soils are somewhat

[6] ARTHUR B. HOLLAND, assistant State conservation engineer, and HAROLD M. RHODES, State conservation engineer, Soil Conservation Service, assisted in the preparation of this section.

TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
Ad	Alluvial land.	0 to 1 foot	3 feet or more to variable bedrock.	Variable; mixed silt, sand, clay, and gravel; subject to occasional overflow.	0 to 36
At	Atkins silt loam.	0 to 1 foot	3 feet or more to sandstone and shale.	3 to 8 feet of alluvial material, ranging from silt loam to silty clay loam and containing some layers and pockets of sandy loam; on bottom lands; subject to occasional to frequent flooding.	0 to 18 18 to 36+
BcB	Bodine very cherty silt loam, 5 to 12 percent slopes.	Not a factor	3 to 6 feet to cherty limestone.	1½ to 2 feet of very cherty silt loam, over 1 foot to 3 feet of very cherty fine silt loam or silty clay loam, grades to cherty limestone; chert fragments from 2 to 6 inches in size make up from 50 to 90 percent of soil material; large stones and pieces of chert on surface of very stony soils; occurs on limestone uplands.	0 to 23 23 to 34 34 to 60+
BcC	Bodine very cherty silt loam, 12 to 25 percent slopes.				
BcD	Bodine very cherty silt loam, 25 to 35 percent slopes.				
BrC	Bodine very stony loam, 12 to 25 percent slopes.				
BrD	Bodine very stony loam, 25 to 35 percent slopes.				
BrE	Bodine very stony loam, 35 to 50 percent slopes.				
CaA	Captina silt loam, 0 to 3 percent slopes.	1½ feet to perched water table.	5 feet or more to sandstone, shale, or limestone.	About 1½ feet of silt loam, over silty clay loam; formed in material weathered from sandstone and shale that included some limestone; fragipan, 1 foot to 2 feet thick, at a depth of 1½ to 2 feet; on terraces above overflow.	0 to 19 19 to 26 26 to 40
CaB	Captina silt loam, 3 to 8 percent slopes.				
CaC	Captina silt loam, 8 to 15 percent slopes.				

generalized and, therefore, are not a substitute for detailed engineering surveys at a particular site.

At construction sites, major soil variations may occur within the depth of proposed excavation, and several soils may be encountered within a small area. The soil map and profile descriptions, as well as the engineering descriptions given in this section, should be used in planning detailed surveys of soils at construction sites. The soil survey information in this report will enable the soils engineer to concentrate on the most significant soils. A minimum number of soil samples will then be required for laboratory testing, and an adequate investigation can be made at least expense.

Some terms used by the agricultural soil scientist may be unfamiliar to the engineer, and some terms may have a special meaning in soil science. These terms are defined in the Glossary at the end of this report.

Physical properties

Table 8 gives the estimated soil properties most likely to affect engineering practices. These properties were evaluated on the basis of the data shown in table 10, or on actual field experience.

Two engineering classifications are given in table 8, the Unified Classification System (*14*), and the American Association of State Highway Officials (AASHO) (*1*). The terms used to describe texture in the United States Department of Agriculture classification are defined in the Glossary.

In the Unified classification, the soils are grouped on the basis of their texture and plasticity and their performance as material for engineering structures. In this system, two letters are used to designate each of 15 possible classes. The letters G, S, C, M, and O stand for gravel, sand, clay, silt, and organic soils, respectively, and W, P, L, and H refer to well graded, poorly graded, low liquid limit, and high liquid limit, respectively. In this system, SM and GM are sands and gravels that include fines of silt; ML and CL are silts and clays that have a liquid limit below 50; and MH and CH are silts and clays that have a liquid limit above 50. The letters O, W, and P are not used in table 8.

classification and physical properties of soils

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Variable; mainly silt loam and sandy loam.	Variable; mainly ML and SM.	Variable; mainly A-4.	Variable	Variable	Variable	Variable; 0.2 to 6.3.	Variable	Low.
Silt loam	ML	A-4	90 to 100	90 to 100	70 to 90	0. 63 to 2. 0	More than 0. 18.	Low.
Silty clay loam	ML or CL	A-6	95 to 100	85 to 100	75 to 90	0. 2 to 0. 63	0. 12 to 0. 15.	Moderate.
Very cherty silt loam.	GM	A-2 or A-4	20 to 50	15 to 45	10 to 40	More than 6.3.	0. 15 to 0. 18.	Low.
Very cherty fine silt loam.	GM	A-2 or A-4	25 to 50	20 to 45	15 to 40	More than 6.3.	0. 12 to 0. 15.	Low.
Very cherty silty clay loam.	GM	A-2 or A-6	10 to 40	10 to 40	10 to 40	More than 6. 3.	0. 12 to 0. 15.	Low.
Silt loam	ML	A-4	98 to 100	95 to 100	70 to 80	2.0 to 6.3	0.15 to 0.18	Low.
Silty clay loam	CL	A-6	95 to 100	95 to 100	75 to 90	0.63 to 2.0	0.12 to 0.15	Moderate.
Silt loam to silty clay loam.	CL	A-6	85 to 100	80 to 100	75 to 90	0.2 to 0.63	0.08 to 0.12	Moderate.

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TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
CbC	Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes.	Not a factor	1 foot to 1½ feet to massive cavernous limestone.	½ foot of dark-colored silty clay, high in organic matter, over 1 foot to 1½ feet of clay; underlain by massive bedrock; numerous outcrops of limestone; on limestone uplands.	0 to 6
CbD	Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes.				6 to 18
CbE	Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes.				
CbE3	Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, severely eroded.				
CkB	Clarksburg silt loam, 3 to 8 percent slopes.	1½ feet to perched water table.	3 to 10 feet to sandstone or shale.	1 foot to 1½ feet of silt loam, over about 2 feet of silty clay loam; slowly permeable layer, 2 to 3 feet thick, at a depth of about 2 feet; colluvium weathered from uplands of shale, sandstone, and some limestone; on concave foot slopes; seeps occur.	0 to 12
CkC	Clarksburg silt loam, 8 to 15 percent slopes.				12 to 20
					20 to 36+
DaB	Dekalb channery loam, 5 to 12 percent slopes.	Not a factor	1½ to 3 feet to sandstone.	1½ to 3½ feet of fine sandy loam or loam, underlain by sandstone; numerous angular fragments that increase with depth; at high elevations, soils are mostly steep or very steep; many large stones on surface of the very stony soils; on mountain slopes and uplands.	0 to 5
DaC	Dekalb channery loam, 12 to 25 percent slopes.				5 to 13
DaD	Dekalb channery loam, 25 to 35 percent slopes.				13 to 34
DbB	Dekalb fine sandy loam, 5 to 12 percent slopes.				
DbC	Dekalb fine sandy loam, 12 to 25 percent slopes.				
DbD	Dekalb fine sandy loam, 25 to 35 percent slopes.				
DeC	Dekalb very stony loam, 10 to 25 percent slopes.				
DeD	Dekalb very stony loam, 25 to 35 percent slopes.				
DeE	Dekalb very stony loam, 35 to 50 percent slopes.				
DeF	Dekalb very stony loam, 50 to 70 percent slopes.				
DfB	Duffield silt loam, 3 to 10 percent slopes.	Not a factor	3 to 6 feet to cavernous limestone.	About 1 foot of silt loam, over about 1 foot of silty clay loam, underlain by 1½ feet of clay or silty clay; on gentle to steep slopes in limestone valley; numerous surface ledges on very rocky soils.	0 to 10
DkB	Duffield silt loam, karst, 3 to 10 percent slopes.				10 to 19
DfC	Duffield silt loam, 10 to 20 percent slopes.				19 to 33
DkC	Duffield silt loam, karst, 10 to 20 percent slopes.				33 to 38
DfD	Duffield silt loam, 20 to 30 percent slopes.				
DfD3	Duffield silt loam, 20 to 30 percent slopes, severely eroded.				
DfE	Duffield silt loam, 30 to 45 percent slopes.				
DrC	Duffield very rocky silt loam, 5 to 20 percent slopes.				
DrD	Duffield very rocky silt loam, 20 to 30 percent slopes.				
DrE	Duffield very rocky silt loam, 30 to 45 percent slopes.				

classification and physical properties of soils—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Silty clay	CH	A-7-6	90 to 100	90 to 100	85 to 95	0.63 to 2.0	0.15 to 0.18	High.
Clay	CH	A-7-6	10 to 100	90 to 100	85 to 95	0.2 to 0.63	0.12 to 0.15	High.
Silt loam	ML	A-4	80 to 100	75 to 95	65 to 85	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6	80 to 100	75 to 95	70 to 90	0.63 to 2.0	0.15 to 0.18	Moderate.
Silty clay loam	CL	A-6	75 to 95	75 to 95	70 to 90	0.2 to 0.63	0.12 to 0.15	Moderate.
Fine sandy loam	SM	A-4	50 to 85	40 to 75	35 to 50	More than 6.3.	0.15 to 0.18	Low.
Fine sandy loam or loam.	SM or ML	A-4	50 to 85	40 to 75	35 to 55	2.0 to 6.3	0.12 to 0.15	Low.
Fine sandy loam	SM or GM	A-2 or A-4	35 to 75	30 to 65	20 to 40	More than 6.3.	0.08 to 0.12	Low.
Silt loam	ML	A-4	75 to 90	75 to 90	55 to 75	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL or CH	A-7-6	80 to 95	80 to 95	70 to 95	0.63 to 2.0	0.15 to 0.18	Moderate to high.
Silty clay	CL or CH	A-7-6	80 to 95	80 to 95	75 to 95	0.63 to 2.0	0.15 to 0.18	Moderate.
Silt loam	ML, MH	A-7	75 to 95	75 to 95	60 to 85	0.63 to 2.0	0.15 to 0.18	Moderate.

TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
DtB	Dunmore cherty silt loam, 3 to 8 percent slopes.	Not a factor	3 to 8 feet to limestone.	1 foot of silt loam, over ½ to 1 foot of silty clay loam, over 2 to 3 feet of clay, underlain by rotten soapstone that grades to hard limestone; occurs on limestone uplands.	0 to 7
DtC	Dunmore cherty silt loam, 8 to 15 percent slopes.				7 to 17
DtD	Dunmore cherty silt loam, 15 to 25 percent slopes.				17 to 27
DuD3	Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded.				27 to 48
DvB	Dunmore silt loam, 3 to 8 percent slopes.				
DvC	Dunmore silt loam, 8 to 15 percent slopes.				
DvD	Dunmore silt loam, 15 to 25 percent slopes.				
FcB	Frederick cherty silt loam, 3 to 8 percent slopes.	Not a factor	3 to 10 feet to cavernous limestone.	About 1 foot of silt loam, over ½ to 1 foot of fine silt loam or silty clay loam, over 2 to 3 feet of silty clay to clay; depth to limestone varies; on gentle to steep slopes in the limestone valley.	0 to 13
FkB	Frederick cherty silt loam, karst, 3 to 8 percent slopes.				13 to 19
FkC	Frederick cherty silt loam, karst, 8 to 15 percent slopes.				19 to 48
FcC	Frederick cherty silt loam, 8 to 15 percent slopes.				48 to 63+
FcD	Frederick cherty silt loam, 15 to 25 percent slopes.				
FcE	Frederick cherty silt loam, 25 to 45 percent slopes.				
FdB	Frederick silt loam, 3 to 8 percent slopes.				
FmB	Frederick silt loam, karst, 3 to 8 percent slopes.				
FdC	Frederick silt loam, 8 to 15 percent slopes.				
FmC	Frederick silt loam, karst, 8 to 15 percent slopes.				
FdD	Frederick silt loam, 15 to 25 percent slopes.				
FdE	Frederick silt loam, 25 to 45 percent slopes.				
FrF	Frederick and Bodine very rocky soils, 45 to 60 percent slopes.	Not a factor	0 to 3 feet to limestone.	Well-drained soils that are underlain at various depths by cavernous limestone; many loose rocks on surface; in sloping to steep areas in limestone valleys.	Variable
FsC	Frederick and Dunmore very rocky soils, 3 to 15 percent slopes.				
FsD	Frederick and Dunmore very rocky soils, 15 to 25 percent slopes.				
FsE	Frederick and Dunmore very rocky soils, 25 to 45 percent slopes.				
Gu	Guthrie silty clay loam.	0 to 1 foot	1½ to 3 feet to limestone.	1 foot to 1½ feet of silty clay loam, over 1 foot to 3 feet of plastic silty clay or clay, underlain by limestone; in level areas and depressions in the limestone valley.	0 to 9
					9 to 16
					16 to 24
HaB	Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes.	Not a factor	3 to 4 feet to sandstone.	About 1 foot of fine sandy loam or loam, over about 1½ feet of loam to silt loam; numerous sandstone fragments in lower part of subsoil; on smooth sandstone and shale ridges.	0 to 12
HaC	Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes.				12 to 28
					28 to 40
Hu	Huntington silt loam.	3 feet	10 feet or more to variable bedrock.	2 feet of silt loam, over 2 to 3 feet of fine silt loam or silty clay loam; grades to stratified silt, very fine sand, and silty clay; well drained; on flood plains; subject to overflow.	0 to 23
					23 to 53
					53 to 80

classification and physical properties of soils—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Silt loam	ML	A-4	65 to 85	65 to 85	55 to 75	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6 or A-7-6	75 to 95	75 to 95	70 to 85	0.63 to 2.0	0.15 to 0.18	Low to moderate.
Clay	MH	A-7-5	90 to 100	85 to 100	85 to 95	0.63 to 2.0	0.12 to 0.15	High.
Clay	MH	A-7-5	90 to 100	90 to 100	85 to 100	0.2 to 0.63	0.12 to 0.15	High.
Silt loam	ML or CL	A-4 to A-6	60 to 90	60 to 90	55 to 90	2.0 to 6.3	More than 0.18.	Low.
Fine silt loam	CL	A-4 to A-6	70 to 95	70 to 95	65 to 90	0.63 to 2.0	0.15 to 0.18	Moderate.
Silty clay	MH or CH	A-7-5 or A-7-6.	90 to 100	90 to 100	80 to 95	0.63 to 2.0	0.15 to 0.18	High.
Clay	MH or CH	A-7-5	80 to 100	80 to 100	75 to 95	0.63 to 2.0	0.15 to 0.18	High.
Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Moderate.
Silty clay loam	CL	A-6 or A-7-6	95 to 100	90 to 100	80 to 95	0.63 to 2.0	More than 0.18.	Moderate.
Silty clay loam	CL or CH	A-6 or A-7-6	95 to 100	90 to 100	80 to 95	0.2 to 0.63	0.15 to 0.18	Moderate to high.
Silty clay or clay	CH	A-7-6	90 to 100	85 to 100	85 to 95	Less than 0.2.	0.12 to 0.15	High.
Fine sandy loam	SM	A-2 or A-4	90 to 95	85 to 95	25 to 45	2.0 to 6.3	0.12 to 0.15	Low.
Loam	SM or ML	A-4 or A-6	90 to 95	85 to 95	40 to 65	2.0 to 6.3	0.12 to 0.15	Low.
Fine sandy loam	SM	A-2 or A-4	85 to 95	85 to 95	25 to 45	2.0 to 6.3	0.08 to 0.12	Low.
Silt loam	ML or CL	A-4	95 to 100	95 to 100	80 to 90	2.0 to 6.3	More than 0.18.	Low.
Silt loam or silty clay loam.	ML or CL	A-6	95 to 100	95 to 100	85 to 95	2.0 to 6.3	0.15 to 0.18	Low to moderate.
Variable	SM, ML, CL.	Variable; A-4 A-6 or A-7-6.	95 to 100	95 to 100	Variable	2.0 to 6.3	0.12 to 0.18	Low.

TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
LaB	Laidig channery loam, 3 to 8 percent slopes.	3 feet or more	15 to 30 feet to variable bedrock.	1 foot to 2 feet of loam or silt loam, over 2 to 3 feet of sandy loam or sandy clay loam, underlain by 2 to 4 feet of firm, dense sandy loam; on lower part of slopes, at base of mountains; stone fragments, from 3 to 10 inches in size, make up from, 10 to 50 percent of soil material.	0 to 26
LaC	Laidig channery loam, 8 to 15 percent slopes.				26 to 47
LaD	Laidig channery loam, 15 to 25 percent slopes.				47 to 120+
LaE	Laidig channery loam, 25 to 45 percent slopes.				
LbC	Laidig very stony loam, 3 to 15 percent slopes.				
LbD	Laidig very stony loam, 15 to 25 percent slopes.				
LbE	Laidig very stony loam, 25 to 45 percent slopes.				
LcB	Landisburg cherty silt loam, 3 to 10 percent slopes.	1½ to 2 feet to perched water table.	3 to 10 feet to limestone.	1½ feet of silt loam or cherty silt loam, over 1½ feet of firm fine sandy loam or silt loam, underlain by 2 to 4 feet of silty clay loam; on lower part of slopes, below limestone soils.	0 to 11 11 to 20 20 to 37 37 to 72
LdB	Leadvale silt loam, 3 to 10 percent slopes.	1½ to 2 feet	4 feet to 10 feet or more to sandstone and shale.	1 foot of silt loam, over 1½ to 2½ feet of blocky silty clay loam, underlain by massive silty clay loam; moderately well drained; seepage common; on lower part of slopes, below shale uplands.	0 to 8 8 to 23 23 to 60+
LhD	Lehew very stony loam, 25 to 35 percent slopes.	Not a factor	1½ to 3 feet to sandstone.	¾ foot of very stony loam, over 1½ feet of sandy clay loam or silty clay loam; grades to shattered sandstone; mainly on steep, upper slopes on mountains.	0 to 8 8 to 12 12 to 24
LhE	Lehew very stony loam, 35 to 50 percent slopes.				
Ln	Lindside silt loam.	1 to 2 feet	5 feet to 10 feet or more to variable bedrock.	1 foot to 2 feet of silt loam, over 2 to 3 feet of silty clay loam; grades to stratified silt, fine sand, or clayey material that contains some gravel; moderately well drained to somewhat poorly drained; on first bottoms; alluvial material, subject to fairly frequent overflow.	0 to 15 15 to 45 45 to 72+
LsB	Litz shaly silt loam, 3 to 10 percent slopes.	Not a factor	1 foot to 2½ feet to shale and siltstone.	½ foot of silt loam or shaly silt loam, over ½ to 1 foot of silty clay loam, underlain by shattered shale that grades to shale and siltstone; on rolling to steep upland slopes; sandstone and limestone outcrops common on the very rocky soils.	0 to 5 5 to 10 10 to 16
LsC	Litz shaly silt loam, 10 to 20 percent slopes.				
LsD	Litz shaly silt loam, 20 to 30 percent slopes.				
LsE	Litz shaly silt loam, 30 to 45 percent slopes.				
LsF	Litz shaly silt loam, 45 to 60 percent slopes.				
LtB	Litz silt loam, 3 to 8 percent slopes.				
LtC	Litz silt loam, 8 to 15 percent slopes.				
LtC3	Litz silt loam, 8 to 15 percent slopes, severely eroded.				
LtD	Litz silt loam, 15 to 25 percent slopes.				
LtD3	Litz silt loam, 15 to 25 percent slopes, severely eroded.				

classification and physical properties of soils—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Loam to silt loam	SM to CL	A-4	60 to 90	60 to 90	35 to 60	2.0 to 6.3	0.15 to 0.18	Low.
Sandy loam	SM to CL	A-4	60 to 90	60 to 85	35 to 60	2.0 to 6.3	0.12 to 0.15	Low.
Sandy loam	GM to CL	A-4 or A-2	60 to 90	60 to 85	20 to 60	0.2 to 0.63	0.08 to 0.12	Low.
Cherty silt loam	ML	A-4	70 to 95	70 to 95	50 to 80	6.3 to 6.3	More than 0.18.	Low.
Cherty silt loam	ML or CL	A-4	75 to 95	75 to 95	60 to 85	2.0 to 6.3	0.15 to 0.18	Low to moderate.
Cherty silt loam	ML	A-6	75 to 95	70 to 90	60 to 85	0.2 to 0.63	0.12 to 0.15	Moderate.
Silty clay loam	CL	A-6 or A-7-6	80 to 95	75 to 90	70 to 90	0.63 to 2.0	0.12 to 0.15	Moderate.
Silt loam	ML	A-4	80 to 100	75 to 95	60 to 90	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6	85 to 100	80 to 100	70 to 95	0.63 to 2.0	0.15 to 0.18	Moderate.
Silty clay	CL	A-6	85 to 100	80 to 100	70 to 95	0.2 to 0.63	0.12 to 0.15	Moderate.
Very stony loam	ML	A-4	65 to 85	60 to 80	40 to 75	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6 or A-7-6	75 to 90	70 to 90	50 to 80	2.0 to 6.3	0.12 to 0.15	Moderate.
Silt loam	ML or CL	A-4	75 to 90	70 to 90	60 to 85	2.0 to 6.3	0.12 to 0.15	Low.
Silt loam	ML	A-4	95 to 100	95 to 100	90 to 100	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6	95 to 100	95 to 100	90 to 100	0.63 to 2.0	0.15 to 0.18	Moderate.
Variable	Variable; SM, ML, CL.	Variable, mainly A-6 or A-7.	90 to 100	90 to 100	Variable	0.63 to 6.3	0.12 to 0.15	Low to moderate.
Silt loam	ML	A-4	75 to 95	70 to 90	65 to 90	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	ML or CL	A-6	80 to 100	75 to 95	60 to 90	0.63 to 2.0	0.15 to 0.18	Moderate.
Shaly silty clay	ML or CL	A-6	75 to 95	75 to 90	60 to 90	2.0 to 6.3	0.12 to 0.15	Moderate.

TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
LtE	Litz silt loam 25 to 45 percent slopes.				
LtE3	Litz silt loam, 25 to 45 percent slopes, severely eroded.				
LtF	Litz silt loam, 45 to 60 percent slopes.				
LvD	Litz very rocky soils, 10 to 30 percent slopes.				
LvE	Litz very rocky soils, 30 to 45 percent slopes.				
LvE3	Litz very rocky soils, 30 to 45 percent slopes, severely eroded.				
LxF	Litz-Rock land complex, 45 to 60 percent slopes.				
Mb	Melvin silt loam.	0 to ½ foot	5 feet to 10 feet or more to variable bedrock.	½ foot of heavy silt loam, over 2 feet of silty clay loam, over 2 feet of silty clay or clay loam, underlain by stratified layers of sand, clay, silt, and some gravel; on poorly drained flood plains; subject to frequent overflow.	0 to 8 8 to 30 30 to 52
MgA	Monongahela silt loam, 0 to 3 percent slopes.	1½ to 2 feet	3 to 6 feet to variable bedrock.	1 foot of silt loam, over 1½ to 2 feet of heavy silt loam, underlain by 2 to 3 feet of dense, massive silt loam or silty clay loam; on stream terraces; above overflow.	0 to 10 10 to 23 23 to 29 29 to 59
MgB	Monongahela silt loam, 3 to 8 percent slopes.				
MgC	Monongahela silt loam, 8 to 15 percent slopes.				
MoC	Montevallo channery silt loam, 10 to 20 percent slopes.	Not a factor	1 foot to 2 feet to folded shale and silt stone.	1 foot to 2 feet of silt loam or silty clay loam, underlain by strongly folded, thinly bedded shale and siltstone; angular stone fragments, from 2 to 3 inches in size, make up about 25 percent of soil material; on sloping to very steep shale and sandstone uplands.	0 to 18
MoC3	Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded.				
MoD	Montevallo channery silt loam, 20 to 30 percent slopes.				
MoD3	Montevallo channery silt loam, 20 to 30 percent slopes, severely eroded.				
MoE	Montevallo channery silt loam, 30 to 45 percent slopes.				
MoE3	Montevallo channery silt loam, 30 to 45 percent slopes, severely eroded.				
MoF	Montevallo channery silt loam, 45 to 65 percent slopes.				
MoF3	Montevallo channery silt loam, 45 to 65 percent slopes, severely eroded.				
MsB3	Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded.				
MsC3	Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded.				
MsD3	Montevallo shaly silt loam, 20 to 30 percent slopes, severely eroded.				
MuB	Murrill channery loam, 3 to 8 percent slopes.	Not a factor	3 feet to 10 feet or more to limestone or calcareous shale.	1 foot to 1½ feet of channery silt loam, over ½ to 1 foot of silty clay loam, over 3 feet of sandy clay loam, over sandy clay loam or clay loam, underlain by limestone or calcareous shale; on lower part of slopes at base of mountains; some sinkholes and ledges; numerous large stones on the surface of very stony soils.	0 to 15 15 to 21 21 to 60 60+
MuC	Murrill channery loam, 8 to 15 percent slopes.				
MuD	Murrill channery loam, 15 to 25 percent slopes.				
MuE	Murrill channery loam, 25 to 45 percent slopes.				
MvC	Murrill very stony loam, 8 to 15 percent slopes.				
MvD	Murrill very stony loam, 15 to 25 percent slopes.				
MvE	Murrill very stony loam, 25 to 45 percent slopes.				

classification and physical properties of soils—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Silt loam	ML	A-4	95 to 100	95 to 100	80 to 90	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6	95 to 100	95 to 100	85 to 90	0.2 to 0.63	0.12 to 0.15	Moderate.
Silty clay	CL	A-6	95 to 100	95 to 100	80 to 90	0.2 to 0.63	0.12 to 0.15	Moderate.
Silt loam	ML	A-4	95 to 100	95 to 100	90 to 100	2.0 to 6.3	More than 0.18.	Low.
Silty clay loam	CL	A-6	95 to 100	95 to 100	90 to 100	0.63 to 2.0	0.15 to 0.18	Moderate.
Silt loam	ML or CL	A-6	95 to 100	95 to 100	80 to 90	0.63 to 2.0	0.15 to 0.18	Moderate.
Silt loam	ML or CL	A-6	80 to 100	80 to 100	70 to 90	0.2 to 0.63	0.15 to 0.18	Moderate.
Silt loam or silty clay loam.	ML or CL	A-4 or A-6	70 to 85	70 to 80	50 to 75	2.0 to 6.3	0.15 to 0.18	Low.
Silt loam	ML	A-4	70 to 85	60 to 75	50 to 70	2.0 to 6.3	0.15 to 0.18	Low.
Silty clay loam	CL	A-6	70 to 90	65 to 85	60 to 80	0.63 to 2.0	0.12 to 0.15	Moderate.
Sandy clay loam	ML or CL	A-6 or A-7-6	70 to 90	60 to 80	50 to 75	0.63 to 2.0	0.12 to 0.15	Moderate.
Sandy clay loam	ML or CL	A-6 or A-7-6	70 to 90	60 to 80	50 to 75	0.63 to 2.0	0.08 to 0.12	Moderate.

TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
Ph	Philo silt loam.	1 to 2 feet	4 feet to 10 feet or more to variable bedrock.	¾ foot of silt loam, over 3 to 4 feet or more of loose loam to fine sandy loam; on moderately well drained to somewhat poorly drained flood plains; subject to occasional to frequent overflow.	0 to 9 9 to 40+
PkB	Pickaway silt loam, 3 to 10 percent slopes.	1½ to 2½ feet	3 to 7 feet to limestone.	1 foot of friable silt loam, over 1 foot to 1½ feet of heavy silt loam, over 2 feet of firm dense silt loam or silty clay loam; on smooth uplands underlain by limestone.	0 to 15 15 to 30 30 to 40
Po	Pope fine sandy loam.	3 feet	6 to 10 feet or more to variable bedrock.	About 2 feet of fine sandy loam, over loamy sand that grades to stratified sand and gravel at a depth of about 3 feet; on well-drained sandy flood plain; subject to overflow.	0 to 11 11 to 25 25 to 37 37+
Ro	Robertsville silt loam.	0 to 1 foot	4 to 10 feet or more to limestone or shale.	1 foot of heavy silt loam, over 2 to 3 feet of silty clay loam, underlain by massive silty clay or clay; on poorly drained terraces above overflow.	0 to 11 11 to 43 43 to 63+
SoD SpE	Sloping eroded land, shale materials. Steep eroded land, shale materials.	Not a factor	0 to 1½ feet to shale or sandstone.	Very severely eroded land underlain by acid shale, sandstone, or limy shale; subsoil or bedrock exposed in places; soil material generally high in shale fragments; occurs as small areas on sloping to steep uplands.	Variable
SrF	Steep rock land.	Not a factor	0 to 3 feet to sandstone.	Miscellaneous outcrops of rock and escarpments mostly very steep.	----------
SvC	Summers very stony loam, 5 to 20 percent slopes.	Not a factor	1 foot to 2 feet to sandstone.	1 foot of fine sandy loam that contains considerable organic matter, over ½ foot to 1½ feet of loose loamy sand; on gentle to moderate slopes on top of mountains.	0 to 11 11 to 21
TaB TaC TaC3 TaD TaE TcD3 TcE3	Teas and Calvin silt loams, 3 to 8 percent slopes. Teas and Calvin silt loams, 8 to 15 percent slopes. Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded. Teas and Calvin silt loams, 15 to 25 percent slopes. Teas and Calvin silt loams, 25 to 45 percent slopes. Teas and Calvin soils, 15 to 25 percent slopes, severely eroded. Teas and Calvin soils, 25 to 45 percent slopes, severely eroded.	Not a factor	1 foot to 2½ feet to shale and siltstone.	¾ foot of silt loam, over 1 foot to 1½ feet of silty clay loam, underlain by shale and siltstone; on sloping to very steep uplands.	0 to 8 8 to 22

classification and physical properties of soils—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Silt loam	ML	A-4	95 to 100	95 to 100	60 to 80	2.0 to 6.3	More than 0.18.	Low.
Loam	ML or SM	A-4	95 to 100	95 to 100	50 to 75	0.2 to 0.63	0.15 to 0.18	Low.
Silt loam	ML	A-4	95 to 100	95 to 100	80 to 95	2.0 to 6.3	More than 0.18.	Low.
Heavy silt loam	CL	A-6	90 to 100	90 to 100	70 to 90	0.63 to 2.0	0.15 to 0.18	Moderate.
Silt loam	ML or CL	A-4 or A-6	80 to 95	80 to 95	70 to 90	0.2 to 0.63	0.15 to 0.18	Moderate.
Fine sandy loam	SM	A-2 or A-4	95 to 100	90 to 100	30 to 50	2.0 to 6.3	More than 0.18.	Low.
Fine sandy loam	SM	A-2 or A-4	95 to 100	90 to 100	30 to 50	2.0 to 6.3	0.12 to 0.15	Low.
Loamy sand	SM	A-2 or A-4	80 to 100	75 to 90	20 to 50	More than 6.3.	Less than 0.08.	Low.
Mixed sand, gravel, and cobbles.						More than 6.3.	Less than 0.08.	Low.
Heavy silt loam	CL	A-6	95 to 100	95 to 100	80 to 95	2.0 to 6.3	More than 0.18.	Moderate.
Silty clay loam	CL	A-6 or A-7-6	95 to 100	95 to 100	85 to 95	0.2 to 0.63	0.15 to 0.18	Moderate to high.
Silty clay to clay	CH	A-7-5 or A-7-6.	95 to 100	95 to 100	90 to 100	Less than 0.2.	0.12 to 0.15	High.
								Low to moderate.
Stony fine sandy loam.	SM	A-4	50 to 85	40 to 75	35 to 50	2.0 to 6.3	More than 0.18.	Low.
Sandy loam	SM	A-2 or A-4	50 to 85	40 to 75	10 to 50	More than 6.3.	0.08 to 0.12	Low.
Silt loam	ML	A-4	75 to 90	70 to 90	65 to 90	2.0 to 6. 3	More than 0.18.	Low.
Silty clay loam	CL	A-6	65 to 95	65 to 95	55 to 90	0.63 to 2.0	0.15 to 0.18	Moderate.

TABLE 8.—*Brief description and estimated engineering*

Map symbol	Soil	Depth to seasonally high water table	Depth to and kind of bedrock	Brief description of site and soil	Depth from surface
					Inches
TlB	Teas-Calvin-Litz silt loams, 3 to 8 percent slopes.	See descriptions for Teas and Calvin silt loams and for Litz silt loams.			
TlC	Teas-Calvin-Litz silt loams, 8 to 15 percent slopes.				
TlD	Teas-Calvin-Litz silt loams, 15 to 25 percent slopes.				
TlE	Teas-Calvin-Litz silt loams, 25 to 45 percent slopes.				
TmB3	Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded.				
TmC3	Teas-Calvin-Litz complex, 8 to 15 percent slopes, severely eroded.				
TmD3	Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded.				
TmE3	Teas-Calvin-Litz complex, 25 to 45 percent slopes, severely eroded.				
TmF	Teas-Calvin-Litz complex, 45 to 55 percent slopes.				
TmF3	Teas-Calvin-Litz complex, 45 to 55 percent slopes, severely eroded.				
TrC	Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes.				
TrE	Teas-Calvin-Litz very stony complex, 25 to 45 percent slopes.				
TrF	Teas-Calvin-Litz very stony complex, 45 to 60 percent slopes.				
TsB	Tilsit fine sandy loam, 3 to 8 percent slopes.	1½ to 2 feet	3 to 6 feet to shale, siltstone, or sandstone.	1½ feet silt loam, over 1½ to 2½ feet compact, mottled silt loam, underlain by massive, silty clay loam; on smooth shale and sandstone ridges.	0 to 9 9 to 19 19 to 27 27 to 40 40 to 62
TtB	Tilsit silt loam, 2 to 8 percent slopes				
TtC	Tilsit silt loam, 8 to 15 percent slopes				

In the AASHO system, soil materials are classified in several principal groups. These groups range from A–1, gravelly soils of high bearing capacity, to A–7, clay soils having low bearing capacity when wet. A few soils have been classified A–7–5 and A–7–6. The A–7–5 soils represent A–7 soils that have moderate plasticity indexes in relation to the liquid limit, and they may be highly elastic and subject to considerable volume change. A–7–6 soils represent A–7 soils that have high plasticity indexes in relation to liquid limit and that are subject to extremely high volume change.

The percentage passing sieves is the normal range of soil particles passing the respective screen sizes.

Permeability refers to the rate of movement of water through the undisturbed soil. Permeability depends largely on the soil texture and structure.

Available moisture capacity is the amount of water in a moist soil, at field capacity, that can be removed by plants. These ratings, expressed in inches of water per inch of soil depth, are of particular value to engineers engaged in irrigation.

Shrink-swell potential is a rating of the ability of soil material to change volume when subjected to changes in moisture. Those soil materials rated high are normally undesirable from the engineering standpoint, since the increase in volume when the dry soil is wetted is usually accompanied by a loss in bearing capacity. In general, soils classed as CH and A–7 have a high shrink-swell potential. Clean sands and gravels (single-grain structure) and soils having small amounts of nonplastic to slightly plastic fines have a low shrink-swell potential.

Engineering interpretation of soils

The suitability or limitation of each soil in Monroe County for engineering uses is shown in table 9. The interpretation of these soils was based on estimates taken from table 8, on test data for certain soils, and on field experience. All soils were considered to be in their undisturbed state when judged for suitability for the various uses, except for use as highway fill, as pond embankments, and as topsoil.

HIGHWAY ENGINEERING. Soil characteristics, or features, that affect highway engineering practices are shown in the first part of table 9.

The rating of the soil material for road subgrade is based on the estimated AASHO classification of the soil

classification and physical properties of soils—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Shrink-swell potential
USDA texture	Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
						Inches per hour	*Inches per inch of depth*	
Silt loam	ML	A-4	95 to 100	95 to 100	75 to 90	2.0 to 6.3	0.15 to 0.18	Low.
Silt loam	ML	A-4	95 to 100	95 to 100	75 to 90	2.0 to 6.3	0.15 to 0.18	Low.
Silt loam	CL	A-6	95 to 100	95 to 100	80 to 95	0.63 to 2.0	0.15 to 0.18	Low to moderate.
Silt loam	MH	A-7-5	95 to 100	95 to 100	75 to 90	0.2 to 0.63	0.12 to 0.15	Low.
Silty clay loam	MH	A-7-5	95 to 100	95 to 100	75 to 90	0.2 to 0.63	0.12 to 0.15	High.

materials that would normally be used in the subgrade. Coarse-textured soil materials are rated good, and fine-textured materials, fair or poor. The soil materials rated fair are silts with low plasticity; those rated poor are plastic clays that lose strength when wet. In areas where freezing occurs to a depth of more than 6 inches and the water table is within 3 feet of the subgrade surface, silty materials should be rated poor instead of fair because they are susceptible to damage by freezing and thawing.

Highway location is influenced by the depth to bedrock and by the type of bedrock. Blasting normally will be required to excavate deep cuts in sandstone and limestone. This problem generally will occur in areas of the Chilhowie, Tumbez, Dekalb, Duffield, Dunmore, and Frederick soils, and Steep rock land. The difficulty of bedrock excavation and the chance of seepage along bedding planes in the bedrock should be investigated. The presence of undesirable soil material within or slightly below the subgrade will affect the stability of the roadbed. A layer of very plastic clay, as in the Guthrie soil, will impede internal drainage and generally will have low stability when wet. Desirable soil material within the soil profile, for example, the sand and gravel in the Bodine soils, makes a naturally stable subgrade.

Highway location is also influenced by local drainage conditions. To provide satisfactory drainage in areas that are occasionally or seasonally flooded, or where the water table is high, the pavement surface should be built at least 3 feet above high water or above the ground water table. Use of interceptor ditches or underdrains will control subsurface seepage. Seepage over impermeable strata in the back slopes of cuts can result in the sliding of the overlying material. If serious enough, the sliding will sometimes influence both the location and cross-sectional design of the roadway.

In considering possible locations for highways in Monroe County, consideration should be given to problems presented by such soils as the Chilhowie, Tumbez, Duffield, Dunmore, Frederick, Guthrie, and Murrill. Subterranean features are unpredictable on these soils, and highway construction on them should include adequate investigations of the subsurface.

CONSERVATION ENGINEERING. Soil features that affect water management are shown in table 9. These features are evaluated on the basis of estimates given in table 8,

TABLE 9.—*Engineering*

[Steep rock land; Sloping eroded land, shale materials; and Steep eroded land, shale materials,

Soil series and map symbols	Suitability of soil material for—		Suitability as source of—	Features affecting engineering practices for—	
	Road subgrade	Road fill	Topsoil	Vertical alignment for highways	Farm ponds: Reservoir
Alluvial land (Ad)	Poor to fair	Fair	Good	Frequently flooded; water table.	Individual site interpretation needed.
Atkins (At)	Poor	Poor to fair	Good	Water table; frequently flooded.	Occasional sandy layers
Bodine (BcB, BcC, BcD, BrC, BrD, BrE).	Good	Very good	Poor	Stony; bedrock	Fractured bedrock
Captina (CaA, CaB, CaC)	Fair	Fair	Good	Seepage at 1½ to 2 feet; bedrock.	Good sites; occasional sandy layers.
Chilhowie-Tumbez (CbC, CbD, CbE, CbE3).	Poor	Poor	Poor	Bedrock	Massive bedrock and sinkholes.
Clarksburg (CkB, CkC	Poor	Fair	Good	Water table	No unfavorable features
Dekalb (Dab, DaC, DaD, DbB, DbC, DbD, DeC, DeD, DeE, DeF).	Fair	Fair to good	Fair	Bedrock	Stony; rapidly permeable
Duffield (DfB, DfC, DfD, DfD3, DfE, DkB, DkC, DrC, DrD, DrE).	Poor	Poor	Good	Sinkholes; cavernous	Crevices and solution channels.
Dunmore (DtB, DtC, DtD, DuD3, DvB, DvC, DvD).	Poor	Fair to poor	Fair	Bedrock	Sinkholes and cavernous limestone.
Frederick (FcB, FcC, FcD, FcE, FdB, FdC, FdD, FdE, FkB, FkC, FmB, FmC).	Poor	Fair to poor	Fair	Cavernous	Crevices and solution channels.
Frederick and Bodine ((FrF)	Poor	Poor	Poor	Bedrock cavernous	Rocky
Frederick and Dunmore (FsC, FsD, FsE).	Poor	Poor	Poor	Bedrock cavernous	Rocky
Guthrie (Gu)	Poor	Poor	Good	Bedrock; water table	No unfavorable features
Hartsells and Wellston (HaB, HaC).	Fair	Fair to good	Fair	Bedrock	Sandy lenses
Huntington (Hu)	Poor	Fair	Good	Flooding; water table	Sandy lenses and substratum.
Laidig (LaB, LaC, LaD, LaE, LbC, LbD, LbE).	Fair	Fair to good	Fair	No special problems	Sandy lenses and substratum.
Landisburg (LcB)	Poor to fair	Fair to good above 3 feet; poor to fair below.	Fair	Water table	Generally, no unfavorable features.

interpretation of soils

generally are not suitable for the uses shown in this table and are not rated]

Features affecting engineering practices for—Continued			Estimated degree of limitation for septic fields	Remarks
Farm ponds—Con.	Agricultural drainage	Irrigation		
Embankment				
Individual site interpretation needed.	Poorly drained; slowly permeable; frequently flooded; artificial drainage seldom feasible.	High water table; slowly permeable; subject to flooding.	Severe; flood hazard	
Low shear strength	Poorly drained; slowly permeable; artificial drainage needed.	Poorly drained; slowly permeable.	Severe; flood hazard; high water table.	
Stony	Well drained	No unfavorable features	Slight	
No unfavorable features	Seepage and surface water collects; spot drainage and diversions needed.	Slowly permeable in lower subsoil.	Severe; slow permeability.	
Rocky and little soil material.	Well drained	Generally steep, shallow to bedrock.	Severe; depth to bedrock.	May have sinkholes and may overlie cavernous limestone.
No unfavorable features	Seepage and surface water collects; spot drainage and diversions needed.	Slowly permeable in lower subsoil.	Severe; slow permeability.	
Stony and sandy	Well drained	Slowly permeable in lower subsoil.	Severe; depth to bedrock	
Unstable compaction	Well drained	No unfavorable features	Moderate; depth to bedrock.	May have sinkholes and may overlie cavernous limestone.
Bedrock at or near surface	Well drained	Slowly permeable subsoil	Severe; depth to bedrock; slow permeability.	May have sinkholes and may overlie cavernous limestone.
Unstable compaction	Well drained	No unfavorable features	Moderate; depth to bedrock.	May have sinkholes and may overlie cavernous limestone.
Rocky	Well drained	Rocky	Severe; slope; depth to bedrock.	May have sinkholes and may overlie cavernous limestone.
Rocky	Well drained	Rocky	Severe; slope; depth to bedrock.	May have sinkholes and may overlie cavernous limestone.
No unfavorable features	Poorly drained; slowly permeable; artificial drainage needed.	Slowly permeable	Severe; slow permeability; high water table.	May overlie cavernous limestone.
No unfavorable features	Well drained	No unfavorable features	Moderate; depth to bedrock.	
Low shear strength	Well drained	No unfavorable features; high available moisture-holding capacity.	Severe; flood hazard	
No unfavorable features	Well drained	No unfavorable features	Moderate; depth to fragipan.	
No unfavorable features	Moderately well drained; pan at depth of 18 to 24 inches; perched water table above pan.	Slowly permeable subsoil	Severe; slow permeability	

TABLE 9.—*Engineering*

Soil series and map symbols	Suitability of soil material for—		Suitability as source of—	Features affecting engineering practices for—	
	Road subgrade	Road fill	Topsoil	Vertical alignment for highways	Farm ponds: Reservoir
Leadvale (LdB)	Poor	Poor to fair	Good	Seepage	No unfavorable features
Lehew (LhD, LhE)	Fair	Fair to good	Poor	Bedrock	Steep; bedrock
Lindside (Ln)	Poor	Poor to fair	Good	Water table; flooding	Generally, no unfavorable features; occasional sandy lenses.
Litz (LsB, LsC, LsD, LsE, LsF, LtB, LtC, LtC3, LtD, LtD3, LtE, LtE3, LtF, LvD, LvE, LvE3, LxF).	Fair	Fair	Fair	Bedrock	Generally steep
Melvin (Mb)	Poor	Fair	Good	Water table; frequently flooded.	Sandy lenses
Monongahela (MgA, MgB, MgC)	Fair to poor	Fair	Fair	Water table	Occasional sandy lenses
Montevallo (MoC, MoC3, MoD, MoD3, MoE, MoE3, MoF, MoF3, MsB3, MsC3, MsD3).	Poor to fair	Fair	Fair	Shale bedrock	Shaly; moderately permeable.
Murrill (MuB, MuC, MuD, MuE, MvC, MvD, MvE).	Fair	Fair to good	Fair	No special problems	Solution channels may form.
Philo (Ph)	Poor	Fair to good	Good	Water table; frequently flooded.	Subject to flooding
Pickaway (PkB)	Poor	Fair	Fair	Water table; bedrock	No unfavorable features
Pope (Po)	Good	Good	Good	Flooding	Rapidly permeable; subject to flooding.
Robertsville (Ro)	Poor	Poor to fair	Good	Water table	No unfavorable features
Summers (SvC)	Good	Poor to fair; shallow; high in organic matter.	Poor	Bedrock	Stony; too permeable
Teas and Calvin (TaB, TaC, TaC3, TaD, TaE, TcD3, TcE3).	Fair	Fair	Good	Bedrock	Generally too steep
Teas-Calvin-Litz (TlB, TlC, TlD, TlE, TmB3, TmC3, TmD3, TmE3, TmF, TmF3, TrC, TrE, TrF).	Fair	Fair	Good	Bedrock	Generally too steep
Tilsit (TsB, TtB, TtC)	Poor	Fair	Fair	Water table	No unfavorable features

interpretation of soils—Continued

Features affecting engineering practices for—Continued			Estimated degree of limitation for septic fields	Remarks
Farm ponds—Con.	Agricultural drainage	Irrigation		
Embankment				
No unfavorable features	Moderately well drained; seepage and surface water collects; diversion and spot drainage needed.	Slowly permeable subsoil	Severe; slow permeability	
No unfavorable features	Well drained	Limited depth over sandstone.	Severe; slope; depth to bedrock.	
Low shear strength	Moderately well drained to somewhat poorly drained; slowly permeable; artificial drainage needed for some crops.	Moderately high water table in growing season.	Severe; flood hazard; high water table.	
Low shear strength	Well drained	Shallow to moderately deep.	Severe; depth to bedrock	
Low shear strength	Poorly drained; high water table; artificial drainage needed.	Subject to flooding; slowly permeable.	Severe; flood hazard; high water table.	
No unfavorable features	Moderately well drained; pan at depth of 18 to 28 inches; spot drainage and diversions helpful.	Slowly permeable layer at depth of 18 to 28 inches.	Severe; slow permeability	
Shaly	Well drained	Shallow to bedrock	Severe; depth to bedrock	
No unfavorable features	Well drained	No unfavorable features	Moderate; moderate permeability.	May have sinkholes and may overlie cavernous limestone.
Low shear strength	Moderately well drained to somewhat poorly drained; artificial drainage needed for some crops.	Water table	Severe; flood hazard; water table.	
Low shear strength	Moderately well drained	No unfavorable features; good available moisture-holding capacity.	Severe; slow permeability	
Rapidly permeable in some places.	Well drained	No unfavorable features	Severe; flood hazard	
No unfavorable features	Slowly permeable; needs surface drainage.	Slowly permeable	Severe; slow permeability; high water table.	
Too permeable	Well drained	Stoniness; depth	Severe; depth to bedrock; slope.	
Low shear strength	Well drained	Moderately deep	Severe; depth to bedrock	
Low shear strength	Well drained	Moderately deep	Severe; depth to bedrock	
Low shear strength	Moderately well drained; pan at depth of 19 to 27 inches; spot drainage helpful.	Slowly permeable in lower subsoil.	Severe; slow permeability	

TABLE 10.—*Engineering*

[Soil samples taken from 11 soil profiles in Monore County, W. Va., and from 1 soil profile in Greenbrier Co., W. Va. Tests performed

Soil name and location	Parent material	Bureau of Public Roads report No.	Depth	Horizon	Moisture-density [1]		Mechanical analysis [2]
					Maximum dry density	Optimum moisture	Large fragments (3 to 10 inches) discarded in field sampling (estimated)
			Inches		*Lb. per cu. ft.*	*Percent*	*Percent*
Dunmore cherty silt loam:							
1 mile SW. of Gap Mills. (Modal profile.)	Beekmantown limestone.	S 35683	0–7	Ap	108	14	----------
		S 35684	17–27	B2	96	25	----------
		S 35685	27–48	B–C	91	29	----------
¼ mile SW. of Green Valley Church, on Zenith-Peterstown road. (Coarse-textured subsoil.)	Beekmantown limestone.	S 35686	0–10	Ap	111	14	10
		S 35687	25–42	B2	98	25	----------
		S 35688	50–78	C	94	27	----------
5 miles NE. of Gap Mills, on State Highway No. 3. (Deep clay subsoil.)	Beekmantown limestone.	S 35689	0–8	Ap	107	16	----------
		S 35690	24–40	B22	89	31	----------
		S 35691	40–60	C	84	36	----------
Frederick cherty silt loam:							
1¾ miles N. of Sinks Grove, on Sinks Grove-Ronceverte road. (Modal profile.)	Greenbrier limestone.	S 35692	0–7	Ap	110	15	----------
		S 35693	19–32	B21	102	22	----------
		S 35694	48–63+	C	96	26	----------
Frederick silt loam:							
South of Union. (Heavy-textured subsoil.)	Greenbrier limestone.	S 35695	0–7	Ap	104	19	----------
		S 35696	31–51	B22	88	31	----------
		S 35697	51–101	C	85	32	----------
2 miles NE. of Sinks Grove, along SE. edge of Neff orchard. (Coarse textured.)	Greenbrier limestone.	S 35698	0–8	Ap	97	20	20
		S 35699	21–32	B2	100	22	5
		S 35700	41–72	C	101	23	5
Laidig very stony loam:							
2 miles E. of Sweetsprings. (Modal profile.)	Colluvium weathered from sandstone.	S 35701	5–12	A2	119	13	10
		S 35702	26–39	B22	121	13	10
		S 35703	47–120	Cm	117	15	20
3 miles E. of State Highway No. 3. (Very channery subsoil.)	Colluvium weathered from sandstone and siltstone.	S 35704	4–11	A2	124	10	20
		S 35705	21–34	B21	125	11	30
		S 35706	46–60+	C	124	11	50
2 miles S. of Caldwell, Greenbrier County, W. Va. (Heavy-textured subsoil.)	Colluvium weathered from sandstone and siltstone.	S 35716	6–13	A2	120	12	10
		S 35717	24–39	B2	122	13	10
		S 35718	39–120	C	129	9	20
Tilsit silt loam:							
1 mile N. of Ballard, on Red Sulphur Springs road. (Modal profile.)	Gray sandstone, shale, and siltstone.	S 35707	0–9	Ap	110	15	----------
		S 35708	19–27	B21m	113	16	----------
		S 35709	40–62	C	103	21	----------
1 mile E. of Peterstown, on Ballard road. (Clayey subsoil.)	Shale and sandstone of the Mauch Chunk formation.	S 35710	0–9	Ap	105	19	----------
		S 35711	26–40	B22m	101	24	----------
		S 35712	40–66	C	106	21	----------
2 miles E. of Peterstown, on Ballard road. (Sandy subsoil.)	Shale and sandstone of the Mauch Chunk formation.	S 35713	0–10	Ap	110	14	----------
		S 35714	16–27	B21m	120	13	----------
		S 35715	33–44	C	114	16	----------

[1] Based on the Moisture-Density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop. AASHO Designation: T 99–57. (Method A was used when the sample contained no particles on No. 4 sieve. Method C was used for other samples with no corrections made for the material larger than ¾ inch.)

[2] Mechanical analyses according to the AASHO Designation: T 88. Results from this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed

test data

by Bureau of Public Roads in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]—Continued												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—[3]								Percentage smaller than—[3]						AASHO [4]	Unified [5]
3 in.	1½ in.	¾ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
100	98	94	81	75	68	66	62	60	47	27	15	31	5	A-4(5)	ML.
------	------	100	97	95	94	94	93	90	84	70	63	66	28	A-7-5(19)	MH.
------	------	------	------	100	99	99	97	95	83	69	61	69	29	A-7-5(20)	MH.
------	90	86	76	73	68	66	59	57	44	22	13	27	5	A-4(6)	ML-CL.
------	------	------	------	100	99	99	97	95	87	69	60	59	24	A-7-5(17)	MH.
------	------	------	------	100	99	99	98	96	89	74	66	66	27	A-7-5(19)	MH.
------	------	100	94	90	86	84	75	72	59	34	20	30	6	A-4(8)	ML-CL.
------	------	------	------	------	------	100	99	99	92	81	73	79	35	A-7-5(20)	MH.
------	------	------	------	------	------	100	98	97	89	81	72	76	31	A-7-5(20)	MH.
------	100	98	92	88	84	82	77	74	56	21	12	26	3	A-4(8)	ML.
------	------	------	------	100	99	98	95	93	81	57	47	56	30	A-7-6(19)	CH.
------	100	98	97	97	95	94	92	90	78	62	55	70	35	A-7-5(20)	MH-CH.
100	99	99	99	99	93	91	88	86	69	35	22	37	11	A-6(8)	ML-CL.
------	------	------	------	100	99	99	99	99	92	77	70	78	36	A-7-5(20)	MH.
------	------	------	------	100	99	99	99	99	95	82	76	74	26	A-7-5(20)	MH.
------	78	74	64	63	61	60	58	57	41	17	8	41	8	A-5(8)	ML.
------	------	94	93	93	91	90	88	86	74	54	46	63	32	A-7-5(20)	MH-CH.
------	------	------	------	95	93	92	90	86	66	49	40	52	18	A-7-5(14)	MH.
------	90	88	85	83	79	76	56	51	40	22	13	21	4	A-4(5)	ML-CL.
------	------	89	85	84	80	77	60	56	43	27	18	27	7	A-4(6)	ML-CL.
------	79	78	76	75	73	70	53	48	37	24	18	30	9	A-4(6)	ML-CL.
------	80	74	63	59	53	50	35	30	22	12	7	20	1	A-4(2)	SM.
------	70	66	57	52	47	45	33	28	20	13	9	23	4	A-4(2)	SM-SC.
------	50	47	42	40	36	34	23	20	15	9	6	23	4	A-4(2)	SM-SC.
------	89	85	73	67	58	55	47	42	32	16	10	25	4	A-4(3)	ML-CL.
------	88	85	77	73	62	59	50	46	35	22	16	30	8	A-4(4)	ML-CL.
80	78	62	39	34	27	26	22	21	16	10	6	28	6	A-2-4(0)	GM-GC.
------	------	------	------	100	99	98	85	81	58	22	12	23	3	A-4(8)	ML.
------	------	------	------	------	------	100	92	87	69	39	28	38	16	A-6(10)	CL.
------	100	99	95	95	93	92	89	87	74	46	33	54	21	A-7-5(15)	MH.
------	------	------	------	100	92	90	87	87	75	42	24	35	9	A-4(8)	ML-CL.
------	------	------	------	100	95	94	93	93	91	76	57	63	27	A-7-5(19)	MH.
------	------	100	97	96	91	90	88	88	84	62	44	56	25	A-7-5(17)	MH-CH.
------	------	------	------	100	99	98	75	70	48	22	12	23	3	A-4(8)	ML.
------	------	------	------	100	99	99	80	76	58	32	21	26	8	A-4(8)	CL.
------	------	------	------	------	------	100	77	71	57	40	31	35	13	A-6(9)	ML-CL.

by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils (*1*).

[3] Based on total material. Laboratory test data corrected for amount discarded in field sampling.

[4] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1, ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. AASHO Designation: M 145-49.

[5] Based on the Unified Soil Classification System. Tech. Memo. No. 3-357, v. 1, Waterways Expt. Sta., Corps of Engin., March 1953 (*14*).

actual test data from certain soils, and field experience.

Farm ponds, diversion ditches, waterways, and soil drainage systems are the most important conservation structures used in Monroe County. There are some hazards in the construction of ponds and diversions on soils underlain by limestone because of the likelihood of massive outcrops of limestone or of caverns or crevices in the underlying material. Instances have occurred in this region where a site was an excellent farm pond one day and a dry hole the next.

The suitability of the soils in the county for farm ponds is shown in table 9. Thin sandy layers, or lenses, occur in places in the Atkins, Captina, Hartsells, Wellston, Huntington, Lindside, Melvin, Monongahela, and Pope soils. Detailed borings should be made on these soils, and sites that contain sand lenses should be avoided. Lenses in a pond reservoir can sometimes be sealed by thorough mixing with finer material, adequate compaction at proper moisture content, and use of suitable admixtures, such as bentonite.

Crevices and solution channels occur in many soils that formed in limestone material, such as the Duffield or Frederick. These soils also have strongly aggregated structure and tend to re-form after compaction. Consequently, they may not be suitable for use as ponds. However, some ponds built in similar soils have been successfully sealed through the use of a polyphosphate dispersing agent and adequate compaction.

Sites where the depth to bedrock would be less than 2 feet below the bottom of the pond should be avoided.

An important function of a diversion ditch is to intercept hillside runoff and subsurface water. Such water is the chief source of wetness on the Clarksburg soils and also causes seepage spots on both the Captina and Clarksburg soils. Diversion ditches are commonly needed along toe slopes adjacent to the Lindside and Melvin soils, which are on bottom lands. The ditches should be about 30 inches deep to intercept as much subsurface water as possible.

The Captina, Clarksburg, Leadvale, Landisburg, Philo, Lindside, Monongahela, and Pickaway soils drain moderately well into tile. In most places tile lines are laid so as to intercept surface and subsurface water from adjacent upland soils. Seepage spots on the Captina, Clarksburg, Leadvale, and Landisburg soils can be drained by use of random tile lines. Soils that have a slowly permeable subsoil, such as Atkins, Guthrie, and Robertsville, commonly do not drain well into tile unless the ditch is backfilled with gravel to the top of the slowly permeable layer. The poorly drained Melvin soils drain well into tile, and drainage is effective for some time.

Septic tank drainage fields. In table 9 the soils are rated as to degree of limitation for use as drainage fields for spetic tanks. Soil features imposing the limitations are also shown. Soils rated *slight* generally are well suited to this use. Those rated *moderate* generally are suitable but may be borderline and should be investigated carefully at the exact site of the proposed installation. These soils generally will require larger drainage fields than those having slight limitations. Soils rated *severe* may be suitable for drainage fields if great care is taken in planning and installation. Some soils in this group are unsuitable for this use. For example, soils subject to flooding should not be used for disposal fields. All soils that have a severe rating should be very carefully investigated. Slow permeability, steep slopes, shallowness to bedrock, and the presence of a seasonally high water table are the main limiting features.

The ratings shown in table 9 are for the most gently sloping phases of the series. Soils that have slopes of more than 8 percent are rated not better than moderate; those that have slopes of more than 15 percent are rated severe. Very rocky soils are rated severe, regardless of other properties.

The additional hazard of contaminating underground water needs to be recognized in soils underlain by cavernous limestone. These soils are indicated in the last column in table 9.

Engineering test data

Twelve soil samples were tested to help evaluate the soils of Monroe County for engineering purposes. The results of these tests are given in table 10, page 56. The samples represent the Dunmore, Frederick, Laidig, and Tilsit series and were taken from 11 soil profiles in Monroe County and 1 soil profile in Greenbrier County.

Residential development

Soil characteristics have an important bearing on the suitability of a site for residential development. Soil drainage, depth to bedrock, nature of the subsoil, and hazard of flooding are factors to be considered in planning residential developments.

Soils that have slow internal drainage are poor building sites. Sewage disposal systems will not function properly in soils that have a slowly permeable subsoil or a seasonally high water table. Basements cannot be expected to remain dry if they are constructed in wet soils.

Soils that are underlain by cavernous limestone are hazardous building sites because of the possibility of cave-ins or sinks. Soils that are subject to flooding are also poor building sites.

The Huntington soils are deep and well drained but are subject to occasional flooding. The Lindside and Melvin soils have a seasonally high water table and are subject to flooding.

The Montevallo, Dekalb, Litz, and Teas soils occur mainly on steep slopes and are less than 3 feet in depth to bedrock. If these soils are on moderate slopes, they are suitable for slab-type buildings, but they may be difficult to excavate.

The Laidig soils generally provide good building sites. They are deep, moderately permeable, and above the flood plain, but in places the water table may be so high that basements cannot be kept dry, unless some measures are taken to prevent seepage, such as installing drains around the foundation.

Descriptions of Soils

In this section the soil series of Monroe County are described in alphabetical order. Following the general description of each series is a profile description of one of the mapping units in that series. Each of the other mapping units of that series is compared with the one for which a profile is described, and additional facts about

each are given. Soils that are mapped only in a complex are described under the name of the complex. Further information on the use and management of each soil is given in the section "Use and Management of Soils." Terms used to describe the soils are defined in the Glossary.

A list of the soils mapped is given at the back of the report, along with the capability unit and woodland suitability group of each. The approximate acreage and the proportionate extent of the soils are given in table 11. The location and distribution of the soils are shown on the soil map at the back of this report.

Alluvial Land (Ad)

Alluvial land occurs along many small streams and some medium-sized streams throughout the county. It consists of sandy and gravelly material, small boulders, and strips and patches of moderately well drained to poorly drained silt loams. These materials washed from uplands of limestone or from uplands of sandstone and shale. They occur in mixed patterns that vary from place to place. They may also vary from year to year because of frequent flooding and deposition of new material. In most areas, from 15 to 30 percent of the surface is covered with coarse-textured material of sufficient depth to affect plant growth seriously. In some areas, as much as 50 percent of the surface is covered with coarse sand and gravel. Generally, gravel and boulders are less common along streams that drain the limestone uplands than along streams that drain the sandstone and shale uplands.

In some places Alluvial land occupies the entire flood plain along small streams; in others it occurs only along the edges of streams, adjacent to the Atkins, Lindside, Melvin, or Philo soils, or other soils on the bottom lands.

This land is strongly to slightly acid and is moderately fertile. The sandy and gravelly areas are often droughty. Because of the serious hazard of flooding and the deposition of additional coarse-textured material, this land generally is suited only to pasture or woods. *Capability unit VIw-1; woodland suitability group 11.*

Atkins Series

The Atkins series consists of deep, poorly drained, nearly level, strongly acid soils on bottom lands. These soils formed from alluvium that washed from uplands of acid sandstone and shale.

The surface layer is dark grayish-brown silt loam that is slightly mottled and slowly permeable. The subsoil is grayish-brown silty clay loam or clay loam that is strongly mottled with brown. It is strongly gleyed. Gleying indicates that the water table remains high for long periods.

These soils are in the eastern and western parts of the county along Potts, Devil, and Brush Creeks and other streams that drain sandstone and shale uplands. They generally occur as narrow strips near the base of hills, but in places they occupy large flood plains. They are flooded about once every 2 or 3 years.

The Atkins soils are associated with the well drained Pope soil and with the moderately well drained Philo soil. Most of the acreage is used for pasture, and some is used for crops.

Representative profile of Atkins silt loam, in a pasture—

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine mottles of strong brown (7.5YR 5/8); weak, fine, granular structure; friable; slightly acid; abrupt, wavy boundary.

B1g—7 to 17 inches, gray (10YR 5/1) silty clay loam; many, medium mottles of strong brown (7.5YR 5/8); common clay films; very weak polygons, 2 to 3 inches across, break into weak, medium, subangular blocks; firm; strongly acid; gradual, wavy boundary.

B2g—17 to 38 inches, grayish-brown (10YR 5/2) silty clay loam or clay loam; many coarse mottles of strong brown (7.5YR 5/8); weak, medium, subangular blocky structure; common clay films; many fine manganese concretions; numerous sedge roots in lower part of horizon; strongly acid; gradual, wavy boundary.

Cg—38 to 60 inches +, grayish-brown (10YR 5/2) silt loam, silty clay loam, and clay loam with lenses of sand; massive; a few pebbles that becomes more numerous with depth; strongly acid; depth to bedrock estimated to be 8 feet.

Range in characteristics: In the lower part of the subsoil, the texture ranges from silty clay loam to silty clay. The depth to bedrock or to gravel ranges from about 3 feet to 8 feet. The substratum is variable. In the eastern part of the county, it commonly contains gravel and channery fragments. In the western part, it generally contains little or no coarse material. Permeability normally is slow but ranges from moderate to very slow.

Location: Nearly level bottom lands.

Drainage: Poorly drained. Water table is near the surface for 3 to 4 months each year. In areas that slope toward streams, depth to water table is much greater.

Overflow hazard: Once every 2 or 3 years along most streams; one or more times a year in a few areas.

Permeability: Slow.

Atkins silt loam (At).—A profile of this soil is the one described as representative of the Atkins series. Small areas of very poorly drained soils and of soils that have a surface layer of fine sandy loam were included in mapping.

Surface drainage generally is poor. The subsoil drains moderately well into tile and into open ditches, if the permanent water table is not too high.

This soil is suitable for crops if adequately drained. Hay or pasture mixtures consisting of water-tolerant grasses and legumes are best suited. *Capability unit IIIw-1; woodland suitability group 11.*

Bodine Series

The Bodine series consists of deep, well-drained, rapidly permeable, cherty soils that developed from material weathered from very cherty strata in the Beekmantown limestone.

The surface layer is dark grayish-brown very stony loam or very cherty silt loam, and the subsoil is brownish-gray to yellowish-brown very cherty silt loam. Horizon development below the surface layer is weak. The very stony Bodine soils developed partly from material weathered from acid sandstone.

These soils are gently sloping to steep and occur in the long, narrow limestone valley in the southern part of the county. They are closely associated with the Dunmore soils, which have a redder, much finer textured subsoil; with the well drained, colluvial Murrill soils; and with the moderately well drained, colluvial Landisburg soil.

TABLE 11.—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent
Alluvial land	3, 169	1. 0
Atkins silt loam	3, 049	1. 0
Bodine very cherty silt loam, 5 to 12 percent slopes	225	. 1
Bodine very cherty silt loam 12 to 25 percent slopes	1, 275	. 4
Bodine very cherty silt loam, 25 to 35 percent slopes	1, 039	. 3
Bodine very stony loam, 12 to 25 percent slopes	842	. 3
Bodine very stony loam, 25 to 35 percent slopes	872	. 3
Bodine very stony loam, 35 to 50 percent slopes	471	. 2
Captina silt loam, 0 to 3 percent slopes	285	. 1
Captina silt loam, 3 to 8 percent slopes	794	. 3
Captina silt loam, 8 to 15 percent slopes	127	(1)
Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes	794	. 3
Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes	1, 511	. 5
Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes	2, 226	. 7
Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, severely eroded	334	. 1
Clarksburg silt loam, 3 to 8 percent slopes	697	. 2
Clarksburg silt loam, 8 to 15 percent slopes	443	. 1
Dekalb channery loam, 5 to 12 percent slopes	452	. 2
Dekalb channery loam, 12 to 25 percent slopes	992	. 3
Dekalb channery loam, 25 to 35 percent slopes	1, 557	. 5
Dekalb fine sandy loam, 5 to 12 percent slopes	1, 814	. 6
Dekalb fine sandy loam, 12 to 25 percent slopes	3, 705	1. 2
Dekalb fine sandy loam, 25 to 35 percent slopes	1, 276	. 4
Dekalb very stony loam, 10 to 25 percent slopes	5, 579	1. 8
Dekalb very stony loam, 25 to 35 percent slopes	4, 419	1. 5
Dekalb very stony loam, 35 to 50 percent slopes	15, 842	5. 2
Dekalb very stony loam, 50 to 70 percent slopes	22, 953	7. 6
Duffield silt loam, 3 to 10 percent slopes	1, 275	. 4
Duffield silt loam, karst, 3 to 10 percent slopes	824	. 3
Duffield silt loam, 10 to 20 percent slopes	3, 421	1. 1
Duffield silt loam, karst, 10 to 20 percent slopes	1, 021	. 3
Duffield silt loam, 20 to 30 percent slopes	1, 539	. 5
Duffield silt loam, 20 to 30 percent slopes, severely eroded	80	(1)
Duffield silt loam, 30 to 45 percent slopes	343	. 1
Duffield very rocky silt loam, 5 to 20 percent slopes	1, 463	. 5
Duffield very rocky silt loam, 20 to 30 percent slopes	2, 354	. 8
Duffield very rocky silt loam, 30 to 45 percent slopes	1, 158	. 4
Dunmore cherty silt loam, 3 to 8 percent slopes	412	. 1
Dunmore cherty silt loam, 8 to 15 percent slopes	1, 186	. 4
Dunmore cherty silt loam, 15 to 25 percent slopes	462	. 2
Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded	98	(1)
Dunmore silt loam, 3 to 8 percent slopes	265	. 1
Dunmore silt loam, 8 to 15 percent slopes	412	. 1
Dunmore silt loam, 15 to 25 percent slopes	403	. 1
Frederick cherty silt loam, 3 to 8 percent slopes	491	. 2
Frederick cherty silt loam, karst, 3 to 8 percent slopes	157	. 1
Frederick cherty silt loam, 8 to 15 percent slopes	1, 381	. 5
Frederick cherty silt loam, karst, 8 to 15 percent slopes	637	. 2
Frederick cherty silt loam, 15 to 25 percent slopes	2, 803	. 9
Frederick cherty silt loam, 25 to 45 percent slopes	725	. 2
Frederick silt loam, 3 to 8 percent slopes	178	. 1
Frederick silt loam, karst, 3 to 8 percent slopes	294	. 1
Frederick silt loam, 8 to 15 percent slopes	657	. 2
Frederick silt loam, karst, 8 to 15 percent slopes	450	. 1
Frederick silt loam, 15 to 25 percent slopes	786	. 3
Frederick silt loam, 25 to 45 percent slopes	265	0. 1
Frederick and Bodine very rocky soils, 45 to 60 percent slopes	715	. 2
Frederick and Dunmore very rocky soils, 3 to 15 percent slopes	1, 618	. 5
Frederick and Dunmore very rocky soils, 15 to 25 percent slopes	7, 380	2. 4
Frederick and Dunmore very rocky soils, 25 to 45 percent slopes	10, 183	3. 4
Guthrie silty clay loam	296	. 1
Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes	833	. 3
Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes	698	. 2
Huntington silt loam	461	. 2
Laidig channery loam, 3 to 8 percent slopes	715	. 2
Laidig channery loam, 8 to 15 percent slopes	531	. 2
Laidig channery loam, 15 to 25 percent slopes	305	. 1
Laidig channery loam, 25 to 45 percent slopes	109	(1)
Laidig very stony loam, 3 to 15 percent slopes	2, 501	. 8
Laidig very stony loam, 15 to 25 percent slopes	9, 232	3. 0
Laidig very stony loam, 25 to 45 percent slopes	3, 470	1. 1
Landisburg cherty silt loam, 3 to 10 percent slopes	138	(1)
Leadvale silt loam, 3 to 10 percent slopes	383	. 1
Lehew very stony loam, 25 to 35 percent slopes	382	. 1
Lehew very stony loam, 35 to 50 percent slopes	470	. 2
Lindside silt loam	951	. 3
Litz shaly silt loam, 3 to 10 percent slopes	706	. 2
Litz shaly silt loam, 10 to 20 percent slopes	2, 273	. 8
Litz shaly silt loam, 20 to 30 percent slopes	1, 548	. 5
Litz shaly silt loam, 30 to 45 percent slopes	5, 193	1. 7
Litz shaly silt loam, 45 to 60 percent slopes	5, 392	1. 8
Litz silt loam, 3 to 8 percent slopes	904	. 3
Litz silt loam, 8 to 15 percent slopes	1, 628	. 5
Litz silt loam, 8 to 15 percent slopes, severely eroded	609	. 2
Litz silt loam, 15 to 25 percent slopes	723	. 2
Litz silt loam, 15 to 25 percent slopes, severely eroded	266	. 1
Litz silt loam, 25 to 45 percent slopes	1, 060	. 4
Litz silt loam, 25 to 45 percent slopes, severely eroded	873	. 3
Litz silt loam, 45 to 60 percent slopes	1, 079	. 4
Litz very rocky soils, 10 to 30 percent slopes	276	. 1
Litz very rocky soils, 30 to 45 percent slopes	1, 070	. 4
Litz very rocky soils, 30 to 45 percent slopes, severely eroded	354	. 1
Litz-Rock land complex, 45 to 60 percent slopes	990	. 3
Melvin silt loam	2, 351	. 8
Monongahela silt loam, 0 to 3 percent slopes	313	. 1
Monongahela silt loam, 3 to 8 percent slopes	795	. 3
Monongahela silt loam, 8 to 15 percent slopes	108	(1)
Montevallo channery silt loam, 10 to 20 percent slopes	441	. 1
Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded	411	. 1
Montevallo channery silt loam, 20 to 30 percent slopes	215	. 1
Montevallo channery silt loam, 20 to 30 percent slopes, severely eroded	833	. 3
Montevallo channery silt loam, 30 to 45 percent slopes	15, 095	5. 0
Montevallo channery silt loam, 30 to 45 percent slopes, severely eroded	6, 497	2. 1
Montevallo channery silt loam, 45 to 65 percent slopes	22, 282	7. 4
Montevallo channery silt loam, 45 to 65 percent slopes, severely eroded	3, 195	1. 1

See footnote at end of table.

TABLE 11.—*Approximate acreage and proportionate extent of soils*—Continued

Soil	Acres	Percent
Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded	225	0.1
Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded	2,686	.9
Montevallo shaly silt loam, 20 to 30 percent slopes, severely eroded	1,990	.7
Murrill channery loam, 3 to 8 percent slopes	893	.3
Murrill channery loam, 8 to 15 percent slopes	1,794	.6
Murrill channery loam, 15 to 25 percent slopes	1,363	.5
Murrill channery loam, 25 to 45 percent slopes	166	.1
Murrill very stony loam, 8 to 15 percent slopes	480	.2
Murrill very stony loam, 15 to 25 percent slopes	4,226	1.4
Murrill very stony loam, 25 to 45 percent slopes	971	.3
Philo silt loam	451	.2
Pickaway silt loam, 3 to 10 percent slopes	1,060	.4
Pope fine sandy loam	472	.2
Robertsville silt loam	226	.1
Sloping eroded land, shale materials	1,582	.5
Steep eroded land, shale materials	1,953	.6
Steep rock land	421	.1
Summers very stony loam, 5 to 20 percent slopes	59	(1)
Teas and Calvin silt loams, 3 to 8 percent slopes	186	.1
Teas and Calvin silt loams, 8 to 15 percent slopes	314	.1
Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded	177	.1
Teas and Calvin silt loams, 15 to 25 percent slopes	704	.2
Teas and Calvin silt loams, 25 to 45 percent slopes	499	.2
Teas and Calvin soils, 15 to 25 percent slopes, severely eroded	559	.2
Teas and Calvin soils, 25 to 45 percent slopes, severely eroded	402	.1
Teas-Calvin-Litz silt loams, 3 to 8 percent slopes	628	.2
Teas-Calvin-Litz silt loams, 8 to 15 percent slopes	1,647	0.5
Teas-Calvin-Litz silt loams, 15 to 25 percent slopes	2,048	.7
Teas-Calvin-Litz silt loams, 25 to 45 percent slopes	8,309	2.7
Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded	284	.1
Teas-Calvin-Litz complex, 8 to 15 percent slopes, severely eroded	2,108	.7
Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded	3,979	1.3
Teas-Calvin-Litz complex, 25 to 45 percent slopes, severely eroded	5,909	2.0
Teas-Calvin-Litz complex, 45 to 55 percent slopes	6,017	2.0
Teas-Calvin-Litz complex, 45 to 55 percent slopes, severely eroded	3,441	1.1
Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes	423	.1
Teas-Calvin-Litz very stony complex, 25 to 45 percent slopes	3,205	1.1
Teas-Calvin-Litz very stony complex, 45 to 60 percent slopes	4,586	1.5
Tilsit fine sandy loam, 3 to 8 percent slopes	433	.1
Tilsit silt loam, 2 to 8 percent slopes	5,744	1.9
Tilsit silt loam, 8 to 15 percent slopes	384	.1
Subtotal	294,147	97.2
Urban and built up	3,600	1.2
Roads and railroads	4,290	1.4
Water	683	.2
Total	302,720	100.0

[1] Less than 0.1 percent.

Although very cherty, the Bodine soils have moderate capacity for holding moisture that plants can use, and they are low to medium in productivity.

The very steep, very rocky Bodine soil is mapped in an undifferentiated mapping unit with the very steep, very rocky Frederick soil. A description of this unit follows the description of the Frederick soils.

Representative profile of Bodine very cherty silt loam, 12 to 25 percent slopes, in a pasture—

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) very cherty silt loam; weak, fine, granular structure; friable; 40 percent chert fragments; very strongly acid; clear, wavy boundary.

A2—6 to 12 inches, grayish-brown (2.5Y 5/2) very cherty silt loam; weak, fine, subangular blocky and very weak, thin, platy structure; friable; 50 percent chert fragments; very strongly acid; clear, wavy boundary.

A3—12 to 18 inches, light brownish-gray (2.5Y 6/2) very cherty silt loam; weak, fine and medium, subangular blocky structure; firm in place, friable if broken out; 60 to 70 percent chert fragments; very strongly acid; gradual, wavy boundary.

B1—18 to 23 inches, light brownish-gray (2.5Y 6/2) very cherty silt loam; 75 to 90 percent chert fragments, including many fine fragments, ½ to 1 inch in size; firm in place, but friable if broken out; very strongly acid; gradual, wavy boundary.

B2—23 to 34 inches, yellowish-brown (10YR 5/4) very cherty heavy silt loam; a few splotches of light yellowish brown (10YR 6/4); few patchy clay films; massive, breaking to weak, medium, subangular blocky structure; 50 to 60 percent chert fragments; firm in place, somewhat firm if broken out; very strongly acid; gradual, wavy boundary.

C—34 to 60 inches, yellowish-brown (10YR 5/4) very cherty silty clay loam; massive, but some breakage to weak, medium, subangular blocky structure; firm in place, somewhat friable if broken out; 75 to 90 percent chert fragments, as much as 3 inches across; very strongly acid; gradual, wavy boundary.

Dr—60 inches +, cherty Beekmantown limestone.

Range in characteristics: The texture of the surface layer ranges from very stony loam to very cherty silt loam, and the texture of the subsoil from cherty loam to very cherty silty clay loam. Chert fragments and stones make up from 50 to 90 percent of the subsoil. The stones are loose limestone, very large pieces of chert, or mixtures that contain numerous sandstone boulders.

Location: Middle and upper parts of slopes in the limestone valley in the southern part of the county.

Slope: Gently sloping to steep.

Drainage: Well drained.

Permeability: Rapid.

Bodine very cherty silt loam, 5 to 12 percent slopes (BcB).—A profile of this soil is similar to the one described as representative of the series. Included in the areas mapped are small areas that have a subsoil of silty clay loam that is slightly redder than that of the typical profile.

This soil contains many small chert fragments and some very large fragments of cherty limestone and sandstone. It can be used for general farm crops, but tillage implements wear out rapidly because of the chert. *Capability unit IVs–26; woodland suitability group 1.*

Bodine very cherty silt loam, 12 to 25 percent slopes (BcC).—A profile of this soil is the one described as representative of the series. A few large fragments of sandstone are scattered on the surface. Included in the areas mapped are small spots of soils similar to the Dunmore soils.

This soil can be used for all crops commonly grown in the county, though it tends to be droughty for shallow-rooted plants like bluegrass. Crops respond to lime and to phosphate and potash. The chert makes cultivation difficult, and in some places the fragments are large enough to interfere with mowing. Chert fragments on the surface provide some protection against erosion. *Capability unit IVs–26; woodland suitability group 1.*

Bodine very cherty silt loam, 25 to 35 percent slopes (BcD).—A profile of this soil is similar to the one described as representative of the series, except it contains more large fragments of chert and sandstone. Included in the areas mapped are small areas of other soils that have a surface of very cherty loam.

The chert, stones, and steep slopes make cultivation impractical and mowing difficult. In addition, erosion is a moderate hazard. This soil is best suited to permanent pasture or woods. *Capability unit VIs–1; woodland suitability group 1.*

Bodine very stony loam, 12 to 25 percent slopes (BrC).—This soil is similar to Bodine very cherty silt loam, 12 to 25 percent slopes, except that it is slightly coarser textured, more permeable, and slightly more droughty. In addition, there are large blocks of chert and some fragments of sandstone on the surface and throughout the profile. The subsoil is either very cherty loam or very cherty silt loam. The large stones and many pieces of chert make cultivation impractical and mowing difficult. The best use for this soil is woods. *Capability unit VIIs–1; woodland suitability group 1.*

Bodine very stony loam, 25 to 35 percent slopes (BrD).—This soil is similar to Bodine very stony loam, 12 to 25 percent slopes, except that limitations on the use of equipment are more severe. It is best suited to woods. *Capability unit VIIs–1; woodland suitability group 1.*

Bodine very stony loam, 35 to 50 percent slopes (BrE).—This soil is similar to Bodine very stony loam, 12 to 25 percent slopes, except that it contains more and larger stones and is coarser textured and more droughty. Colluvial material from higher lying Dekalb soils has accumulated in some places. If well managed, this soil produces merchantable timber, but harvesting operations are somewhat difficult. *Capability unit VIIs–1; woodland suitability group 1.*

Calvin Series

This series consists of shallow to moderately deep, well-drained soils that developed from material weathered from acid, reddish-brown siltstone and shale of the Mauch Chunk formation. The Mauch Chunk formation contains thin layers of calcareous shale and siltstone, from which part of the parent material of the closely associated Teas soils was derived.

The Calvin soils are strongly acid and are low in exchangeable bases. The surface layer is reddish-brown silt loam, and the subsoil is reddish-brown heavy silt loam. The lower part of the subsoil typically is high in content of shale and siltstone.

These soils occur mainly in the western part of the county, but small areas also occur in the southern and eastern parts. In Monroe County, they are mapped only in complexes with the reddish, slightly less acid Teas and the brownish Litz soils or in undifferentiated units with the Teas soils.

Representative profile of Calvin silt loam, 15 to 25 percent slopes, in a wooded area—

A1—0 to 2 inches, dark reddish-brown (5YR 3/3) silt loam; weak, moderate, granular structure; very friable; many fine roots; medium acid; clear, wavy boundary.

A2—2 to 7 inches, dark reddish-brown (5YR 3/4) silt loam; weak, medium, granular and weak, fine, subangular blocky structure; friable; many roots; strongly acid; clear, wavy boundary.

B2—7 to 13 inches, reddish-brown (5YR 4/4) silt loam; slightly finer textured than A2 horizon; weak to moderate, medium, subangular blocky structure; friable; few silty films on ped faces; about 35 percent small reddish fragments of siltstone; strongly acid; gradual, wavy boundary.

B3—13 to 20 inches, reddish-brown (5YR 4/4) heavy silt loam; massive; somewhat firm in place but friable if broken out; 75 percent reddish blocky fragments of siltstone as much as 4 inches across; strongly acid; gradual, wavy boundary.

Dr—20 inches +, reddish-brown siltstone, somewhat broken on top.

Range in characteristics: The texture of the B horizon ranges from silt loam to coarse silty clay loam. Typically, fragments of shale and siltstone make up more than 50 percent of the lower part of the B horizon, and in places make up as much as 90 percent. The depth to bedrock ranges from about 15 inches to 28 inches.

Location: Mainly in western part of county, on dissected slopes underlain by reddish shale and siltstone.

Drainage: Well drained.

Permeability: Moderate.

Captina Series

In this series are deep, moderately well drained, nearly level to strongly sloping soils that have a fragipan in the lower part of the subsoil. These soils developed in old alluvium washed from soils that developed in material weathered from limestone or influenced by limestone.

The surface layer is dark grayish-brown silt loam, and the upper part of the subsoil is yellowish-brown silt loam or silty clay loam. A silty fragipan occurs at a depth of about 24 inches. The depth to limestone or limy shale ranges from about 4 feet to 12 feet.

These soils occur on stream terraces above overflow, mainly along Indian, Second, and Sweet Springs Creeks. They are associated with the poorly drained Robertsville soils, which are on terraces; with the Huntington, Lindside, and Melvin soils, which are on flood plains; and with the Dunmore, Frederick, Teas, and Litz soils, which are on limestone uplands.

The Captina soils are moderate in available moisture holding capacity and are moderate in productivity. All

but a few areas are used for general crops and pasture.

Representative profile of Captina silt loam, 3 to 8 percent slopes, in a field—

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; very weak, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—8 to 13 inches, light yellowish-brown (10YR 6/4) silt loam; contains about 10 percent material from Ap horizon, occurring as tongues and on faces and in cracks; very weak, thin, platy structure; somewhat firm; medium acid; clear, wavy boundary.

B1—13 to 19 inches, yellowish-brown (10YR 5/4) silt loam with ped faces of brown (10YR 5/3); moderate, medium, subangular blocky structure; friable to firm; common clay films; numerous fine pores; few small pebbles; medium acid; clear, wavy boundary.

B21—19 to 26 inches, yellowish-brown (10YR 5/6) silty clay loam; continuous clay films of light yellowish brown (10YR 6/4) on most peds; moderate, medium, subangular blocky structure; firm; common fine mottles of strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2); 5 percent gravel, as much as ¾ inch in size; slightly acid; gradual, wavy boundary.

B22m—26 to 40 inches, mottled light yellowish-brown (10YR 6/4) and strong-brown (7.5YR 5/8), heavy silt loam; continuous yellowish-brown (10YR 5/6) clay coatings and flows; moderate, medium, subangular block structure; firm to very firm; moderately well developed fragipan; 5 percent gravel, as much as 1 inch in size; common, fine manganese concretions increase in number with depth; slightly acid; abrupt, wavy boundary.

C—40 inches +, very gravelly silt loam; 40 to 60 percent fine and medium-sized gravel; fine material similar to material in B22m horizon; common manganese concretions; gravel increases in size and quantity with depth; friable to firm; medium acid; total depth to shale estimated to be about 10 feet.

Range in characteristics: The surface layer is predominantly silt loam, but in some small areas it is gravelly silt loam. The depth to the fragipan ranges from about 22 to 30 inches. The depth to gravel, limestone, or limy shale ranges from 4 to 12 feet. The gravelly substratum is not present everywhere.

Location: Terraces that are above overflow.

Slope: Nearly level to strongly sloping.

Drainage: Moderately well drained.

Permeability: Slow in fragipan.

Captina silt loam, 0 to 3 percent slopes (CaA).—This soil is similar to the soil described as representative of the series, except that surface drainage is slower and the depth to the fragipan is a few inches less. Included in the areas mapped are small areas of poorly drained soils.

Most of this soil is used for general crops. Winter damage is likely if alfalfa and winter grain are grown on this slowly permeable soil. *Capability unit IIw-2; woodland suitability group 3.*

Captina silt loam, 3 to 8 percent slopes (CaB).—A profile of this soil is the one described as representative of the series. A few small areas of well-drained soils were included in the area mapped.

Most of this soil is used for crops and for pasture. *Capability unit IIe-14; woodland suitability group 3.*

Captina silt loam, 8 to 15 percent slopes (CaC).—This soil has better surface drainage and is more subject to erosion than Captina silt loam, 3 to 8 percent slopes. The depth to bedrock or gravel normally is less, and in places there are some outcrops of limestone. Small areas of well-drained soils were included in the areas mapped.

Most of this soil is used for crops and pasture. *Capability unit IIIe-14; woodland suitability group 3.*

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Chilhowie Series

The Chilhowie series consists of well-drained, gently sloping to steep, very rocky soils that developed in material weathered from limestone of the Greenbrier formation. The limestone contains a considerable amount of clay and has a distinctive flat surface. Areas of exposed limestone, from 5 to 15 feet across, are common. The exposed limestone generally has an even surface but is characterized by small cracks and fissures.

The Chilhowie soils in Monroe County are mapped only in complexes with the Tumbez soils.

Chilhowie-Tumbez Complexes

The Chilhowie and Tumbez soils in Monroe County occur in such complex patterns that they could not be consistently separated in mapping. Consequently, they were mapped together in complexes. The Chilhowie soils make up about a quarter of each mapping unit, and the Tumbez soils make up the rest. These soils occur on smooth slopes where the limestone generally is parallel to the surface.

The Chilhowie soils show slightly more soil development than the Tumbez soils. Their surface layer is dark-brown silty clay loam, and their subsoil is very dark grayish-brown clay. The depth to limestone bedrock ranges from 16 to 26 inches. The reaction is slightly acid to neutral throughout.

The Tumbez soils show little soil development. They have a surface layer of very dark gray or black silty clay and a very dark gray, clayey subsoil. They are erodible and droughty. The depth to limestone ranges from 10 to 18 inches. The reaction is neutral to slightly akaline throughout.

Fairly large areas of the Chilhowie and Tumbez soils occur south of Union and in the vicinity of Johnson Crossroads. Smaller areas are scattered throughout the limestone valley. These soils are associated with the deeper, more strongly developed Frederick and Dunmore very rocky soils, and to a lesser extent with the nonstony Frederick and Duffield soils.

Representative profile of Chilhowie very rocky silty clay loam, 15 to 25 percent slopes, in a pasture—

Ap—0 to 5 inches, dark-brown (10YR 3/3) very rocky silty clay loam; moderate, medium, granular structure and moderate, fine, subangular blocky structure; neutral; clear, wavy boundary.

B1—5 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam to silty clay; moderate, medium and fine, subangular blocky structure; firm; some clay skins on peds; slightly acid; clear, wavy boundary.

B21—8 to 14 inches, light olive-brown (2.5Y 5/4) and grayish-brown (10YR 5/2) silty clay; moderate, fine, subangular blocky structure; firm; root holes numerous; slightly acid; gradual, wavy boundary.

B22—14 to 24 inches, very dark grayish-brown (10YR 3/2) clay with many medium splotches of light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/8); strong, fine, subangular blocky structure; firm when moist; plastic and slightly sticky when wet; numerous manganese concretions; few lime concretions just above bedrock; slightly acid to neutral; abrupt, wavy boundary.

Dr—24 inches +, limestone.

The Tumbez soils make up about three-quarters of the complex, but there are small areas where the proportion of

Tumbez soil and Chilhowie soil is about equal. Spots of bare limestone range from few to common and are 5 to 15 feet across. Rock exposures are 30 to 100 feet apart and cover about 10 to 15 percent of the surface.

Location: Uplands of the limestone valley, mainly on Greenbrier limestone.

Slope: Gently sloping to steep.

Drainage: Well drained.

Permeability: Moderately slow to slow in both soils.

Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes (CbC).—The profiles of these soils are similar to the ones described as typical of their respective series. The surface generally is smooth, but bare spots and outcrops of rock are common. Areas between outcrops can be used for pasture. The Tumbez soil makes up about three-quarters of this complex, and the Chilhowie soil makes up the rest. *Capability unit VIs–1; woodland suitability group 9.*

Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes (CbD).—Profiles of these soils are the ones described as representative of their respective series. Rock outcrops are common, and some areas of bare rock occur, but most areas can be mowed. Bluegrass grows well in these areas but is affected by drought late in summer. *Capability unit VIs–1; woodland suitability group 9.*

Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes (CbE).—These soils tend to be slightly more shallow than the soils described as typical of their respective series. There are numerous outcrops of rock but only a few spots of bare limestone. The Tumbez soil makes up from one-half to three-quarters of the unit. Included in the areas mapped are small areas of Frederick and Dunmore very rocky soils.

The soils in this unit are moderately well suited to bluegrass but are droughty late in summer. They are too rocky and too rough, however, to be used to any extent for pasture. They produce good stands of merchantable timber if well managed. *Capability unit VIIs–1; woodland suitability group 9.*

Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, severely eroded (CbE3).—These soils are similar to the Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, except that they are more shallow and more droughty and have more outcrops of rock. Much of the original surface layer has been removed by erosion, and there are many shallow gullies and some spots of bare limestone.

Yields of bluegrass are poor to fair, and management to increase yields generally is not practical. Most areas are better suited to trees than to pasture. *Capability unit VIIs–1; woodland suitability group 9.*

Clarksburg Series

This series consists of deep, moderately well drained soils that developed in colluvium weathered from the lime-influenced Litz soils and associated soils.

The surface layer is brownish silt loam, and the subsoil is yellowish-brown silty clay loam that is mottled at a depth of about 20 inches.

These soils occur mainly in the southwestern part of the county. Fairly large areas are along U.S. Highway No. 219, near Lindside. The Clarksburg soils occur next to the Litz and Teas soils but are at lower elevations. In many places they are adjacent to the Captina soils, which are on terraces, and to the Huntington, Lindside, and Melvin soils, which are on bottom lands.

The Clarksburg soils have a slowly permeable subsoil, are slightly acid, are moderate to high in available moisture holding capacity, and are moderate to high in productivity. Most of the acreage is used for crops and pasture.

Representative profile of Clarksburg silt loam, 3 to 8 percent slopes, in a meadow—

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; friable; weak, fine, granular structure; slightly acid; abrupt, smooth boundary.

A2—5 to 9 inches, yellowish-brown (10YR 5/4) silt loam; friable; weak, fine and medium, subangular blocky structure; common fine pores; slightly acid; clear, wavy boundary.

B1—9 to 11 inches, yellowish-brown (10YR 5/6–5/8), heavy silt loam; moderate, medium and coarse, subangular blocky structure; medium acid; friable; clear, wavy boundary.

B21—11 to 21 inches, yellowish-brown (10YR 5/8) silty clay loam; moderate and strong, medium and coarse, subangular blocky structure; few medium mottles of strong brown (7.5YR 5/8) and light olive gray (5Y 6/2) in lower part; few manganese coatings on peds; medium acid; gradual, wavy boundary.

B3—21 to 36 inches, yellowish-brown (10YR 5/6) silty clay loam with many medium mottles of strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2); few manganese coatings; moderate, medium and coarse, subangular blocky structure; firm; about 25 percent finely weathered shale chips; medium acid; clear, wavy boundary.

Dr—36 inches +, dark-gray (5Y 4/1) shale, somewhat broken and platy on top; in places, shale effervesces at a depth of 8 to 10 feet.

Range in characteristics: The B horizon ranges in texture from silty clay loam to silty clay and in color from hues of 10YR to hues of 7.5YR. Fragments of shale make up from 10 to 40 percent of the lower part of the B horizon. The depth to shale bedrock ranges from about 30 to 48 inches.

Location: At the base of narrow, concave, colluvial slopes.

Slope: Gently sloping to strongly sloping.

Drainage: Moderately well drained, but receives some seepage and runoff from uplands.

Permeability: Slow.

Clarksburg silt loam, 3 to 8 percent slopes (CkB).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are small spots that are slightly redder than typical, and a few areas that are slightly better drained.

All of this soil is used for crops or permanent pasture. Because of the slowly permeable subsoil, winter damage is likely if alfalfa or winter grain is grown. There are some small seepy spots, but these can be drained. *Capability unit IIe–14; woodland suitability group 2.*

Clarksburg silt loam, 8 to 15 percent slopes (CkC).—A profile of this soil is similar to the one described as representative of the series. Included in the areas mapped are some soils that are redder than typical, some that contain a little red shale, some that are well drained, and some that are severely eroded.

This soil is suited to the crops commonly grown in the county, but it needs to be well managed for control of

erosion. *Capability unit IIIe-14; woodland suitability group 2.*

Dekalb Series

The Dekalb series consists of moderately deep, well-drained to excessively drained soils that developed on the uplands in material weathered from acid, gray sandstone.

These soils occupy more than 50,000 acres in Monroe County. About three-fourths of the acreage consists of the very stony, steep and very steep Dekalb soils that are on the higher mountains. These very stony soils have a thin A1 horizon of very dark grayish-brown very stony loam; a thin, leached A2 horizon of light yellowish-brown loam; and a B horizon of yellowish-brown fine sandy loam.

The Dekalb fine sandy loams and channery loams occupy smoother, generally less steep slopes and are slightly paler and a little more leached than the very stony Dekalb soils. These soils have a thin A1 horizon of dark grayish-brown fine sandy loam or channery loam; a moderately thick A2 horizon of brown fine sandy loam or loam; and a B2 horizon of yellowish-brown fine sandy loam.

In all of the Dekalb soils, profile development is weak below the surface horizon, and there is little or no accumulation of clay in the subsoil.

The Dekalb soils are extensive on the upper part of slopes on Peters, Potts, and Flattop Mountains and on the side slopes and ridges of other mountains in the county. They are more shallow than the associated Hartsells and Wellston soils; have a lower content of organic matter than the very stony Summers soils; and are upslope from the shallow Montevallo soils.

The very stony Dekalb soils are mostly in forests of mixed hardwoods. Most of the smoother areas of the nonstony Dekalb soils are used for general farming.

Representative profile of Dekalb very stony loam, 35 to 50 percent slopes, in a wooded area—

A00—3 inches to ½ inch, good ground cover of hardwood leaf litter.

A0—½ inch to 0, partly decomposed, compacted leaf litter containing a few sand grains.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) very stony loam; weak, fine, granular structure; very friable to loose; many fine roots; very strongly acid; abrupt, irregular boundary.

A2—2 to 4 inches, light yellowish-brown (10YR 6/4) very stony loam; very weak, fine, subangular blocky structure; very friable, but slightly compact in place; very strongly acid; clear, irregular boundary.

B2—4 to 14 inches, yellowish-brown (10YR 5/4–5/6) fine sandy loam; weak, fine, subangular blocky structure; 25 percent small, broken pieces of sandstone and some large sandstone fragments; friable; no clay films observed; mixed material from A1 horizon in few root holes and cracks; very strongly acid; gradual, irregular boundary.

C—14 to 30 inches, yellowish-brown (10YR 5/4) fine sandy loam that grades to sandy loam with depth; massive; 50 to 60 percent broken pieces of sandstone; friable to loose; very strongly acid; gradual, irregular boundary.

Dr—30 inches +, acid gray Pocono sandstone, somewhat broken on top.

Range in characteristics: The texture of the A horizon ranges from loam or very stony loam to fine sandy loam. In the nonstony soils, the A2 horizon is brown (10YR 5/3) and is about 6 inches thick. In the stony soils, this horizon is gray (10YR 6/1) in places and is about 2 inches thick. Thin micropodzol sequences are common on wooded mountain slopes. The B2 horizon ranges from fine loam to sandy loam. The depth to bedrock ranges from 18 to 40 inches. Stones range from very large flagstones to angular boulders, 8 to 10 feet across.

Location: On the upper parts of slopes and on ridges of Peters, Potts, Flattop, and other mountains.

Drainage: Well drained to somewhat excessively drained.

Permeability: Moderately rapid.

Dekalb channery loam, 5 to 12 percent slopes (DaB).—A profile of this soil is similar to the one described as representative of the series, except that there are no large stones or boulders on the surface but many channery fragments of sandstone. Included in the areas mapped are small areas of soils that have a slightly redder subsoil and are underlain by pinkish sandstone.

This soil is fairly well suited to corn, small grain, red clover, timothy, and alfalfa, but it needs lime and fertilizer at short interveals. If tilled crops are grown, contour strips and other practices are needed to control erosion. *Capability unit IIIe-12; woodland suitability group 5.*

Dekalb channery loam, 12 to 25 percent slopes (DaC).—A profile of this soil is similar to the one described as representative of the series. The stones on the surface consist mainly of small fragments of sandstone and a few large standstone boulders.

Corn, small grain, clover, timothy, and alfalfa grow fairly well, but lime and fertilizer should be applied at short intervals. If tilled crops are grown, contour strips and other practices are needed to control erosion. *Capability unit IVe-5; woodland suitability group 5.*

Dekalb channery loam, 25 to 35 percent slopes (DaD).—A profile of this soil is similar to the one described as representative of the series. There are no large stones or boulders on the surface, but there are many small fragments of sandstone.

This soil is best suited to permanent pasture and to woods. Frequent applications of lime and fertilizer are needed to maintain a good grass cover. Farm equipment can be used on most slopes. *Capability unit VIe-4; woodland suitability group 5.*

Dekalb fine sandy loam, 5 to 12 percent slopes (DbB).—A profile of this soil is similar to the one described as representative of the series, except that this soil is not stony, and it is somewhat sandier than the representative soil. This soil occurs on smooth slopes and ridges. Yields of most crops are fair. Frequent applications of fertilizer are needed, however, to keep the soil productive. *Capability unit IIIe-12; woodland suitability group 5.*

Dekalb fine sandy loam, 12 to 25 percent slopes (DbC).—This soil is similar to Dekalb fine sandy loam, 5 to 12 percent slopes. It is suitable for tilled crops grown in rotation, but frequent applications of fertilizer are needed. *Capability unit IVe-5; woodland suitability group 5.*

Dekalb fine sandy loam, 25 to 35 percent slopes (DbD).—This soil is similar to Dekalb fine sandy loam, 5 to 12 percent slopes. It occurs on smooth side slopes and contains some large stones. It is best suited to permanent pasture and trees. *Capability unit VIe-4; woodland suitability group 5.*

Dekalb very stony loam, 10 to 25 percent slopes (DeC).—A profile of this soil is similar to the one described as representative of the series. Many stones too large to be moved are on the surface and throughout the profile. Most of this soil is in forest and should remain in forest. Only a few areas can be used for pasture, and these areas have severe limitations that restrict their use. *Capability unit VIIs–2; woodland suitability group 5.*

Dekalb very stony loam, 25 to 35 percent slopes (DeD).—A profile of this soil is the one described as representative of the series. Stones, steep slopes, periodic droughtiness, low natural fertility, and difficulty of access make this soil better suited to woods than to pasture. *Capability unit VIIs–2; woodland suitability group 5.*

Dekalb very stony loam, 35 to 50 percent slopes (DeE).—A profile of this soil is the one described as representative of the series. There are both outcrops of rock and large, loose sandstone boulders on the surface. This soil represents almost a quarter of the acreage of Dekalb soils in the county. It is mostly in forest and should remain in forest because of severe limitations for other uses. Some areas are suitable for recreational sites. *Capability unit VIIs–2; woodland suitability group 5.*

Dekalb very stony loam, 50 to 70 percent slopes (DeF).—A profile of this soil is similar to the one described as representative of the series. This soil makes up about 40 percent of the acreage of Dekalb soils in the county. It is on the very steep sides of mountains, and most of it is in forest and should remain in forest. It can be used for recreational sites, for well-vegetated watersheds, and to provide food and cover for wildlife. *Capability unit VIIs–2; woodland suitability group 5.*

Duffield Series

The Duffield series consists of deep, strongly sloping to steep, well-drained soils on rolling uplands. These soils developed under a forest of hardwoods in material weathered from the silty strata in Greenbrier limestone. This rock, from which the lime apparently has been leached, is locally called "soapstone." It is yellowish brown, porous, and relatively soft. In some places it is massive, and in others it is bedded like shale, but generally it has a smooth surface and is overlain by soils that are fairly uniform in depth.

The Duffield soils are strongly acid. The surface layer is dark grayish-brown silt loam, and the subsoil is yellowish-brown silty clay or clay.

These soils occur in the broad limestone valley in the north-central part of the county. They are associated with the Frederick soils, which have a redder subsoil and which formed in material weathered from relatively hard limestone; with the moderately well drained Pickaway soils; and with the more rocky Frederick and Dunmore soils.

The Duffield soils are low in content of organic matter, high in available moisture holding capacity, and moderate to high in productivity. Most of the acreage is used for crops and pasture.

Representative profile of Duffield silt loam, 3 to 10 percent slopes, in a meadow [7]—

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; very weak, fine, granular structure; very friable; neutral; abrupt, smooth boundary.

A2—7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; very friable; slightly acid; clear, wavy boundary.

B21—10 to 19 inches, yellowish-brown (10YR 5/8) silty clay loam with faces of yellowish brown (10YR 5/4); moderate, medium, subangular blocky structure; friable; common clay films, somewhat degraded; strongly acid; gradual, wavy boundary.

B22—19 to 29 inches, yellowish-brown (10YR 5/8) silty clay with faces of yellowish brown (10YR 5/4); strong, medium and coarse, blocky structure; firm; prominent continuous clay films; strongly acid; clear, wavy boundary.

B3—29 to 33 inches, yellowish-brown (10YR 5/6) silty clay; weak, medium and coarse, blocky structure; 20 percent material from C horizon, in lenses and layers; friable; strongly acid; clear, wavy boundary.

C—33 to 38 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6), weathered, massive, soft "soapstone" that can be broken in hands, harder with depth; material rubs down to silt loam; strongly acid; gradual, wavy boundary.

Dr—38 inches +, hard, silty limestone.

Range in characteristics: The surface layer is silt loam or very rocky silt loam. The silt loams range from about 3 feet to 6 feet in depth to bedrock, but over fairly large areas the depth to bedrock is fairly uniform and limestone ledges are few. On the very rocky silt loams, the outcrops of rock are from 30 to 100 feet apart and cover from 10 to 15 percent of the surface.

Location: Uplands of the limestone valley, in the north-central part of the county.

Slope: Gently sloping to strongly sloping; slope range is from 3 to 45 percent.

Drainage: Well drained.

Permeability: Moderate.

Duffield silt loam, 3 to 10 percent slopes (DfB).—A profile of this soil is the one described as representative of the series. Part of the original surface layer has been removed by erosion.

This soil is friable and easy to cultivate. It can be used for most crops commonly grown on the limestone soils in the county. Simple erosion-control measures, such as contour cultivation, contour stripcropping, and sodded waterways are needed. *Capability unit IIe–1; woodland suitability group 1.*

Duffield silt loam, karst, 3 to 10 percent slopes (DkB).—A profile of this soil is similar to the one described as representative of the series. Round sinkholes are common in the landscape. Generally, the shoulders of the sinkholes are severely eroded, and there is a thick accumulation of surface soil on the bottom of the holes. Included in the areas mapped are small areas of soils that have slopes of more than 10 percent.

Because of the many sinkholes, contour cultivation and contour stripcropping are difficult. Row crops generally are grown in straight lines regardless of the gradient, and in a few places the soil is cultivated up and down the slope. The irregular surface makes the growing of row crops hazardous. If the soil is well managed and erosion is controlled, the most intensive safe rotation is corn, a small grain, and 2 years of hay. *Capability unit IIIe–1; woodland suitability group 1.*

Duffield silt loam, 10 to 20 percent slopes (DfC).—A profile of this soil is similar to the one described as repre-

[7] Chemical and physical data for profile S58WVa–32–2–(1–6) appears in the section "Laboratory Data on Selected Soil Profiles."

sentative of the series. The slopes are relatively smooth, and sinkholes are not a problem.

This soil is easily tilled, and it is productive, but intensive conservation practices are needed to control erosion and to maintain fertility. *Capability unit IIIe-1; woodland suitability group 1.*

Duffield silt loam, karst, 10 to 20 percent slopes (DkC).—This soil is similar to Duffield silt loam, karst, 3 to 10 percent slopes. Included in the areas mapped are small areas of soils from which most of the original surface layer has been removed by erosion.

Stripcropping is not practical on this soil, because of the many sinkholes. To prevent soil loss and to maintain fertility and productivity, this soil should be used to grow long-term hay. *Capability unit IVe-1; woodland suitability group 1.*

Duffield silt loam, 20 to 30 percent slopes (DfD).—A profile of this soil is similar to the one described as representative of the series, except that the depth to bedrock is slightly less. This soil is subject to severe erosion if not protected by a good vegetative cover. If carefully managed it can be used for long-term hay. A row crop can be grown in a long rotation. *Capability unit IVe-1; woodland suitability group 1.*

Duffield silt loam, 20 to 30 percent slopes, severely eroded (DfD3).—This soil has lost most of the original surface layer through erosion, and in some places there are gullies. This soil is not suitable for either row crops or hay. Erosion-control measures are needed. Critical areas should be seeded and mulched. Permanent pastures need lime and fertilizer. *Capability unit VIe-1; woodland suitability group 1.*

Duffield silt loam, 30 to 45 percent slopes (DfE).—This soil is subject to moderate erosion, and it should be kept in permanent pasture. The slopes generally are less than 35 percent, and farm machinery can be used on much of the acreage. There are, however, a few outcrops of rock. *Capability unit VIe-1; woodland suitability group 1.*

Duffield very rocky silt loam, 5 to 20 percent slopes (DrC).—This soil is similar to Duffield silt loam, 10 to 20 percent slopes, except that in most places it is a little more shallow, and there are some outcrops of limestone. The outcrops interfere to some extent with tillage, but much of the acreage can be mowed and treated with farm machinery. Most areas are well suited to pasture. *Capability unit VIs-1; woodland suitability group 9.*

Duffield very rocky silt loam, 20 to 30 percent slopes (DrD).—This soil is similar to Duffield very rocky silt loam, 5 to 20 percent slopes, but there are more outcrops of rock.

This soil is subject to severe erosion if not protected. It is best suited to permanent pasture. Much of the acreage can be mowed and treated with machinery. *Capability unit VIs-1; woodland suitability group 9.*

Duffield very rocky silt loam, 30 to 45 percent slopes (DrE).—This soil needs good management for control of erosion. It has more outcrops of rock than Duffield very rocky silt loam, 20 to 30 percent slopes, and it is more difficult to mow. Most areas are suitable for permanent pasture, but these areas need regular applications of lime and fertilizer. *Capability unit VIIs-1; woodland suitability group 9.*

Dunmore Series

This series consists of deep, well-drained, cherty soils on rolling uplands of limestone. Although these soils developed in material weathered from Beekmantown limestone of Ordovician age, they are strongly acid or very strongly acid throughout the profile. The clay in the soil material is high in kaolinite.

These soils have a cherty, dark grayish-brown surface layer and a yellowish-red to red subsoil that ranges in texture from silty clay in the upper part to plastic, sticky clay in the lower part. The slope range is from gently sloping to moderately steep (fig. 9).

The Dunmore soils occupy a long, narrow valley just north of Peters Mountain. They commonly occur next to the deep, colluvial Murrill and Laidig soils, which are at the base of Peters Mountain, and are adjacent to the shallow Montevallo soils, which are on the mountain slopes to the north. The Dunmore soils resemble the Frederick soils, except that they have a more plastic, sticky subsoil, and they developed in material weathered from much older limestone, which, when weathered, yields large amounts of kaolinitic clay. The very rocky Dunmore soils have been mapped in undifferentiated units with the very rocky Frederick soils, and these mapping units are described under the heading "Frederick Series."

The Dunmore soils are moderate in available moisture holding capacity and are moderately to highly productive.

***Figure 9.*—Roadbank south of Lindside showing Dunmore cherty silt loam, 3 to 8 percent slopes.**

Representative profile of Dunmore cherty silt loam, 8 to 15 percent slopes, in a pasture [8]—

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) cherty silt loam; very weak, fine, granular structure; 30 percent chert fragments; slightly acid; abrupt, smooth boundary.

A2—7 to 12 inches, brown (7.5YR 5/4) heavy silt loam; weak, fine, subangular blocky and very weak, thin, platy structure; 20 percent chert; friable; strongly acid; clear, wavy boundary.

B1—12 to 17 inches, yellowish-red (5YR 5/6) silty clay with faces of reddish brown (2.5YR 4/4); moderate, fine and medium, subangular blocky structure; thin, continuous clay films; 5 percent chert fragments; friable; strongly acid; clear, wavy boundary.

B2—17 to 27 inches, reddish-brown (5YR 4/4) clay with faces of yellowish red (5YR 5/6); strong, medium and fine, blocky structure; very prominent clay films; firm; plastic and slightly sticky when wet, smooth and waxy to feel; 5 percent chert fragments; strongly acid; gradual, wavy boundary.

B3 or C—27 to 48 inches, yellowish-red (5YR 5/6) clay with faces and streaks of strong brown (7.5YR 5/6); weakly massive, breaking to moderate, coarse, blocky structure and some moderate, thick, platy structure; friable to firm; 10 percent reddish-yellow (7.5YR 6/6) rotten siltstone occurs as thin streaks; strongly acid; gradual, wavy boundary.

C—48 to 55 inches +, strong-brown (7.5YR 5/6) rotten "soapstone"; somewhat brittle in place, but easily crushed; friable; contains less than 5 percent chert; strongly acid.

Range in characteristics: The texture of the surface layer is dominantly cherty silt loam, but in some areas the texture is silt loam. The silt loams contain some chert on the surface and throughout the profile. The texture of the subsoil ranges from silty clay to very plastic clay. The depth to limestone ranges from 3 to 8 feet, but in places there are some outcrops of limestone.

Location: Uplands of the limestone valley, and Sweet Springs and Green Valleys just north of Peters Mountain.

Slope: Gently sloping to moderately steep.

Drainage: Well drained.

Permeability: Moderately slow to moderate.

Dunmore cherty silt loam, 3 to 8 percent slopes (DtB).—A profile of this soil is similar to the one described as representative of the series. This soil is well suited to all crops commonly grown in the county. If tilled crops are grown, contour stripcropping and other erosion-control measures are needed. Diversion terraces can be used effectively to intercept runoff from adjacent slopes. Some areas contain enough large pieces of chert to interfere with mowing. *Capability unit IIe–1; woodland suitability group 1.*

Dunmore cherty silt loam, 8 to 15 percent slopes (DtC).—A profile of this soil is the one described as representative of the series. This soil is moderately susceptible to sheet erosion.

Corn, small grain, red clover, orchardgrass, and alfalfa grow well, but tilled crops should be grown in contour strips to control erosion. Diversion terraces are needed on some long slopes to control erosion or to intercept runoff from higher areas. *Capability unit IIIe–1; woodland suitability group 1.*

Dunmore cherty silt loam, 15 to 25 percent slopes (DtD).—A profile of this soil is similar to the one described as representative of the series. In places there are a few outcrops of limestone.

This soil needs careful management and a long rotation to maintain productivity. A suitable rotation is corn, a small grain, and then a mixture of alfalfa and grass for 2 years or more. These crops should be grown in contour strips. Field strips should be used in areas where sinkholes make stripcropping impractical. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from higher areas. *Capability unit IVe–1; woodland suitability group 1.*

Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded (DuD3).—This soil is similar to Dunmore cherty silt loam, 15 to 25 percent slopes, except that most of the original surface layer has been removed by erosion, and some shallow gullies have formed.

This soil is best suited to bluegrass-white clover pasture. Lime and fertilizer should be applied according to need as shown by soil tests. Gullies need to be sloped, seeded, and mulched. Diversion terraces are needed in places to divert water from gullied areas. Pastures should be mowed regularly to control weeds and brush and to prevent the bunchy growth of pasture grasses. *Capability unit VIe–1; woodland suitability group 1.*

Dunmore silt loam, 3 to 8 percent slopes (DvB).—A profile of this soil is similar to the one described as representative of the series, except that the content of chert in the surface horizon is less than 15 percent. Consequently, this soil is a little more susceptible to erosion.

Corn, small grain, alfalfa, red clover, orchardgrass, and bluegrass grow well. However, if tilled crops are grown, contour stripcropping and other erosion-control measures are needed. Diversion terraces can be used to divert runoff from higher slopes. *Capability unit IIe–1; woodland suitability group 1.*

Dunmore silt loam, 8 to 15 percent slopes (DvC).—A profile of this soil is similar to the one described as representative of the series, except that the content of chert in the surface horizon is less than 15 percent. Consequently, this soil is a little more susceptible to erosion, especially to sheet erosion.

Corn, small grains, red clover, orchardgrass, and alfalfa grow well. Tilled crops should be grown in contour strips to control erosion. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from higher slopes. *Capability unit IIIe–1; woodland suitability group 1.*

Dunmore silt loam, 15 to 25 percent slopes (DvD).—This soil is similar to Dunmore cherty silt loam, 15 to 25 percent slopes, except that it contains less chert and, consequently, is more susceptible to sheet erosion. Included in the areas mapped are small areas of severely eroded soils.

This soil needs about the same management and treatment as the cherty Dunmore soil. A rotation of corn, a small grain, and then a mixture of alfalfa and orchardgrass for 2 years or more is needed to control erosion and to maintain organic matter. Crops should be grown in contour strips. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from higher slopes. *Capability unit IVe–1; woodland suitability group 1.*

[8] Chemical and physical data for profile S58WVa–32–4–(1–6) appears in section "Laboratory Data on Selected Soil Profiles."

Frederick Series

The Frederick series consists of deep, well-drained, moderately permeable soils on the uplands. These soils developed under a cover of hardwoods, in material weathered from Greenbrier limestone. They are strongly acid to medium acid.

The surface layer is friable, dark grayish-brown cherty silt loam or silt loam. The subsoil is reddish-brown to red silty clay to clay.

The Frederick soils are extensive in the broad limestone valley that occupies the north-central part of the county. They are associated with the moderately well drained Pickaway soils; with the more silty, less red Duffield soils, which have thinner B horizons and are more uniform in depth; and with the very rocky Dunmore soils.

The Frederick soils are high in available moisture holding capacity and are moderately to highly productive.

The very rocky Frederick soils are mapped in undifferentiated units with the very rocky, very steep Bodine soil and with the very rocky Dunmore soils.

Representative profile of Frederick cherty silt loam, 3 to 8 percent slopes, in a cropped field [9]—

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) cherty silt loam; very weak, fine, granular structure; very friable; 20 percent chert fragments, 1 to 2 inches in size; medium acid; abrupt, smooth boundary.

A2—7 to 13 inches, yellowish-brown (10YR 5/4) cherty silt loam; weak, fine, granular structure and weak, thin, platy structure; very friable; 20 percent chert fragments; strongly acid; clear, wavy boundary.

A3—13 to 19 inches, reddish-brown (5YR 5/4) heavy silt loam; faces and cracks coated with material from A2 horizon; moderate, fine and medium, subangular blocky structure; friable; 25 percent chert fragments; thin clay films; strongly acid; clear, wavy boundary.

B21—19 to 32 inches, reddish-brown (2.5YR 4/4) silty clay with faces of reddish brown (5YR 5/4); strong, medium and fine, blocky structure; firm; 25 percent chert fragments; continuous clay films; medium acid; gradual, wavy boundary.

B22—32 to 48 inches, red (2.5YR 4/6) silty clay with faces of yellowish red (5YR 5/6); strong, coarse and medium, blocky structure; firm; prominent clay films; 30 percent chert fragments; medium acid; gradual, irregular boundary.

C—48 to 63 inches +, dark-red (2.5YR 3/6) clay with faces and streaks of strong brown (7.5YR 5/6); massive, some breakage to moderate, coarse, blocky structure; firm when dry, plastic and slightly sticky when wet; 40 percent chert fragments, as much as 4 inches across; medium acid; boundary abrupt to limestone; top of limestone very irregular with many spires and hummocks making total depth variable.

Range in characteristics: The depth to limestone varies within short distances. In most places the limestone is at a depth of 3 feet or more, but in some places small spires and irregular ledges are within a foot of the surface.

Location: On broad uplands of the limestone valley.

Slope: Gently sloping to steep.

Drainage: Well drained.

Permeability: Moderate.

Frederick cherty silt loam, 3 to 8 percent slopes (FcB).—A profile of this soil is the one described as representative of the series. Slopes generally are short and irregular. Included in the areas mapped are small spots of Pickaway and Duffield soils and small areas of soils that have a browner, heavier, slightly acid subsoil.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well. If tilled crops are grown, short slopes should be tilled on the contour, and long slopes should be stripcropped on the countour to help control erosion. *Capability unit IIe-1; woodland suitability group 1.*

Frederick cherty silt loam, karst, 3 to 8 percent slopes (FkB).—This soil is similar to the Frederick cherty silt loam, 3 to 8 percent slopes, except that there are numerous shallow sinkholes and depressions that form short, irregular slopes. In places the sinkholes have open, visible outlets.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well. Contour stripcropping generally is not practical. If tilled crops are grown, field stripcropping is needed to reduce soil loss. In field stripcropping, alternate strips of close-growing and clean-tilled crops are grown across the general slope and as nearly on the contour as possible. *Capability unit IIIe-1; woodland suitability group 1.*

Frederick cherty silt loam, 8 to 15 percent slopes (FcC).—A profile of this soil is similar to the one described as representative of the series. There are a few ledges of limestone.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well, but contour stripcropping is needed to control erosion in tilled fields. *Capability unit IIIe-1; woodland suitability group 1.*

Frederick cherty silt loam, karst, 8 to 15 percent slopes (FkC).—This soil is similar to Frederick cherty silt loam, karst, 3 to 8 percent slopes, except that the slopes are longer, steeper, and more irregular, and there are more ledges on the shoulders and rims of sinkholes. Small areas of this soil are eroded to the extent that much of the plow layer is reddish-brown, heavy silt loam.

This soil is not well suited to row crops, because of the very irregular slopes, but it can be used for long-term hay. Management practices should include minimum tillage, management of residues, and cross-slope cultivation. *Capability unit IVe-1; woodland suitability group 1.*

Frederick cherty silt loam, 15 to 25 pecent slopes (FcD).—A profile of this soil is similar to the one described as representative of the series. Slopes normally are fairly uniform but are not long. Included in the areas mapped are small areas of severely eroded soils on the shoulders and rims of sinkholes.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well. Contour stripcropping is needed in tilled fields to control erosion. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from higher slopes. *Capability unit IVe-1; woodland suitability group 1.*

Frederick cherty silt loam, 25 to 45 percent slopes (FcE).—This soil is similar to Frederick cherty silt loam, 3 to 8 percent slopes, except that there are more outcrops of rock.

This soil should be maintained as permanent pasture. Pastures need to be well managed. Lime and fertilizer should be applied according to need as indicated by soil tests. *Capability unit VIe-1; woodland suitability group 1.*

Frederick silt loam, 3 to 8 percent slopes (FdB).—A profile of this soil is similar to the one described as repre-

[9] Chemical and physical data for profile S58WVa-32-8-(1-6) appears in the section "Laboratory Data on Selected Soil Profiles."

sentative of the series, except that this soil has little or no chert on the surface or in the profile. This soil is easier to till than the cherty soil, but it is slightly more erodible.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well. If tilled crops are grown, short slopes should be tilled on the contour and long slopes stripcropped on the contour, to control erosion. *Capability unit IIe–1; woodland suitability group 1.*

Frederick silt loam, karst, 3 to 8 percent slopes (FmB).—This soil is similar to the soil described as representative of the series, but it contains only a small amount of chert, and there are many sinkholes that form short, irregular slopes. In a few places it is eroded to the extent that much of the plow layer is reddish-brown, heavy silt loam.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well, but field stripcropping is needed to reduce soil loss in tilled fields. *Capability unit IIIe–1; woodland suitability group 1.*

Frederick silt loam, 8 to 15 percent slopes (FdC).—This soil is similar to the soil described as representative of the series, except that it is less cherty. Included in the areas mapped are small areas of severely eroded soils.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well, but contour stripcropping is needed to control erosion in tilled fields. *Capability unit IIIe–1; woodland suitability group 1.*

Frederick silt loam, karst, 8 to 15 percent slopes (FmC).—This soil is similar to the one described as representative of the series, except that it contains only a small amount of chert. However, slopes are very irregular, and there are many sinkholes. Consequently, this soil is not well suited to row crops, but it can be used for long-term hay. Reseeding by disking helps to prevent soil loss. Field stripcropping is also needed to control erosion. *Capability unit IVe–1; woodland suitability group 1.*

Frederick silt loam, 15 to 25 percent slopes (FdD).—This soil is similar to Frederick cherty silt loam, 15 to 25 percent slopes, except that it is less cherty and is a little more erodible.

Corn, wheat, red clover, timothy, orchardgrass, and alfalfa grow well. Contour stripcropping is needed in tilled fields to control erosion. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from higher slopes. *Capability unit IVe–1; woodland suitability group 1.*

Frederick silt loam, 25 to 45 percent slopes (FdE).—This soil is similar to the one described as representative of the series, except that it is shallower and less cherty, and there are more outcrops of limestone. In most places the slope range is from 25 to 35 percent. Included in the areas mapped are small areas of severely eroded soils.

This soil is well suited to permanent pasture. Lime and fertilizer should be applied according to need as indicated by soil tests. *Capability unit VIe–1; woodland suitability group 1.*

Frederick and Bodine very rocky soils, 45 to 60 percent slopes (FrF).—These soils are somewhat similar to the Frederick and Dunmore very rocky soils, except that the Bodine soil contains a considerable amount of coarse chert. Slopes are very steep, short, and irregular, and there are many limestone ledges. The Bodine soil occurs mainly in the southern part of the county, and the more extensive Frederick soil is scattered throughout the limestone valley in the north-central part. Any given unit may consist entirely of the Frederick soil or entirely of the Bodine soil, or it may contain some of both soils. Included in the areas mapped are some small severely eroded spots.

Yields of bluegrass are low if pastures are not mowed and fertilized. It is not practical, however, to use farm machinery on these steep, rocky slopes. These soils are best suited to woods. *Capability unit VIIs–1; woodland suitability group 9.*

Frederick and Dunmore Very Rocky Soils

These undifferentiated units are made up of shallow to deep, well-drained, mostly medium-textured soils that developed in material weathered from Greenbrier limestone in the north-central part of the county and, to a lesser extent, in material weathered from Beekmantown limestone in Sweet Springs Valley. Outcrops of rock and ledges of hard limestone make up from 2 to 5 percent of the surface, and there are many large pieces of chert and some loose limestone on the surface. The slopes are short, the surface is irregular, and sinkholes are common. Drainage is largely through these sinkholes into underground streams. The areas mapped may be all Frederick soil or all Dunmore soil, or they may contain both soils. The Frederick soil is the most common.

These soils vary greatly in depth within short distances. They are mostly moderately deep or deep, but near outcrops of rock, they commonly are shallow or very shallow, although there are some moderately deep or deep soils close to sloping outcrops of limestone.

The very rocky Frederick soil is generally redder and more plastic than the typical Frederick soil. It is extensive in the north-central part of the county. The very rocky Dunmore soil is similar to the nonstony Dunmore soil, and it is common in Sweet Springs Valley. The shallow and very shallow Frederick and Dunmore soils, near outcrops of rock, commonly have a finer textured, darker colored surface layer and are less acid than the deeper soils of their respective series.

These soils commonly occur as small areas within larger areas of the nonstony Frederick, Duffield, and Dunmore soils (fig. 10). They also occur near the very rocky Chilhowie-Tumbez soils and the very rocky Duffield soils.

The Frederick and Dunmore very rocky soils were mapped in undifferentiated units because of the rocks that affect their use and management. They are too rocky to be plowed, but farm machinery can be used to a limited extent for mowing and fertilizing on slopes of less than 25 percent. These soils are moderately productive of bluegrass and white clover pasture.

Frederick and Dunmore very rocky soils, 3 to 15 percent slopes (FsC).—These soils are very rocky, but there are areas between the rocks that can be mowed. In these areas, the soils are deep, have a high water-holding capacity, and produce excellent bluegrass pasture. Lime and fertilizer should be applied according to need as indicated by soil tests. *Capability unit VIs–1; woodland suitability group 9.*

Frederick and Dunmore very rocky soils, 15 to 25 percent slopes (FsD).—These soils are similar to Frederick and Dunmore very rocky soils, 3 to 15 percent slopes, except

Figure 10.—**View south of Gap Mills. In the foreground are cherty Dunmore soils on which there are many sinkholes; in the left background are steep Frederick and Dunmore very rocky soils.**

that there are more outcrops of limestone. Small areas of severely eroded soils were included in mapping.

These soils can be used for pasture, but yields will be moderate because the outcrops of rock limit the use of farm machinery for mowing and fertilizing. *Capability unit VIs-1; woodland suitability group 9.*

Frederick and Dunmore very rocky soils, 25 to 45 percent slopes (FsE).—These soils are similar to Frederick and Dunmore very rocky soils, 3 to 15 percent slopes, except that there are more outcrops of rock and more shallow areas. Some small severely eroded spots were included in mapping.

These soils can be used for trees and to a limited extent for pasture. If used for pasture, they should be properly stocked, and the stock should be removed in winter. In many areas the use of farm machinery is not practical. Water-control measures are needed in some places. *Capability unit VIIs-1; woodland suitability group 9.*

Guthrie Series

The Guthrie series consists of moderately deep to deep, somewhat poorly drained to poorly drained, plastic soils. These soils developed mainly in material weathered from argillaceous limestone of the Greenbrier and Beekmantown formations and to some extent in colluvial material washed from adjoining soils that formed in weathered limestone material. They occupy nearly level to slightly depressed areas on the lower part of slopes on the uplands. Internal drainage is slow to very slow, and surface drainage generally is poor.

The surface layer is dark grayish-brown silty clay loam, and may have a few brown mottles. The subsoil is gray, plastic, sticky silty clay or clay that is gleyed and strongly mottled.

The Guthrie soils occur mainly in shallow depressions within larger areas of moderately well drained Pickaway soils and well drained Duffield soils. They also occur next to and within areas of the Frederick and Dunmore soils. They are used for pasture and crops.

726-713—65——6

Representative profile of Guthrie silty clay loam, on 0 to 5 percent slopes, in a field—

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silty clay loam; few fine mottles of strong brown (7.5YR 5/6) and gray brown (10YR 5/2); very weak, fine, granular structure; somewhat firm; slightly acid; abrupt, wavy boundary.

B21g—9 to 15 inches, gray-brown (10YR 5/2) silty clay loam; many medium mottles of strong brown (7.5YR 5/6); few manganese concretions; strong, coarse, blocky structure; firm when moist, plastic and slightly sticky when wet, hard when dry; strongly acid; clear, wavy boundary.

B22g—15 to 30 inches, gray (10YR 5/1) silty clay; many coarse mottles of strong brown (7.5YR 5/8); strong coarse, blocky structure; hard when dry, very firm when moist, plastic and sticky when wet; common medium concretions of manganese; strongly acid; gradual, wavy boundary.

Cg—30 to 36 inches, gray (2.5Y 5/0) clay; common large mottles of strong brown (7.5YR 5/6); massive, with some breakage to medium, coarse, blocky structure; very firm when moist, plastic and sticky when wet; common, fine and medium concretions of manganese; slightly acid; abrupt boundary.

Dr—36 inches +, limestone bedrock.

Range in characteristics: The texture of the B horizon ranges from silty clay loam to clay. The depth to limestone bedrock ranges from about 20 to 60 inches. Manganese concretions may occur in the subsoil.

Location: Nearly level to slightly depressed areas on the lower part of slopes, on limestone uplands.

Slope: Level to about 5 percent.

Drainage: Somewhat poorly drained on gentle slopes to poorly drained in level areas near drainageways. In places surface drainage is poor because of runoff from higher areas.

Permeability: Slow to very slow in the lower part of the subsoil.

Guthrie silty clay loam (Gu).—A profile of this soil is the one described as representative for the Guthrie series. Included in the areas mapped are very small areas of poorly drained and very poorly drained soils that have a dark-colored surface layer.

This soil responds moderately well to surface drainage where outlets exist. In most places it occurs in such small individual areas that it is farmed with the rest of the field, which generally contains some Pickaway soils. Grasses and legumes that tolerate wetness are best suited. *Capability unit IVw-1; woodland suitability group 11.*

Hartsells Series

The Hartsells series consists of deep, gently sloping to strongly sloping soils that developed on the uplands in material weathered from acid, gray sandstone of Mississippian age. These soils are strongly acid throughout and are moderately permeable.

The surface layer is dark grayish-brown, very friable fine sandy loam, and the subsoil is yellowish-brown fine sandy clay loam.

These soils occupy smooth, broad ridges. They are closely associated with the more silty Wellston soils, which are adjacent to or within larger areas of the Hartsells soil. In Monroe County, the Hartsells and Wellston soils are mapped only in undifferentiated units. The Hartsells soils are also associated with the shallower, less well de-

veloped Dekalb soils and with the moderately well drained Tilsit soils.

The Hartsells soils warm up early in spring and are easily tilled. They have moderate to high available moisture holding capacity, have a low content of organic matter, and are moderately productive. Much of the acreage is used for crops and pasture.

Representative profile of Hartsells fine sandy loam, 3 to 10 percent slopes, in a wooded area—

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; strongly acid; abrupt, wavy boundary.

A2—3 to 13 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, subangular blocky structure and very weak, medium, platy structure; somewhat firm in place, but very friable if broken out; strongly acid; clear, wavy boundary.

B21—13 to 18 inches, yellowish-brown (10YR 5/6) fine sandy clay loam; weak and moderate, fine and medium, subangular blocky structure; friable to firm; common discontinuous clay films; strongly acid; clear, wavy boundary.

B22—18 to 28 inches, yellowish-brown (10YR 5/8) sandy clay loam; moderate, medium, subangular blocky structure; firm; many, patchy, thin clay films of yellowish brown (10YR 5/4); strongly acid; gradual, wavy boundary.

C—28 to 41 inches, yellowish-brown (10YR 5/8) fine sandy loam or loam; massive, with some breakage to very weak, coarse, subangular blocky structure; friable; 50 percent soft, weathered, yellowish-brown (10YR 5/4) and red (2.5YR 4/8) sandstone fragments; strongly acid; gradual boundary.

Dr—41 inches +, gray, acid sandstone, some reddish streaks; soft on top, but massive and harder with depth.

Range in characteristics: The texture of the subsoil ranges from clay loam to sandy clay loam. In some areas the sandstone strata contain reddish layers, and the soil, especially the subsoil, is slightly redder than the typical Hartsells soils. In places there are a few sandstone fragments on the surface or throughout the profile.

Location: On broad, smooth ridges.

Slope: From 3 to 20 percent.

Drainage: Well drained.

Permeability: Moderate to moderately rapid.

Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes (HaB).—These soils occur on the smoother ridges and flats in the western part of the county. Any given unit may consist entirely of the Hartsells soil or entirely of the Wellston soil, or it may contain some of both soils. Included in the areas mapped are small areas of Tilsit soils and some soils that have a redder subsoil.

Most of the acreage is used for crops commonly grown in the county. *Capability unit IIe-4; woodland suitability group 5.*

Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes (HaC).—These soils are similar to the Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes, except that they generally contain more fragments of sandstone. In places the Hartsells soil has a coarser textured subsoil and is a little more droughty than typical. In some small areas, there are a few large sandstone boulders.

These soils are more erodible than the less sloping Hartsells and Wellston soils, but they are suited to the same kinds of crops if longer rotations are used. They will produce good woodland crops, and a considerable acreage is in woods. *Capability unit IIIe-4; woodland suitability group 5.*

Huntington Series

The Huntington series consists of deep, well-drained, nearly level soils on bottom lands. These soils developed in alluvial material that washed from uplands of limestone, gray and red limy shale, and sandstone. They are slightly acid to neutral throughout and are well supplied with organic matter and plant nutrients.

The surface layer is dark-brown, very friable silt loam, and the subsoil is friable, dark yellowish-brown to dark-brown, heavy silt loam. Profile development is weak.

These soils occur mainly along Indian, Second, and Sweet Springs Creeks. They are flooded about once every 2 or 3 years but generally are not seriously damaged. They are associated with the moderately well drained Lindside soils and with the poorly drained Melvin soils.

Representative profile of Huntington silt loam, in a pasture—

Ap—0 to 12 inches, dark-brown (10YR 3/3) to dark yellowish-brown (10YR 3/4) silt loam; moderate, fine, granular structure and moderate, fine, subangular blocky structure; very friable to friable; many fine roots; neutral; abrupt, smooth boundary.

C1—12 to 23 inches, dark-brown (10YR 4/3) silt loam with coatings of dark yellowish-brown (10YR 3/4) material from Ap horizon on faces; weak, fine, subangular blocky structure; friable to firm; many worm casts; neutral; clear, wavy boundary.

C2—23 to 34 inches, dark yellowish-brown (10YR 3/4), heavy silt loam with continuous, shiny coatings of very dark grayish-brown (10YR 3/2), apparently high in organic matter; weak, fine and medium, subangular blocky structure; friable, slightly less firm than C1 horizon; some worm casts; neutral; clear, wavy boundary.

C3—34 to 53 inches, dark-brown (10YR 3/3) silt loam with continuous coatings of dark grayish brown (10YR 4/2), similar to those in C2 horizon; very weak, fine and medium, subangular blocky structure; friable; many worm casts; few fine shale chips; neutral; gradual, wavy boundary.

C4—53 to 80 inches +, dark-brown (10YR 3/3) stratified silt, silty clay loam, and very fine sand; structureless, somewhat variable in texture within short distances; scattered medium-sized gravel; neutral.

Range in characteristics: The texture of the subsoil ranges from light silty clay loam to loam. The depth to limestone or limy shale ranges from about 6 feet to 12 feet or more. In some places there is a considerable amount of gravel or chert in the subsurface layers, and in other places there is none.

Location: First bottoms along streams that drain limestone uplands.

Drainage: Well drained.

Overflow hazard: Overflow occurs about once every 2 or 3 years but does not cause serious damage.

Permeability: Moderate.

Huntington silt loam (Hu).—A profile of this soil is described as representative of the series. Included in the areas mapped are small areas of soils that are higher above streams, that are flooded less often, and that have slightly more profile development.

This soil is productive, and it is well suited to all crops commonly grown in the county. Some small, very narrow areas adjacent to streams are flooded annually or more

often. These areas should be kept in permanent vegetation, such as bluegrass, to prevent damage by scouring. *Capability unit I–6; woodland suitability group 10.*

Laidig Series

The Laidig series is made up of deep, well- drained soils that developed in colluvial material weathered from uplands of acid sandstone and shale. In many places the colluvial material is as much as 20 feet thick.

The surface layer is dark grayish-brown channery loam or very stony loam. The subsoil is yellowish brown and ranges from silt loam in the upper part to sandy clay loam in the lower part. A compact, weak fragipan is common at a depth of about 4 feet or more.

These soils occur mainly on concave slopes at the base of Peters and Potts Mountains. They are downslope from the residual Dekalb soils of the uplands and upslope from the colluvial Murrill soils, which are underlain by limestone and are influenced by limestone material.

The Laidig soils have moderate available moisture holding capacity and are low to medium in productivity. They receive surface runoff and underground seepage from the extensive mountain slopes.

Representative profile of Laidig very stony loam, 15 to 25 percent slopes, in a wooded area—

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) very stony loam; weak, medium, granular structure; very friable; 30 percent channery sandstone fragments; strongly acid; clear, irregular boundary.

A2—5 to 12 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure and very weak, thin, platy structure; friable; 25 percent channery fragments; strongly acid; clear, wavy boundary.

B1—12 to 20 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; 30 percent channery fragments; few clay films; strongly acid; clear, wavy boundary.

B21—20 to 26 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; friable; 30 percent channery fragments; few clay films; strongly acid; gradual, wavy boundary.

B22—26 to 39 inches, strong-brown (7.5YR 5/6) sandy clay loam; common clay films of reddish brown (5YR 5/4); moderate, medium, subangular blocky structure; friable; 40 percent channery fragments; strongly acid; gradual, irregular boundary.

B3—39 to 47 inches, yellowish-brown (10YR 5/6) sandy loam; few medium mottles of reddish brown (5YR 5/4) and light brownish gray (2.5Y 6/2); weak, fine and medium, subangular blocky structure; friable, but firmer than the B22 horizon; 40 percent channery and rock fragments; strongly acid; gradual, irregular boundary.

Cm—47 to 120 inches, yellowish-brown (10YR 5/6) sandy loam; many coarse mottles of reddish brown (5YR 5/4) and light brownish gray (2.5Y 6/2); weak to moderately well developed fragipan; massive, with weak, coarse polygons; firm to very firm; strongly acid; very gradual, irregular boundary; total depth to sandstone bedrock about 20 feet.

Range in characteristics: The texture of the surface layer ranges from channery loam to very stony loam. The colluvium ranges from about 10 feet to 30 feet or more in thickness. Stones on the surface are about 1 foot in diameter and generally are from 5 to 30 feet apart.

Location: On colluvial slopes, mainly at the base of Peters and Potts Mountains.

Drainage: Well drained, but receive seepage water and surface runoff from higher slopes.

Permeability: Moderate to rapid.

Laidig channery loam, 3 to 8 percent slopes (LaB).—This soil is similar to the one described as representative of the series, except that it is channery instead of very stony, and it occurs on smooth slopes, some distance from the mountains. Channery fragments occur throughout the profile, and generally there are a few large sandstone boulders on the surface.

This soil responds to applications of lime and fertilizer. It can be used for all crops commonly grown in the county. Diversion terraces are needed in places to control runoff from higher slopes. *Capability unit IIe–4; woodland suitability group 2.*

Laidig channery loam, 8 to 15 percent slopes (LaC).—This soil is similar to Laidig channery loam, 3 to 8 percent slopes. It can be used for the same kind of crops as the less sloping soil, but it requires more intensive conservation measures. *Capability unit IIIe–4; woodland suitability group 2.*

Laidig channery loam, 15 to 25 percent slopes (LaD).—This soil is similar to Laidig channery loam, 3 to 8 percent slopes, except that it generally occurs closer to mountain slopes, and it contains more channery fragments throughout the profile. The coarse channery fragments make tillage somewhat difficult and interfere to some extent with mowing. Row crops should be grown only when the soil is reseeded to long-term hay or pasture. Reseeding should be done in contour strips. *Capability unit IVe–3; woodland suitability group 2.*

Laidig channery loam, 25 to 45 percent slopes (LaE).—This soil occupies only 109 acres in the county. It is similar to Laidig channery loam, 3 to 8 percent slopes, except that it occurs closer to mountain slopes. There are a few large stones and many large channery fragments on the surface. Most of the acreage can be used for permanent pasture. *Capability unit VIe–4; woodland suitability group 2.*

Laidig very stony loam, 3 to 15 percent slopes (LbC).—A profile of this soil is similar to the one described as representative of the series. However, this soil is too stony for any use other than trees and pasture. It is excellent for trees, but there are some limitations on the use of harvesting equipment. The use of farm machinery generally is difficult in areas that are maintained as pasture. *Capability unit VIIs–2; woodland suitability group 2.*

Laidig very stony loam, 15 to 25 percent slopes (LbD).—A profile of this soil is the one described as representative of the series. This soil occurs close to the mountain slopes. Included in the areas mapped are some narrow, extremely stony strips that occur mostly on bottoms along drainageways.

In some places this soil can be used for pasture, but in most places the stones limit the use of machinery for mowing and fertilizing. Except for some limitations on the use of equipment, this soil is well suited to trees. *Capability unit VIIs–2; woodland suitability group 2.*

Laidig very stony loam, 25 to 45 percent slopes (LbE).—This soil is similar to the soil described as representative of the series, except that there are more and larger stones and boulders on the surface.

This soil will produce good woodland crops, but generally it is not suitable for pasture because of the steep slopes, numerous stones, and difficulty of management. *Capability unit VIIs–2: woodland suitability group 2.*

Landisburg Series

In this series are deep, moderately well drained, gently sloping to moderately sloping, cherty soils that have a moderately well developed fragipan. These soils formed in colluvial material weathered mainly from uplands of cherty limestone. They are underlain by limestone or by material weathered partly from limestone.

The surface layer is dark-brown cherty silt loam, and the upper part of the subsoil is yellowish-brown cherty silt loam. A fragipan of cherty loam occurs at a depth of about 20 inches.

The Landisburg soils are mainly on smooth slopes at the base of Gap Mountain, northeast of Gap Mills. They formed in colluvial material weathered mainly from the higher lying Bodine soils and to a lesser extent from the Dekalb soils. They are associated with the Dunmore soils, which formed in residual material, and with the well-drained Murrill and Laidig soils, which formed in colluvial material derived from uplands of sandstone.

The Landisburg soils are slow in permeability, moderate in available moisture holding capacity, and moderate in fertility. They are used mainly for crops and pasture.

Representative profile of Landisburg cherty silt loam, 3 to 10 percent slopes, in a meadow—

Ap—0 to 7 inches, dark-brown (10YR 4/3) cherty silt loam; weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

A2—7 to 11 inches, brown (10YR 5/3) cherty silt loam; very weak, thin and medium, platy structure; friable; strongly acid; clear, wavy boundary.

B1—11 to 20 inches, yellowish-brown (10YR 5/4) cherty silt loam; moderate, medium, subangular blocky structure; friable; 25 to 30 percent chert fragments; many medium pores; strongly acid; clear, wavy boundary.

B2m—20 to 37 inches, yellowish-brown (10YR 5/4) cherty loam; pale brown (10YR 6/3) on cracks and faces; massive; moderately well developed fragipan; firm to very firm in place, somewhat friable if broken out; 15 to 25 percent channery-sized chert and sandstone fragments; strongly acid; gradual, wavy boundary.

Db—37 to 72 inches +, brown (7.5YR 5/4) silty clay loam or silty clay; many coarse splotches of red (2.5YR 4/6); massive, breaking to moderate, medium, subangular blocky structure; firm; less than 5 percent chert fragments; slightly plastic and slightly sticky when wet; strongly acid; horizon apparently developed mainly in residual material weathered from the underlying limestone.

Range in characteristics: The texture is dominantly cherty silt loam but ranges to cherty loam. The chert fragments range from 1 to 6 inches in size. The depth to the fragipan ranges from 20 to 30 inches. The depth to limestone bedrock ranges from about 3 feet to 10 feet.

Location: Smooth, gently sloping, colluvial slopes below uplands of cherty limestone.

Drainage: Moderately well drained. Runoff from higher slopes collects in some places. There may be seepy areas.

Permeability: Slow.

Landisburg cherty silt loam, 3 to 10 percent slopes (LcB).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are small areas of well-drained cherty soils. In some small spots, pieces of chert are large enough to interfere with use of tillage implements.

Corn, small grain, red clover, and orchardgrass grow well. Alfalfa also grows well but is subject to winter damage because of the slow permeability of the subsoil. If tilled crops are grown, contour stripcropping is needed to control erosion. Diversion terraces are needed in some places to divert runoff from higher slopes. *Capability unit IIe-14; woodland suitability group 2.*

Leadvale Series

The Leadvale series consists of deep, moderately well drained soils that developed in colluvial material weathered from uplands of acid, gray sandstone and shale. These soils are strongly acid, and they contain numerous fragments of shale and sandstone. There is a considerable amount of seepage from the higher slopes.

The surface layer is dark-brown silt loam. The upper part of the subsoil is yellowish-brown silt loam, and the lower part is silty clay loam that is mottled at a depth of about 20 inches. A firm, massive, slowly permeable layer of silty clay loam or sandy clay loam occurs at a depth of about 25 inches.

These soils occur below the Montevallo and Dekalb soils, which are on the uplands, and in many places they are next to the Pope, Philo, or Atkins soils, which are on bottom lands.

The Leadvale soils are moderate to high in available moisture holding capacity. They are used for general farming.

Representative profile of Leadvale silt loam, 3 to 10 percent slopes, in a pasture—

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, medium, granular structure; very friable; many fine roots; few shale and sandstone fragments; strongly acid; abrupt, wavy boundary.

B21—8 to 18 inches, yellowish-brown (10YR 5/6), heavy silt loam; moderate, medium, subangular blocky structure; friable; 15 percent small shale and sandstone fragments; strongly acid; gradual, wavy boundary.

B22g—18 to 26 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium mottles of strong brown (7.5YR 5/8) and light gray (2.5Y 7/2); moderate, medium, subangular blocky structure; friable; continuous clay films; 20 percent shale and sandstone fragments; strongly acid; gradual, wavy boundary.

Cgm—26 to 44 inches +, light brownish-gray (10YR 6/2) silty clay loam approaching sandy clay loam; many, medium mottles of strong brown (7.5YR 5/8) and light gray (10YR 7/2); massive, breaks to moderate, medium, and weak, thick, platy structure; firm; about 25 percent shale and sandstone fragments, but quantity varies within short distances and increases with depth; few manganese concretions; common clay films; strongly acid, weak fragipan.

Range in characteristics: The texture of the subsoil ranges from silt loam to sandy clay loam. The content of shale and sandstone in the profile varies within short distances and ranges from 5 to 30 percent. The Cgm horizon is stratified, and it varies widely in texture and in content of stones. The depth to mottling ranges from about 18 to 30 inches. In many areas there are a few sandstone boulders on the surface. The depth to sandstone or shale bedrock ranges from about 4 to 10 feet.

Location: Concave slopes at the base of hills, downslope from the Montevallo and Dekalb soils.

Drainage: Moderately well drained; runoff and seepage from higher slopes collects on these soils.

Permeability: Slow in lower horizons.

Slope: Gently sloping.

Leadvale silt loam, 3 to 10 percent slopes (LdB).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are small areas that are well drained and that contain many fragments of sandstone and shale, and a few small areas that are very stony. Small seep spots are common.

This soil occurs in small, narrow, individual areas and is used mostly for general farming. It can be used for all crops commonly grown in the county. *Capability unit IIe-13; woodland suitability group 2.*

Lehew Series

The Lehew series consists of shallow to moderately deep, well-drained to excessively drained soils that developed in material weathered from acid, red sandstone.

The surface layer is dark-brown very stony loam, and the subsoil is reddish-brown loam and contains numerous small fragments of sandstone. Profile development is weak.

These soils occur on the upper part of strongly sloping to steep slopes on Peters and Potts Mountains. They are similar in development to the Dekalb soils, which formed in material weathered from gray sandstone; they are lower in organic matter than the Summers soils; and they are deeper than the Montevallo soils, which developed in material weathered from folded shale.

The Lehew soils are not extensive in the county, and most of the acreage is forested.

Representative profile of Lehew very stony loam, 25 to 35 percent slopes, in a wooded area—

A0—1 inch to 0, black humus and moss.

A1—0 to 3 inches, dark-brown (7.5YR 3/2) very stony loam; weak, fine, granular structure; loose; many fine roots; very strongly acid; abrupt, irregular boundary.

A2—3 to 8 inches, dark-brown (7.5YR 4/2) loam; weak, fine, subangular blocky structure; very friable; few channery fragments, and 5 to 10 percent small sandstone chips; ½ to ¾ inch in size; very strongly acid; clear, wavy boundary.

B2—8 to 12 inches, reddish-brown (5YR 4/4) loam; weak, medium, subangular blocky structure; 10 to 15 percent channery fragments and small sandstone chips, ½ to ¾ inch in size; few patchy clay films; very strongly acid; clear, wavy boundary.

C—12 to 24 inches, reddish-brown (5YR 4/4) to yellowish-red (5YR 4/6) loam; massive, with some breakage to very weak, medium, subangular blocky structure; 50 to 75 percent flattish sandstone fragments, some partly weathered; stoniness increases with depth; very strongly acid.

Dr—24 inches +, somewhat broken red Medina or Clinton sandstone.

Range in characteristics: The depth to sandstone bedrock ranges from about 18 to 30 inches. On concave slopes the soils are a little deeper to bedrock, and the subsoil is slightly finer textured than the surface layer. The stones on the surface generally are about 1 foot in diameter and from 5 to 30 feet apart. They range from small boulders to flagstones.

Location: Upper part of slopes on Peters and Potts Mountains.

Drainage: Well drained to somewhat excessively drained.

Permeability: Moderately rapid.

Lehew very stony loam, 25 to 35 percent slopes (LhD).—A profile of this soil is described as representative of the series. Included in the areas mapped are a few small areas of less sloping soils, deeper soils, and soils that have a B horizon of silty clay loam.

This soil is too stony to be used for crops or pasture. It is best suited to trees. *Capability unit VIIs-2; woodland suitability group 5.*

Lehew very stony loam, 35 to 50 percent slopes (LhE).—This soil is somewhat more shallow than Lehew very stony loam, 25 to 35 percent slopes, and it contains more large stones but less channery material. It is also more droughty than the less sloping soil and is somewhat less productive of trees. The use of equipment is severely restricted. *Capability unit VIIs-2; woodland suitability group 5.*

Lindside Series

The Lindside series consists of deep, moderately well drained to somewhat poorly drained soils on bottom lands. These soils developed in recently deposited alluvium that washed from uplands of limestone and limy shale. They are slightly acid to neutral throughout.

The surface layer is friable, very dark grayish-brown silt loam, and the subsoil is dark yellowish-brown silty clay loam that is mottled below a depth of 2 feet.

These soils are associated with the well-drained Huntington soils and with the poorly drained Melvin soils.

The Lindside soils are flooded about once every 3 years. They occur mostly in small areas but are important agricultural soils.

Representative profile of Lindside silt loam, in a pasture—

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; very friable; neutral; clear, smooth boundary.

A3—9 to 15 inches, dark grayish-brown (10YR 4/2) silt loam with noticeable traces of material from Ap horizon in cracks and on faces; weak, fine and medium, subangular blocky structure; slightly firm; neutral; clear, wavy boundary.

C1—15 to 23 inches, dark yellowish-brown (10YR 3/4) silty clay loam with few, common, fine, distinct mottles of gray brown (10YR 5/2) and strong brown (7.5YR 5/8) in lower part; moderate, medium, subangular blocky structure; firm; slightly acid; gradual, wavy boundary.

C2—23 to 47 inches, dark yellowish-brown (10YR 3/4) silty clay loam to silty clay; many, medium, distinct mottles of gray brown (10YR 5/2) and strong brown (7.5YR 5/8); prominent coatings of gray brown (10YR 5/2); coarse and some medium, subangular blocky structure; firm; few small pebbles and shale chips; common fine concretions of manganese; slightly acid; gradual boundary.

C3—47 to 72 inches +, splotched gray (10YR 5/1), yellowish-brown (10YR 5/8), and strong-brown (7.5YR 5/8) stratified silty clay loam, silty clay with fine sand lenses, and various amounts of fine gravel; neutral.

Location: Nearly level bottom lands along streams that drain limestone uplands.

Drainage: Moderately well drained to somewhat poorly drained. Water table normally is high in spring. Internal drainage varies somewhat, depending on position of soils on bottom lands.

Permeability: Moderate to slow.

Lindside silt loam (Ln).—A profile of this soil is described as representative of the series. Small areas of poorly drained Melvin soils were included in mapping.

The natural fertility and moisture-holding capacity of this soil are good. The principal problems are restricted drainage and the hazard of overflow. If artificially drained, this soil can be used for the crops commonly grown in the county, but alfalfa may be short lived. *Capability unit IIw-7; woodland suitability group 10.*

Litz Series

In this series are shallow to moderately deep, friable, well-drained soils that developed in material weathered from interbedded layers of acid gray shale, siltstone, and sandstone that contained small amounts of calcareous material.

The surface soil is brown shaly silt loam or dark-brown silt loam, and the subsoil is brown to yellowish-brown silty clay loam or heavy silt loam (fig. 11).

These soils are gently sloping to steep. They occur mainly south and west of Union. The Litz shaly silt loams are adjacent to the deep Frederick soils, which are to the north and east, and to the Teas-Calvin-Litz complexes, which are to the south and west. The Litz silt loams occur on ridgetops and slopes. They are associated with the Teas and Calvin soils, and in places they are mapped in a complex with these soils. This complex is described under the heading "Teas Series."

The Litz soils are low to moderate in available moisture holding capacity and are moderate in fertility.

***Figure 11.*—Roadbank near Lindside showing shallow Litz shaly silt loam underlain by thin, platy, gray shale.**

Representative profile of Litz shaly silt loam, 3 to 10 percent slopes, in a meadow—

Ap—0 to 5 inches, brown (10YR 5/3) shaly silt loam; weak, medium and coarse, granular structure; strongly acid; gradual, wavy boundary.

B2—5 to 10 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4), light silty clay loam; moderate, coarse, subangular blocky structure, crushes easily to fine, subangular blocky peds; slightly hard when dry; 15 percent shale; strongly acid; gradual, wavy boundary.

C—10 to 16 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4), loose shaly material; about 70 to 80 percent shale, coated with silty clay loam similar to material in B2 horizon; cracks and interstices between shale fragments also filled with this material; strongly acid; very irregular boundary.

Dr—16 inches +, gray (5YR 5/1) shattered shale bedrock; some silt and clay coatings in cracks; upper strata partly weathered so that fragments are coated with brown and reddish brown; seams filled with carbonates; calcareous at a depth of 3 to 8 feet; roots follow seams to a depth of several feet.

Representative profile of Litz silt loam, 8 to 15 percent slopes, in a pasture—

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; strongly acid; abrupt, smooth boundary.

A2—8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure and very weak, thin, platy structure; friable; 10 percent shale chips, ¼ to ½ inch in size; strongly acid; clear, wavy boundary.

B2—11 to 15 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; discontinuous clay films; 15 percent shale chips; strongly acid; clear, wavy boundary.

C—15 to 21 inches, strong-brown (7.5YR 5/6) silty clay loam; 75 percent shale chips, ¼ to 1 inch in size; massive, with some breakage to weak, fine, subangular blocky structure; friable to very friable; strongly acid; gradual boundary.

Dr—21 inches +, gray platy and blocky siltstone and shale.

Range in characteristics: The texture is dominantly shaly silt loam, but in places it is silt loam or very rocky shaly silt loam. The B2 horizon ranges from 5 to 10 inches in thickness, depending on the percentage of slope and on the amount of erosion. The C horizon ranges from a few inches to about 2 feet in thickness. This range in thickness is caused by irregular intrusions of hard strata.

Location: Mostly in the western part of Monroe County, on dissected slopes that are underlain by gray shale that contains some calcareous material.

Drainage: Well drained.

Permeability: Moderate to rapid.

Slope: Gently sloping to very steep.

Litz shaly silt loam, 3 to 10 percent slopes (LsB).—A profile of this soil is the one described as representative of the shaly silt loams in this series. The shaly silt loams developed in material weathered from the Bluefield shale of the Mauch Chunk formation. They contain more calcareous material in the form of lenses, seams, and outcrops of limestone than the silt loams, and they normally have a slightly finer textured B horizon.

A rotation consisting of corn, a small grain, and 3 years or more of hay, grown in contour strips, is needed to control erosion. *Capability unit IIIe-31; woodland suitability group 6.*

Litz shaly silt loam, 10 to 20 percent slopes (LsC).—A profile of this soil is similar to the one described as representative of the shaly silt loams in the series.

A rotation consisting of a small grain and 3 years or more of hay, grown in contour strips, is needed to control erosion. *Capability unit IVe-31; woodland suitability group 6.*

Litz shaly silt loam, 20 to 30 percent slopes (LsD).—A profile of this soil is similar to the one described as representative of the shaly silt loams in the series.

Because of the hazard of erosion, this soil needs to be kept in permanent vegetation, such as pasture or trees. *Capability unit VIe-31; woodland suitability group 6.*

Litz shaly silt loam, 30 to 45 percent slopes (LsE).—A profile of this soil is similar to the one described as representative of the shaly silt loams in the series. This soil is susceptible to erosion, and it is droughty. It should be kept in woods. *Capability unit VIIe-3; woodland suitability group 6.*

Litz shaly silt loam, 45 to 60 percent slopes (LsF).—This soil is very shallow and very droughty. It is susceptible to erosion and is difficult to manage. It should be kept in woods. *Capability unit VIIe-3; woodland suitability group 6.*

Litz silt loam, 3 to 8 percent slopes (LtB).—A profile of this soil is similar to the one described as representative of the silt loams in the series. The silt loams developed in material weathered from the Hinton section of the Mauch Chunk formation. They have a lower content of shale in the A and B horizons than the shaly silt loams, and they are less calcareous and slightly deeper to bedrock.

Corn, wheat, clover, timothy, orchardgrass, and alfalfa grow fairly well. If tilled crops are grown, contour cultivation is needed on short slopes to control erosion, and contour stripcropping is needed on long slopes. *Capability unit IIe-11; woodland suitability group 7.*

Litz silt loam, 8 to 15 percent slopes (LtC).—A profile of this soil is the one described as representative of the silt loams in this series.

A rotation consisting of corn, a small grain, and 2 years or more of hay, grown in contour strips, is needed to control erosion. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from critical areas. *Capability unit IIIe-11; woodland suitability group 7.*

Litz silt loam, 8 to 15 percent slopes, severely eroded (LtC3).—A profile of this soil is similar to the one described as representative of the silt loams in the series, except that this soil has lost most of the original surface layer through erosion. The present surface layer is low in organic matter, is slowly permeable, and is susceptible to further erosion. Consequently, this soil should be kept in permanent cover.

Mixtures of alfalfa and grass do fairly well if properly limed and fertilized. A mixture of orchardgrass and ladino clover is suitable for tall-grass pastures. If the seedbed is prepared by plowing, contour stripcropping is needed to control erosion. Diversion terraces are needed on some long slopes to control erosion or to divert runoff from gullies that are active. *Capability unit IVe-2; woodland suitability group 7.*

Litz silt loam, 15 to 25 percent slopes (LtD).—A profile of this soil is similar to the one described as representative of the silt loams in the series.

This soil is low in fertility and is subject to erosion. It is best suited to permanent hay or tall-grass pastures.

Mixtures of alfalfa and grass do well if properly limed and fertilized. A mixture of orchardgrass and ladino clover is suitable for long-term pastures. If the seedbed is plowed, contour stripcropping is needed to control erosion. *Capability unit IVe-2; woodland suitability group 7.*

Litz silt loam, 15 to 25 percent slopes, severely eroded (LtD3).—A profile of this soil is similar to the one described as representative of the silt loams in the series, except that erosion has removed most of the original surface layer, and gullies have formed or are forming.

If properly managed, this soil will produce fair bluegrass pasture. If not needed for pasture, it should be planted to trees. *Capability unit VIe-2; woodland suitability group 7.*

Litz silt loam, 25 to 45 percent slopes (LtE).—A profile of this soil is similar to the one described as representative of the silt loams in the series. Because of steep slopes and susceptibility to erosion, this soil is best suited to trees. In some places it can be used to a limited extent for pasture if it is limed, fertilized, and mowed. *Capability unit VIIe-2; woodland suitability group 7.*

Litz silt loam, 25 to 45 percent slopes, severely eroded (LtE3).—Erosion has removed most of the original surface layer from this soil, and there has been considerable mixing of the soil by slumping and washing. The best use for this soil is forest. *Capability unit VIIe-2; woodland suitability group 7.*

Litz silt loam, 45 to 60 percent slopes (LtF).—This soil is slightly more shallow than the one described as representative of the silt loams in the series, and it contains some shale throughout the profile. Some small, severely eroded areas were included in mapping. Generally, this soil is suited only to forest. *Capability unit VIIe-2; woodland suitability group 7.*

Litz very rocky soils, 10 to 30 percent slopes (LvD).—This soil occupies narrow strips where slopes break. It is similar to the soil described as representative of the shaly silt loams in the series, except that there are some outcrops of limestone.

This soil is not suited to cultivation, because of shallowness and outcrops of rock. It is too droughty to produce good yields of bluegrass. Much of the acreage should be in woods. *Capability unit VIIs-1; woodland suitability group 9.*

Litz very rocky soils, 30 to 45 percent slopes (LvE).—This soil contains many outcrops of limestone. Some small areas of very shallow, severely eroded soils were included in mapping.

This soil tends to be droughty and, consequently, is not well suited to bluegrass. It is best suited to forest. *Capability unit VIIs-1; woodland suitability group 9.*

Litz very rocky soils, 30 to 45 percent slopes, severely eroded (LvE3).—This soil has lost most, and in places all, of the original surface layer through erosion. It is shallow or very shallow, very droughty, and high in content of shale. Because of the steep slopes and hazard of erosion, the best use for this soil is forest. *Capability unit VIIe-4; woodland suitability group 9.*

Litz-Rock land complex, 45 to 60 percent slopes (LxF).—This complex is more shallow than the typical Litz soils. It contains a considerable amount of shale, and there are numerous outcrops of limestone. Many areas are severely eroded.

This complex is very droughty. It is best suited to forest, but there are severe limitations on the use of equipment. *Capability unit VIIs-1; woodland suitability group 9.*

Melvin Series

The Melvin series consists of deep, nearly level, poorly drained soils on flood plains. These soils developed in alluvium that washed from uplands of limestone and limy shale. They are only slightly acid throughout.

The surface layer is slightly mottled, dark-brown silt loam, and the subsoil is dark-brown, strongly mottled silty clay that is slowly permeable.

These soils occur as small, slighty depressed spots or as large areas on nearly level bottom lands that are subject to flooding about once every 2 or 3 years. In many places they are near or adjacent to the well drained Huntington and the moderately well drained to somewhat poorly drained Lindside soils, which are also on bottom lands.

These soils are important for pasture and crops.

Representative profile of Melvin silt loam, in a pasture—

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; many fine roots and worm casts; relatively high in organic matter; common fine mottles of gray (10YR 5/1) and a few rust spots of strong brown (7.5YR 5/8); slightly acid; clear, wavy boundary.

B2g—8 to 30 inches, dark-brown (10YR 3/3) silty clay loam; many medium mottles of dark gray (10YR 4/1), and a few fine rust spots of strong brown (7.5YR 5/8); strong, coarse, blocky structure; firm when moist, slightly plastic and slightly sticky when wet; slightly acid, gradual, wavy boundary.

C1g—30 to 52 inches, dark-brown (10YR 3/3) silty clay; many coarse mottles of dark gray (10YR 4/1) and many fine rust spots of strong brown (7.5YR 5/8); massive, some breakage to weak, medium and coarse, subangular blocky structure; firm; plastic and slightly sticky when wet; slightly acid; gradual boundary.

C2g—52 inches +, stratified silty clay and sandy clay; some thin sand lenses; slightly acid; depth estimated to be about 8 feet.

Range in characteristics: The texture of the surface layer ranges from silt loam to silty clay loam. Surface drainage ranges from fair to completely ponded. The water table is seasonally high in all areas, and it remains high or near the surface in some areas. The frequency of flooding varies considerably from place to place and from stream to stream.

Location: Bottom lands along streams that drain the limestone uplands.

Slope: Mostly nearly level or slightly depressed areas.

Drainage: Poorly drained; water table at or near surface late in winter and early in spring.

Permeability: Slow.

Melvin silt loam (Mb).—A profile of this soil is described as representative of the series. Included in the areas mapped are small areas of soils that have a surface layer of silty clay loam and of soils that are very poorly drained. The main problem on this soil is restricted drainage. However, the subsoil drains reasonably well into either tile or open ditches.

If drained, this soil is well suited to pasture or to hay crops and corn. It is not well suited to alfalfa. *Capability unit IIIw-1; woodland suitability group 11.*

Monongahela Series

The Monongahela series consists of deep, moderately well drained, nearly level to strongly sloping soils that have a brittle compact layer, or fragipan, in the lower part of the subsoil. These soils developed in old alluvium that washed from uplands of acid sandstone and shale. They occur on stream terraces above overflow.

The surface layer is grayish-brown silt loam, and the upper part of the subsoil is yellowish-brown heavy silt loam. The fragipan occurs at a depth of about 2 feet. Rounded pebbles are scattered throughout the profile, and layers of medium-sized to large gravel are common in the lower horizons. The depth to shale or sandstone ranges from about 3 to 8 feet.

These soils are fairly extensive along Potts Creek in the eastern part of the county, but small areas also occur along other streams. They are associated with the Dekalb and Montevallo soils, which are on uplands; with the well-drained, colluvial Laidig soils; and with the Pope, Philo, and Atkins soils, which are on bottom lands.

The Monongahela soils are moderate in available moisture holding capacity and are moderate in productivity. Most of the acreage is farmed.

Representative profile of Monongahela silt loam, 3 to 8 percent slopes, in a meadow—

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam; friable; weak, fine, granular structure; medium acid; abrupt, smooth boundary.

A2—7 to 10 inches, light yellowish-brown (10YR 6/4) silt loam; very weak, thin, platy structure and weak, fine, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B21—10 to 23 inches, light olive-brown (2.5Y 5/6), heavy silt loam; thin continuous coatings of yellowish brown (10YR 5/4); moderate, fine and medium, subangular blocky structure; friable; strongly acid; gradual, smooth boundary.

B22g—23 to 29 inches, yellowish-brown (10YR 5/4), heavy silt loam; many prominent mottles of gray (10YR 6/1) and dark brown (7.5YR 4/4); moderate, fine and medium, subangular blocky structure; firm; few patchy clay films; very strongly acid; gradual, wavy boundary.

B23m—29 to 59 inches, light yellowish-brown (10YR 6/4) silt loam; many, coarse, prominent mottles of light gray (10YR 7/1) and yellowish red (5YR 5/8); massive, but breaks to moderate, coarse, blocky structure to weak, thick, platy structure; moderately strong fragipan; very firm in place, firm when broken out; strongly acid; gradual, wavy boundary.

C—59 inches +, light yeollowish-brown (10YR 6/4), gray (10YR 6/1), and yellowish-red (5YR 5/8) stratified loam and fine sandy loam; few medium-sized rounded pebbles; massive; firm; strongly acid; underlain by folder acid shale at an estimated depth of 8 feet.

Range in characteristics: The depth to the fragipan ranges from about 20 inches to 30 inches. In places there is a little rounded gravel in the lower horizons, and in other places there are stones as much as 8 inches in size.

Location: Smooth terraces above overflow.

Slope: Nearly level to strongly sloping.

Drainage: Moderately well drained.

Permeability: Slow in the fragipan.

Monongahela silt loam, 0 to 3 percent slopes (MgA).—This soil is similar to the one described as representative of the series, and it has about the same restrictions. Included in the areas mapped are some small spots of somewhat poorly drained soils.

Surface drainage is slow, but seepy spots can be artificially drained. Diversion terraces can be used where runoff from adjacent slopes is excessive. This soil is suitable for most crops commonly grown in the county but it probably is best suited to water-tolerant species. *Capability unit IIw-1; woodland suitability group 3.*

Monongahela silt loam, 3 to 8 percent slopes (MgB).—A profile of this soil is the one described as representative of the series. A few small areas of well-drained soils were included in mapping.

In some areas there is considerable runoff from adjacent slopes, and diversion terraces are needed. Seepage spots can be drained into artificial drainage systems. However, rounded stones occur at a depth of 3 feet or more and may interfere to some extent with the use of mechanical ditchers.

This soil is particularly low in potash and in content of organic matter. All crops commonly grown in the county are suitable, but alfalfa is likely to be short lived because of impeded drainage. *Capability unit IIe-13; woodland suitability group 3.*

Monongahela silt loam, 8 to 15 percent slopes (MgC).—This soil is similar to the one described as representative of the series, except that normally it is more shallow, and in places it contains more gravel. Where it occurs downslope from the Dekalb or Montevallo soils, there may be a few large boulders. Surface drainage generally is good, but the hazard of erosion is greater than on the typical soil.

This soil occupies only about 100 acres in the county. It occurs mostly as narrow bands on breaks between two terrace levels or between a terrace and bottom land.

This soil is suited to the crops commonly grown in the county, but it generally is farmed with the adjoining gently sloping Monongahela soils. Consequently, erosion is seldom adequately controlled. *Capability unit IIIe-13; woodland suitability group 3.*

Montevallo Series

The Montevallo series consists of shallow, silty, somewhat excessively drained soils on the uplands. In the eastern part of the county, these soils developed in material weathered mostly from strongly folded, acid, gray silty shale and sandstone. In the western part, they developed in material weathered from shale and siltstone that contained thin, widely spaced layers of calcareous shale or limestone. These soils developed under a cover of hardwoods. They are very strongly acid throughout and are low in plant nutrients.

The surface layer is grayish-brown, channery or shaly silt loam, and the subsoil is thin, yellowish-brown heavy silt loam. Profile development is weak.

In the eastern and southern parts of the county, these soils occupy the middle and lower parts of mountain slopes and are closely associated with the slightly deeper, loamy or sandy Dekalb soils. In the western part, they occupy the side slopes of the dissected plateau and are associated with the reddish Teas and Calvin soils and with the deeper, strongly developed Litz soils.

The Montevallo soils are low in available moisture holding capacity and are low in productivity. Most of the acreage has remained in forest.

Representative profile of Montevallo channery silt loam, 30 to 45 percent slopes, in a wooded area [10]—

A00—2 inches to ½ inch, hardwood leaf litter.

A0—½ inch to 0, compacted, partly decomposed leaf litter; little soil mixing.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) channery silt loam; moderate, fine, granular structure; very friable; 20 percent channery-sized silty shale; very strongly acid; clear, irregular boundary.

A2—2 to 8 inches, light yellowish-brown (10YR 6/4) channery silt loam; weak, fine, subangular blocky structure; very friable; 25 percent shale and sandstone fragments, as much as 1 inch in size; very strongly acid; clear, wavy boundary.

B2—8 to 13 inches, yellowish-brown (10YR 5/6) heavy channery silt loam; weak, fine and medium, subangular blocky structure; friable; 30 percent thin shale and sandstone fragments as much as 2 inches in size; few thin, patchy clay films; few to common fine pores; very strongly acid; clear, wavy boundary.

C—13 to 18 inches, yellowish-brown (10YR 5/6) heavy channery silt loam; 75 percent channery-sized shale and sandstone fragments; few roots; massive; few patchy clay films; very strongly acid; gradual boundary.

Dr—18 inches +, light-gray (10YR 6/1) shale and sandstone, somewhat layered and broken on top.

Range in characteristics: The content of coarse fragments in the surface layer ranges from 15 percent in some places to as much as 50 percent in a few places. The depth to bedrock ranges from about 12 inches to 24 inches. The channery soils occur principally in the eastern part of the county. The channery soils that occur in the western part are severely eroded, and they contain numerous thin fragments of shale, and there is some limy strata in the underlying bedrock. The shaly soils, which occur mainly in the western part of the county, are also severely eroded, and there is some limy strata in the underlying bedrock.

Location: Middle and lower parts of mountain slopes.

Slope: Strongly sloping to very steep; in places the slope is as much as 75 percent.

Drainage: Well drained to somewhat excessively drained.

Permeability: Moderate to rapid.

Montevallo channery silt loam, 10 to 20 percent slopes (MoC).—A profile of this soil is similar to the one described as representative of the series. Included in the areas mapped are a few small areas of soils that have slopes of 3 to 10 percent and of soils that have fragments of sandstone scattered on the surface.

This soil is shallow, droughty, moderately erodible, and low in productivity. It is used for all crops commonly grown in the county, but yields are not high even if adequate amounts of lime and fertilizer are applied. About half of the acreage is cleared and is used mostly for pasture. *Capability unit IVe-32; woodland suitability group 4.*

Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded (MoC3).—This soil is similar to the soil described as representative of the series, except that sheet erosion has removed most of the original surface layer. The remaining surface layer is more shallow than typical, contains more stone fragments, is lower in organic matter, and contains some of the former subsoil. A few shallow gullies have formed.

[10] Chemical and physical data for profile S58WVa-32-5-(1-3) appears in the section "Laboratory Data on Selected Soil Profiles."

This soil is very droughty, erodible, and low in productivity. It is not well suited to tilled crops. It is only fairly well suited to pasture and is too droughty to produce good yields of bluegrass. About half of the acreage is in pasture that is in poor condition. The rest is in forest, most of which has been heavily grazed. *Capability unit VIe-32; woodland suitability group 4.*

Montevallo channery silt loam, 20 to 30 percent slopes (MoD).—A profile of this soil is similar to the one described as representative of the series, except that it contains more silty shale. A few small areas of moderately deep soils were included in mapping.

This soil is droughty, and it is low in productivity. About two-thirds of the acreage is cleared and used mostly for pasture. Yields of pasture plants are fair. *Capability unit VIe-32; woodland suitability group 4.*

Montevallo channery silt loam, 20 to 30 percent slopes, severely eroded (MoD3).—This soil has lost most of the original surface layer through erosion, and the present surface layer is thinner, contains less organic matter, and is higher in content of shale than that of Montevallo channery silt loam, 20 to 30 percent slopes. Consequently, this soil is more droughty and is less productive. It is best suited to forest. *Capability unit VIIe-3; woodland suitability group 4.*

Montevallo channery silt loam, 30 to 45 percent slopes (MoE).—A profile of this soil is the one described as representative of the series. In coves, the profile is deeper than that described. Included in the areas mapped are some small stony areas.

This soil occurs in large areas. It is moderately productive of trees, but it is too steep and too droughty to be suitable for pasture. About 90 percent of the acreage is in forest. *Capability unit VIIe-3; woodland suitability group 4.*

Montevallo channery silt loam, 30 to 45 percent slopes, severely eroded (MoE3).—A profile of this soil is similar to the one described as representative of the series, except that this soil has lost most of the original surface layer through erosion, and it is more shallow and more stony than the typical soil. In some places there are shallow gullies. In the western part of the county, the profile contains more thin fragments of shale than in the eastern part.

This soil is droughty and erodible. It is best suited to forest. *Capability unit VIIe-3; woodland suitability group 4.*

Montevallo channery silt loam, 45 to 65 percent slopes (MoF).—This soil is slightly deeper than the soil described as representative of the series, and it contains more and larger channery fragments and in places some flagstones and small boulders. This soil is deeper on northern and eastern exposures than on southern and western exposures. Along small drainageways, there are many soil pockets that are as much as 26 inches in depth.

This soil occurs in very large individual areas, and most of the acreage is forested. Yields of forest products range from poor to good. *Capability unit VIIe-3; woodland suitability group 4.*

Montevallo channery silt loam, 45 to 65 percent slopes, severely eroded (MoF3).—A profile of this soil is similar to the one described as representative of the series, except that it generally is a little more shallow. This soil is very droughty and erodible. It is best suited to woods. *Capability unit VIIe-3; woodland suitability group 4.*

Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded (MsB3).—A profile of this soil is similar to the one described as representative of the series, except that this soil is shaly instead of channery, and most of the original surface layer has been removed by erosion. The remaining soil is shallow, the subsoil is thin, and there is a considerable amount of shale throughout the profile. In a few places shallow gullies have formed. There are a few thin layers of calcareous shale and limestone in the underlying bedrock, and in places the limestone crops out.

This soil occurs mainly in the western part of the county, generally adjacent to Litz shaly silt loams. It is droughty and erodes readily. It is best suited to long-term hay, but a row crop can be grown occasionally. *Capability unit IVe-31; woodland suitability group 6.*

Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded (MsC3).—This soil is similar to Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded, and it also occurs mainly in the western part of the county. It is droughty and readily eroded. It is best suited to pasture or woods. *Capability unit VIe-31; woodland suitability group 6.*

Montevallo shaly silt loam, 20 to 30 percent slopes, severely eroded (MsD3).—This soil is similar to Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded, except that it is somewhat more shallow, and in some small areas it is very shallow. In a few places gullies have formed. This soil is high in content of shale, very droughty, and highly erodible. It is best suited to woods. *Capability unit VIIe-3; woodland suitability group 6.*

Murrill Series

The Murrill series consists of deep, well-drained soils that developed in colluvial material weathered from uplands of acid sandstone and shale. These soils are underlain by limestone or by residual clays weathered from limestone, and the lower part of the subsoil is apparently influenced by this material as a result of the percolation of ground water. There is considerable lateral underground seepage from higher areas. Below a depth of 3 feet, these soils tend to have a firm layer that has characteristics of a weak fragipan.

The surface layer is dark yellowish-brown channery loam or stony loam. The subsoil is yellowish-brown silty clay loam to sandy clay loam that becomes firmer with depth. It is underlain by reddish-brown residual clay loam weathered from limestone.

There are large areas of these soils on the northwest foot slopes of Peters Mountain, and smaller areas are scattered throughout the county. These soils are downslope from the Dekalb soils, from which most of the colluvium has been derived. They also are associated with the very rocky Dunmore, Frederick, and Bodine soils.

The Murrill soils are moderate in permeability, moderate to high in available moisture holding capacity, and moderate in fertility. Most of the channery loams and about half of the stony loams have been cleared and are used mainly for bluegrass pasture.

Representative profile of Murrill channery loam, 8 to 15 percent slopes, in a field—

Ap—0 to 9 inches, dark yellowish-brown (10YR 4/4) channery loam; weak, fine, granular structure; 20 percent channery material; very friable; strongly acid; abrupt, smooth boundary.

A2—9 to 15 inches, brown (10YR 5/3) channery loam; weak, fine and medium, subangular blocky structure; friable; 30 percent channery sandstone material; strongly acid; clear, smooth boundary.

B21—15 to 21 inches, yellowish-brown (10YR 5/4) channery silty clay loam; moderate, fine and medium, subangular blocky structure; friable to somewhat firm; 20 to 30 percent channery material; strongly acid; clear, wavy boundary.

B22—21 to 39 inches, dark-brown (7.5YR 4/4) channery sandy clay loam; somewhat firm to firm; moderate, medium and coarse, subangular blocky structure; 40 percent channery material; distinct clay films of yellowish brown (10YR 5/4) on faces of peds; strongly acid; gradual, wavy boundary.

B23—39 to 60 inches, strong-brown (7.5YR 5/6) channery sandy clay loam; generally massive, breaking to moderate, medium, subangular blocky structure and medium and coarse, platy structure; firm; tends toward a weak fragipan; 30 to 50 percent channery material; few manganese coatings; strongly acid; gradual boundary; much evidence of underground seepage; appears to have been viscous and almost fluid.

Db—60 inches +, reddish-brown (5YR 4/4) clay loam strongly splotched with pale brown (10YR 6/3), red (2.5YR 4/6), and gray (10YR 6/1); peds have common black coatings of manganese on faces; strong, medium and coarse, blocky structure; primarily limestone residual material; strongly acid.

Range in characteristics: The texture of the surface layer is dominantly very stony loam or channery loam, but in places it is channery silt loam. Stones on the surface generally are about 1 foot in diameter and about 5 to 30 feet apart. There are some outcrops of limestone and some sinkholes. In places the lower part of the subsoil is firm enough to restrict to some extent the downward percolation of water. The colluvium ranges from 4 to 20 feet in thickness and is underlain directly by limestone. At the base of Swoopes Knobs and Flattop Mountain, the soils developed in sandstone colluvium but are underlain by limy shale. These soils are similar to those that occur in Sweet Springs Valley, but the colluvium is only from 3 to 5 feet thick.

Location: Concave colluvial slopes, mostly at the base of Peters Mountain.

Slope: Gently sloping to steep.

Drainage: Well drained; subject to seepage and surface runoff from mountain slopes.

Permeability: Moderate.

Murrill channery loam, 3 to 8 percent slopes (MuB).—A profile of this soil is similar to the one described as representative of the series. The hazard of erosion is moderate.

Corn, small grain, red clover, orchardgrass, alfalfa, and bluegrass grow well. If tilled crops are grown, erosion-control measures, such as contour stripcropping, are needed. Diversion terraces are needed in places to intercept runoff from higher areas. *Capability unit IIe-1; woodland suitability group 2.*

Murrill channery loam, 8 to 15 percent slopes (MuC).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are a few spots that have lost most of the original surface soil through erosion.

Corn, small grain, red clover, orchardgrass, alfalfa, and bluegrass grow well. Tilled crops should be grown in contour strips to control erosion. Diversion terraces can be used to divert runoff from adjacent steeper slopes. *Capability unit IIIe-1; woodland suitability group 2.*

Murrill channery loam, 15 to 25 percent slopes (MuD).—A profile of this soil is similar to the one described as representative of the series. The hazard of erosion is serious on this steeply sloping soil, and in some places there are outcrops of limestone.

A suitable rotation is a row crop, a small grain, and 3 or 4 years of hay. Crops should be grown in contour strips to control erosion. Diversion terraces are needed in places to intercept runoff from higher areas. *Capability unit IVe-1; woodland suitability group 2.*

Murrill channery loam, 25 to 45 percent slopes (MuE).—A profile of this soil is similar to the one described as representative of the series. There are some large sandstone boulders on the surface and some outcrops of limestone.

This soil should be kept in permanent pasture. Lime and fertilizer should be applied according to need as indicated by soil tests. Soils that have slopes of less than 30 percent generally can be used for tall-grass pastures. *Capability unit VIe-1; woodland suitability group 2.*

Murrill very stony loam, 8 to 15 percent slopes (MvC).—A profile of this soil is similar to the one described as representative of the series. There are enough large sandstone boulders on the surface and in the soil material to make cultivation difficult.

This soil is productive for bluegrass pasture, but some areas are not accessible to farm machinery. Accessible areas should be limed and fertilized to maintain productivity and mowed to control weeds and brush. *Capability unit VIs-1; woodland suitability group 2.*

Murrill very stony loam, 15 to 25 percent slopes (MvD).—This soil has many sandstone boulders on the surface. It is productive for bluegrass pasture, but stones interfere with the use of farm machinery. Areas that are accessible should be limed and fertilized to maintain productivity and mowed to control weeds and brush. *Capability unit VIs-1; woodland suitability group 2.*

Murrill very stony loam, 25 to 45 percent slopes (MvE).—This soil is similar to the one described as representative of the series, except that it is very stony. It is only fairly well suited to bluegrass pasture. Areas that are accessible to farm machinery should be limed and fertilized to maintain productivity and mowed to control weeds and brush. Most of this soil is best suited to trees, but the use of equipment is difficult. *Capability unit VIIs-1; woodland suitability group 2.*

Philo Series

In the Philo series are deep, nearly level, moderately well drained to somewhat poorly drained soils on bottom lands. These soils formed in alluvium that washed from adjacent uplands of acid sandstone and shale. They are strongly acid.

The surface layer is dark grayish-brown silt loam. The lower part of the subsoil is dark yellowish-brown loam that is mottled. The water table is high for long periods.

These soils occur along Potts Creek, Brush Creek, and other small streams. They occur near the well-drained

Pope soils and the poorly drained Atkins soils.

The Philo soils are flooded about once in 3 years. They are used for crops and pasture.

Representative profile of Philo silt loam in a meadow—

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; many fine roots; common worm casts; very friable; strongly acid; abrupt, smooth boundary.

C1—8 to 22 inches, yellowish-brown (10YR 5/6) coarse silt loam; breaks to very weak, medium, subangular blocky structure; few strong-brown (7.5YR 5/8) mottles in lower few inches; friable; strongly acid; gradual, wavy boundary.

C2g—22 to 46 inches +, dark yellowish-brown (10YR 4/4) loam becomes coarser with depth and contains thin lenses of silty clay loam, sandy loam, and a few small pebbles; structureless; friable to firm; common medium mottles of light grayish brown (10YR 6/2) and strong brown (7.5YR 5/6); strongly acid; depth to sandstone estimated to be about 8 feet.

Range in characteristics: The texture of the surface layer ranges from silt loam to loam. The texture of the lower part of the subsoil ranges from silty clay loam to fine sandy loam. The depth to mottling ranges from 16 to 24 inches. In most areas the water table is seasonally high, but in some areas it is within 2 or 3 feet of the surface for much of the year. The Philo soils along Potts Creek generally are a little coarser textured than those along the creeks in the western part of the county.

Location: Nearly level bottom lands along streams that drain acid uplands.

Drainage: Moderately well drained to somewhat poorly drained.

Permeability: Moderate to slow.

Water table: Seasonally high; permanently high in a few areas.

Philo silt loam (Ph).—A profile of this soil is the one described as representative of the series. Small areas of soils that have a surface layer of fine sandy loam were included in mapping.

This soil is easily tilled and is highly productive, but it commonly needs lime. It is suited to all crops commonly grown in the county, but impeded drainage may shorten the life of alfalfa stands. Drainage improves this soil. Some areas are subject to flood damage and need to be kept in close-growing sod. *Capability unit IIw-7; woodland suitability group 10.*

Pickaway Series

In this series are deep, moderately well drained silty soils that have a compact layer, or fragipan, at a depth of about 24 inches. These soils developed in material weathered from Greenbrier limestone that contained considerable silt impurities.

The surface layer is dark-brown or dark grayish-brown silt loam, and the upper part of the subsoil is yellowish-brown, friable silt loam or silty clay loam. The compact layer is silt loam or silty clay loam.

These soils occur on gently sloping, generally slightly concave slopes on uplands of the limestone valley in the north-central part of the county. There are relatively large areas near Pickaway, and small areas are scattered throughout the limestone valley. These soils generally occur within larger areas of the well-drained Frederick and Duffield soils and next to the somewhat poorly drained Guthrie soils.

The Pickaway soils are slow in permeability, moderate to high in available moisture holding capacity, and low to moderate in fertility. They are used principallly for crops.

Representative profile of Pickaway silt loam, 3 to 10 percent slopes, in a meadow, 100 yards north of church at Pickaway [11]—

Ap—0 to 9 inches, dark-brown (10YR 4/3) to dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; slightly acid; abrupt, wavy boundary.

A2—9 to 15 inches, yellowish-brown (10YR 5/4) silt loam; mainly weak, fine, subangular blocky structure, some weak, thin, platy structure; friable; slight tendency to form a traffic pan; slightly acid; clear, wavy boundary.

B1—15 to 21 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine and medium, subangular blocky structure; few small concretions of manganese; friable; medium acid; clear, wavy boundary.

B21—21 to 30 inches, yellowish-brown (10YR 5/4) heavy silt loam; some faces of strong brown (7.5YR 5/6); few faint mottles of light brownish gray (10YR 6/2); moderate, medium and coarse, subangular blocky structure and weakly massive; common manganese concretions; friable to firm; few thin clay films; medium acid; gradual, wavy boundary.

B22m—30 to 44 inches, light olive-brown (2.5YR 5/4) silt loam; common fine mottles of light brownish gray (2.5YR 6/2) and strong brown (7.5YR 5/6); weak fragipan; massive, but breaks to moderate, medium, platy structure and moderate, fine and medium, subangular blocky structure; common manganese concretions; firm; few thin clay films; strongly acid; gradual, wavy boundary.

B3—44 to 50 inches, light olive-brown (2.5YR 5/4) silt loam; massive; firm or very firm; many shot-sized manganese concretions, also clusters of concretions as much as 2 inches across, and some large 1-inch nodules; strongly acid; abrupt, wavy boundary.

Dr—50 inches +, limestone; top of which is quite silty.

Range in characteristics: The texture of the subsoil ranges from silt loam to silty clay loam. The depth to mottling ranges from 18 to 24 inches. The fragipan is weak to moderately well developed. It occurs at a depth of 24 to 30 inches and is from 1 to 2 feet thick. In some places there are only a few manganese concretions, and in others there are many. Fairly flat limestone occurs at a depth of 3 to 6 feet.

Location: Smooth, slightly concave slopes on uplands of limestone.

Slope: 3 to 10 percent.

Drainage: Moderately well drained.

Permeability: Slow in the fragipan layer.

Pickaway silt loam, 3 to 10 percent slopes (PkB).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are a few small areas of Guthrie silty clay loam and of Duffield silt loam.

This soil has been intensively cropped. It has a very low content of organic matter and may be low in phosphorus and potassium. All crops commonly grown in the county are suitable, but alfalfa may be short lived.

[11] Chemical and physical data for profile S58WVa-32-1-(1-6) appears in the section "Laboratory Data on Selected Soil Profiles."

The content of organic matter needs to be maintained. Phosphate and potash are essential for good yields. Some seepage spots need to be drained. *Capability unit IIe-14; woodland suitability group 3.*

Pope Series

The Pope series consists of deep, well-drained, nearly level soils on bottom lands that are occasionally flooded. These soils developed in recently deposited alluvium that washed from adjacent uplands of acid sandstone and shale. They are strongly acid.

The surface layer is grayish-brown, very friable fine sandy loam. It is underlain by dark yellowish-brown fine sandy loam that becomes coarser textured with depth.

These soils occur close to the stream channels. They are associated with the moderately well drained to somewhat poorly drained Philo soils and with the poorly drained Atkins soils.

The Pope soils are moderately rapid in permeability. They are used for crops and pasture.

Representative profile of Pope fine sandy loam, in a field—

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) to dark-brown (10YR 4/3) fine sandy loam; very weak, medium, granular structure; very friable; medium acid; clear, wavy boundary.

C1—11 to 25 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; mainly structureless, but some breakage to very weak, medium, subangular blocky structure; very friable when broken out, but somewhat firm and compact in place; strongly acid; gradual boundary.

C2—25 to 37 inches, dark yellowish-brown (10YR 4/4) sandy loam; single grain; few fine pebbles; very friable to loose; strongly acid; gradual boundary.

C3—37 inches +, stratified gravel, channery material, and sand; some large stones; strongly acid; depth to bedrock about 10 feet; creek flows on broken sandstone and acid shale.

Range in characteristics: The texture of the surface layer is dominantly fine sandy loam but ranges to silt loam. The texture of the subsoil ranges from loamy sand to sandy clay loam. The depth to underlying gravel ranges from 3 to 5 feet. The frequency of overflow varies, especially along the smaller streams.

Location: Nearly level bottom lands along streams that drain the acid uplands.

Drainage: Well drained.

Overflow hazard: About once in 3 years in most places; annually or more often in a few areas.

Permeability: Moderately rapid.

Pope fine sandy loam (Po).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are some less frequently flooded areas, which are principally along the Greenbrier River, and some small areas of soils that have a surface layer of silt loam or gravelly fine sandy loam.

This soil is easily tilled and is high in natural fertility, but it generally needs lime. It is well suited to all crops commonly grown in the county, although some small gravelly areas may be too droughty for the best production of bluegrass. Except for small areas that are damaged by flooding, it has no serious limitations for crops. *Capability unit I-6; woodland suitability group 10.*

Robertsville Series

The Robertsville series consists of deep, nearly level, poorly drained soils that have a dense, slowly permeable, clayey subsoil. These soils occur on concave or slightly depressed slopes on stream terraces that are above the present overflow. They developed in old alluvium that had been washed from uplands of limestone or from soils that have been influenced by lime.

The surface layer is friable, grayish-brown silt loam; the upper part of the subsoil is light brownish-gray silty clay loam; and the lower part is heavily mottled, light-gray and brownish-yellow dense silty clay. The depth to limestone or limy shale ranges from about 6 to 12 feet.

Small areas of these soils occur principally along Indian and Second Creeks. They are associated with the moderately well drained Captina soils, which are on terraces, and with the Huntington, Lindside, and Melvin soils, which are on flood plains.

The Robertsville soils are low to moderate in available moisture holding capacity. They are used for pasture and crops. In many areas they have been improved to some extent by artificial drainage.

Representative profile of Robertsville silt loam, in a meadow—

Ap—0 to 8 inches, grayish-brown (10YR 5/2) to dark grayish-brown (2.5Y 4/2) silt loam; very weak, fine, granular structure; somewhat firm; common mottles of strong brown (7.5YR 5/8); common fine concretions of manganese; medium acid; abrupt, smooth boundary.

A2—8 to 11 inches, light brownish-gray (10YR 6/2) heavy silt loam mixed with some dark grayish-brown (2.5Y 4/2) material from Ap horizon; common, medium, distinct mottles of reddish yellow (7.5YR 6/8) and light gray (10YR 7/1); weak, fine, subangular blocky structure to weak, thin, platy structure; slightly firm; common fine concretions of manganese; medium acid; clear, wavy boundary.

B21g—11 to 18 inches, light brownish-gray (10YR 6/2) heavy silty clay loam; many medium mottles of reddish yellow (7.5YR 7/8) and light gray (10YR 7/1); moderate, fine, subangular blocky structure; few concretions of manganese; few fine pores; medium acid; gradual boundary.

B22g—18 to 43 inches, splotched light-gray (10YR 7/2) and yellowish-brown (10YR 5/8) silty clay; continuous clay flows on peds of grayish brown (10YR 5/2); weak, coarse, subangular blocky structure, breaks to moderate, fine and medium, subangular blocks; common fine pores; common fine concretions of manganese; firm when moist, slightly plastic and slightly sticky when wet; medium acid; gradual, wavy boundary.

C—43 to 63 inches +, yellowish-brown (10YR 5/6) and light-gray (10YR 7/2), stratified silty clay to clay; massive, some breakage to weak, medium, subangular blocky structure; firm when moist, plastic and sticky when wet; medium acid; shaly limestone at a depth of about 8 feet; about 1 foot of gravel on top of limestone.

Range in characteristics: In some places texture of the surface layer is almost silty clay loam. The texture of the subsoil ranges from silty clay loam to clay. The depth to very slowly permeable silty clay or clay ranges from 18 to 26 inches. Surface drainage ranges from fair to ponded.

Location: Nearly level terraces, above present overflow.

Slope: Nearly level.

Drainage: Poorly drained.

Permeability: Slow to very slow.

Robertsville silt loam (Ro).—A profile of this soil is the one described as representative of the series. Included in the areas mapped are some darker colored soils in small depressed areas.

Restricted drainage is the main problem on this soil. In many places water stands on or near the surface early in spring. Artificial drainage is only moderately effective. If the soil is drained, however, corn and mixtures of water-tolerant plants for hay or pasture can be grown successfully. *Capability unit IVw-1; woodland suitability group 11.*

Sloping Eroded Land, Shale Materials (SoD)

Sloping eroded land, shale materials, consists of many small areas of soils that are similar to the severely eroded Teas, Calvin, and Litz soils. Most or all of their original surface layer has been removed by erosion, and the remaining soil material is mostly shallow or very shallow to bedrock. It is very droughty and generally contains a high content of shale. Red or gray shale is exposed in spots, and shallow gullies are common. The slope range is from 10 to 25 percent. There is considerable runoff from higher slopes, and erosion is a very serious hazard.

This land should be kept under permanent cover to prevent further erosion. It is best suited to trees and other woody vegetation. Water-control measures, such as diversion ditches, are needed in most places. *Capability unit VIIe-4; woodland suitability group 8.*

Steep Eroded Land, Shale Materials (SpE)

This land is similar to Sloping eroded land, shale materials, except that the slope range is from 25 to 60 percent. Spots of raw shale occur in many places, and there are many shallow gullies.

This land is very droughty, and it is susceptible to severe erosion. It needs the protection of woody vegetation. Tree planting generally is necessary. Water-control measures, such as diversion ditches, are also needed. *Capability unit VIIe-4; woodland suitability group 8.*

Steep Rock Land (SrF)

Steep rock land consists of small areas in which there are very large outcrops of sandstone. The rocks occur both as ridges and as outcrops on side slopes. There is little or no soil material between the rocks. The vegetation consists mainly of a few stunted trees. Small perpendicular cliffs were included in the areas mapped. The slope range is from 45 to 100 percent.

This land is important mainly as scenic spots and as landmarks in the rough, mountainous woodland. *Capability unit VIIIs-1; woodland suitability group 12.*

Summers Series

The Summers series consists of shallow, well-drained, dark-colored soils that developed in material weathered from acid sandstone. These soils occur only on the high, cool ridges of Peters and Potts Mountains, at an elevation of more than 3,100 feet. They receive more precipitation than is normal for the county.

The surface layer is black or very dark brown stony loam, and the subsoil is brown fine sandy loam. Soil development consists mainly of the buildup of a moderately thick surface horizon, fairly rich in organic matter that stains both the surface and subsurface horizons.

These soils are adjacent to but generally at higher elevations than the associated Dekalb and Lehew soils, which have a normal A1 horizon and leached subsurface horizons.

The Summers soils are mostly in open-canopied forests. Some areas have been cleared and are used for bluegrass pasture.

Representative profile of Summers very stony loam, 5 to 20 percent slopes, in a native bluegrass pasture—

A11—0 to 7 inches, black (10YR 2/1) to very dark brown (10YR 2/2) very stony loam; strong, medium, granular structure; loose; 10 to 30 percent channery material; many fine roots; slightly acid; abrupt, irregular boundary.

A12—7 to 11 inches, dark-brown (10YR 3/3) fine sandy loam; weak, fine, granular structure and weak, fine, subangular blocky structure; friable; 20 to 40 percent channery sandstone fragments; medium acid; clear, irregular boundary.

B2—11 to 21 inches, brown (7.5YR 4/3) sandy loam; mainly single grain, but some weak, fine, subangular blocky structure; loose; some organic stains on most sand grains; 30 to 40 percent channery-sized sandstone fragments; medium acid; abrupt, irregular boundary.

Dr—21 inches +, gray, massive, hard sandstone.

Range in characteristics: The texture of the surface layer is dominantly very stony loam, but in a few areas it is channery loam or channery fine sandy loam. The depth to sandstone bedrock ranges from about 15 to 30 inches.

Location: On ridgetops of Peters and Potts Mountains, at elevations of more than 3,100 feet.

Drainage: Well drained.

Permeability: Moderately rapid.

Stoniness: Stones are about 1 foot in size and generally are from 5 to 30 feet apart on the surface.

Summers very stony loam, 5 to 20 percent slopes (SvC).—A profile of this soil is the one described as representative of the series. Some small areas of channery loams were included in mapping.

This soil occupies less than 100 acres in the county. A few areas have been cleared and are used for bluegrass pasture. If these areas are not too stony, bluegrass grows fairly well even if it is not fertilized. If phosphate is applied, yields are good. Tree growth depends largely on the species and on the position and aspect of the slope. *Capability unit VIIs-2; woodland suitability group 5.*

Teas Series

This series consists of shallow to moderately deep, well-drained, friable, reddish-brown soils that developed in material weathered from acid and weakly calcareous reddish shale and siltstone of the Mauch Chunk and Maccrady formations. These soils are gently sloping to very steep.

The surface layer is reddish-brown silt loam, and the subsoil is reddish-brown heavy silt loam to silty clay loam. The underlying reddish shale contains thin, widely spaced, calcareous lenses and seams.

These soils occur mainly south and west of Union, but there are some small areas north and east of Union that are either adjacent to or within areas of deep soils that developed in limestone material, such as the Frederick soils.

The Teas soils are closely associated with the Calvin soils, which developed in material weathered from reddish Mauch Chunk shale that contained little or no calcareous material. In most places the Teas soils have slightly more clay in the subsoil than the Calvin soils. The Teas soils are also widely associated with the brownish Litz soils.

The Teas soils are moderate in permeability, low to moderate in available moisture holding capacity, and low to moderate in fertility.

In Monroe County, the Teas soils are mapped only in undifferentiated units with the Calvin soils or in complexes with the Calvin and Litz soils.

Representative profile of Teas silt loam, 15 to 25 percent slopes, in a wooded area—

A00—3 inches to ½ inch, continuous cover of hardwood leaf litter.

A0—½ inch to 0, compact, partly decomposed, hardwood litter.

A1—0 to 1 inch, dark reddish-brown (5YR 3/3) silt loam; moderate, fine, granular structure; very friable; many fine roots; medium acid; clear, wavy boundary.

A2—1 to 8 inches, reddish-brown (5YR 5/3) silt loam; weak, fine, subangular blocky structure and weak, thin, platy structure; very friable; many fine roots; medium acid; clear, wavy boundary.

B2—8 to 14 inches, reddish-brown (2.5YR 4/4) coarse silty clay loam; moderate, fine and medium, subangular blocky structure; friable; discontinuous silty films; about 20 percent siltstone fragments; strongly acid; clear, wavy boundary.

C—14 to 22 inches, reddish-brown (2.5YR 4/4) silty clay loam; massive; friable; 60 percent blocky, red and olive-gray siltstone fragments; strongly acid; gradual, wavy boundary.

Dr—22 inches +, olive-gray (5Y 4/2) and weak red (2.5YR 4/2) siltstone.

Range in characteristics: The texture of the surface layer is dominantly silt loam. The texture of the subsoil ranges from silt loam to silty clay loam. The depth to shale bedrock ranges from 18 to 30 inches. The depth to calcareous lenses and seams in the shale bedrock ranges from 6 feet to 10 feet or more.

Location: Mainly in the western part of the county; on dissected slopes that are underlain by red shale that contains some calcareous material.

Drainage: Well drained.

Permeability: Moderate.

Teas and Calvin silt loams, 3 to 8 percent slopes (TaB).—Profiles of these soils are similar to the ones described as representative of their respective series, except that they generally are slightly deeper. The proportion of each soil in this unit is about equal, but individual areas may consist entirely of the Teas soil or entirely of the Calvin soil, or it may contain some of both soils. The Teas soil is dominant in areas that are adjacent to or within areas of soils formed from limestone material. The Calvin soil is more common in steeper areas in the extreme western part of the county. Included in the areas mapped are some small severely eroded spots.

These soils are suited to all crops commonly grown in the county, but they produce only moderate yields. They are readily eroded and should be stripcropped on the contour to prevent soil loss. Diversion ditches will help to control runoff. *Capability unit IIe-11; woodland suitability group 7.*

Teas and Calvin silt loams, 8 to 15 percent slopes (TaC).—These soils are similar to the Teas and Calvin silt loams, 3 to 8 percent slopes, except that they are susceptible to severe erosion. Some severely eroded spots were included in mapping.

These soils are suited to all crops commonly grown in the county, but they need intensive conservation measures, such as contour stripcropping and diversion ditches, to help control runoff and to prevent soil loss. *Capability unit IIIe-11; woodland suitability group 7.*

Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded (TaC3).—These soils are similar to the Teas and Calvin silt loams, 3 to 8 percent slopes, except that they have lost most of the original surface layer through erosion. Consequently, they are shallower, and there is more shale in the profile. There are also some outcrops of sandstone or shale. The hazard of further erosion is severe.

These soils are best suited to long-term hay, but a row crop can be grown in a long rotation. Contour stripcropping and diversion ditches will help to control runoff and to prevent soil loss if tilled crops are grown. *Capability unit IVe-2; woodland suitability group 7.*

Teas and Calvin silt loams, 15 to 25 percent slopes (TaD).—These soils are similar to the Teas and Calvin silt loams, 3 to 8 percent slopes, except that there are some outcrops of rock. Some small severely eroded spots were included in mapping.

These soils are best suited to long-term hay, but a row crop can be grown in a long rotation. Tilled crops should be grown in contour strips. Diversion ditches are needed in places to help control surface runoff. *Capability unit IVe-2; woodland suitability group 7.*

Teas and Calvin silt loams, 25 to 45 percent slopes (TaE).—These soils occur mostly in the extreme western part of the county. They are slightly more shallow than the typical soils, and there are some outcrops of sandstone and some small severely eroded spots. The Calvin soil tends to be dominant in the areas mapped.

These soils can be used to some extent for pasture, but they are best suited to trees because of the steep slopes and the severe hazard of erosion. *Capability unit VIIe-2; woodland suitability group 7.*

Teas and Calvin soils, 15 to 25 percent slopes, severely eroded (TcD3).—These soils are similar to the Teas and Calvin silt loams, 15 to 25 percent slopes, except that they have lost most of the original surface layer through erosion, and, consequently, they are shallower. In places the surface layer is shaly silt loam or silty clay loam. There are some outcrops of sandstone and shale.

These soils are best suited to pasture or woods. *Capability unit VIe-2; woodland suitability group 7.*

Teas and Calvin soils, 25 to 45 percent slopes, severely eroded (TcE3).—These soils are similar to the Teas and Calvin silt loams, 25 to 45 percent slopes, except that they have lost most of their original surface layer through erosion, and they are shallower. In places the surface layer is silty clay loam. Outcrops of sandstone and shale occur in places.

These soils are best suited to trees. They have severe restrictions if used for pasture. *Capability unit VIIe–2; woodland suitability group 7.*

Teas-Calvin-Litz Complexes

In some areas in Monroe County, the Teas, Calvin, and Litz soils occur in such intricate patterns that it was not practical to map them separately. These soils were mapped together in complexes. Generally, the Teas and Calvin soils make up about half of each complex, and the Litz soil makes up the rest. On steeper slopes, however, the proportion of Teas and Calvin soils is greater.

These soils are dominantly silt loam and very stony silt loam. They are moderate in permeability and low to moderate in available moisture holding capacity. In most places they are moderately productive. Severe erosion is common.

Teas-Calvin-Litz silt loams, 3 to 8 percent slopes (TlB).—Profiles of these soils are slightly deeper than the ones described as representative of their respective series. These soils occur on relatively smooth slopes near the top of hills or on rolling ridges. The Litz soil makes up about two-thirds of this complex.

These soils are fairly well suited to the crops commonly grown in the county. Tilled crops should be grown in contour strips to control erosion. Diversion ditches are needed on some long slopes. *Capability unit IIe–11; woodland suitability group 7.*

Teas-Calvin-Litz silt loams, 8 to 15 percent slopes (TlC).—These soils are similar to the Teas-Calvin-Litz silt loams, 3 to 8 percent slopes. Slopes are fairly smooth and uniform.

A rotation should be no more intensive than corn, a small grain, and 2 years or more of hay. Crops should be grown in contour strips to control erosion. Diversion terraces are needed on some long slopes to control or divert runoff. *Capability unit IIIe–11; woodland suitability group 7.*

Teas-Calvin-Litz silt loams, 15 to 25 percent slopes (TlD).—These soils are similar to the Teas-Calvin-Litz silt loams, 3 to 8 percent slopes, except that they are slightly more shallow. They are low in fertility and are susceptible to severe erosion. The Litz soil makes up about half of this complex. Some small severely eroded spots were included in mapping.

These soils are best suited to a long rotation, such as a row crop, a small grain, and 3 years or more of hay. Mixtures of alfalfa and grass are well suited if the soils are properly limed and fertilized. Tilled crops should be grown in contour strips to control erosion. Diversion terraces are needed on some long slopes. *Capability unit IVe–2; woodland suitability group 7.*

Teas-Calvin-Litz silt loams, 25 to 45 percent slopes (TlE).—These soils are more shallow than the Teas-Calvin-Litz silt loams, 3 to 8 percent slopes, and some rock ledges are exposed. The steep slopes are subject to erosion. The Teas and Calvin soils make up about 60 percent of this complex. Included in the areas mapped are small areas of severely eroded soils.

These soils are best suited to trees. If used for pasture, they need to be limed, fertilized, and mowed. *Capability unit VIIe–2; woodland suitability group 7.*

Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded (TmB3).—These soils range from shallow to moderately deep within short distances. They are similar to the Teas-Calvin-Litz silt loams, 3 to 8 percent slopes, except that they have lost most of the original surface layer through erosion, and some small gullies have formed. The Litz soil makes up about two-thirds of this complex. Included in the areas mapped are some soils that have a finer textured surface layer.

A rotation no more intensive than corn, a small grain, and 2 years or more of hay is required to control erosion. Crops should be grown in contour strips. Diversion terraces are needed on some long slopes to control erosion or to divert water from gullies that are actively eroding. *Capability unit IIIe–11; woodland suitability group 7.*

Teas-Calvin-Litz complex, 8 to 15 percent slopes, severely eroded (TmC3).—These soils are similar to the Teas-Calvin-Litz silt loams, 3 to 8 percent slopes, except that they have lost most of the original surface layer through erosion. They range from shallow to moderately deep within short distances. The remaining surface layer ranges from silt loam or shaly silt loam to silty clay loam, and in places there are small outcrops of shale.

These soils are best suited to hay. A row crop can be grown in a long rotation. Contour stripcropping and diversion ditches help to divert runoff and to control erosion. *Capability unit IVe–2; woodland suitability group 7.*

Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded (TmD3).—These soils are similar to the Teas-Calvin-Litz silt loams, 3 to 8 percent slopes, except that they have lost most of the original surface layer through erosion, and some gullies have formed. The remaining surface layer ranges somewhat in texture; in some places it is shaly silt loam, and in others it is silty clay loam. In most places the soils are shallow, but they range from shallow to moderately deep.

These soils will produce fair bluegrass pasture if well managed. In some areas they are best suited to trees. *Capability unit VIe–2; woodland suitability group 7.*

Teas-Calvin-Litz complex, 25 to 45 percent slopes, severely eroded (TmE3).—These soils have steep, rather short slopes. They have lost most of the original surface layer through erosion and are shallow in most places. Small gullies have formed, sandstone ledges crop out in places, and some small spots of shale are exposed. The surface layer is silt loam, shaly silt loam, and silty clay loam. The Teas and Calvin soils make up about 60 percent of this complex.

These soils are susceptible to severe erosion. They are best suited to trees. *Capability unit VIIe–2; woodland suitability group 7.*

Teas-Calvin-Litz complex, 45 to 55 percent slopes (TmF).—In most places these soils are shallow. They contain some small fragments of sandstone, and there are a few outcrops of sandstone. There has been some mixing of shale and sandstone, and consequently in places the Litz soil is more reddish than typical and the Teas and Calvin soils are browner. The Teas and Calvin soils make up more than half of this complex. Except for some small areas of severely eroded soils that were included in mapping, the Litz soil makes up the rest.

These soils are erodible. They are best suited to woods. *Capability unit VIIe–2; woodland suitability group 7.*

Teas-Calvin-Litz complex, 45 to 55 percent slopes, severely eroded (TrnF3).—These soils are similar to those in the Teas-Calvin-Litz complex, 45 to 55 percent slopes, except that they have lost most of the original surface layer through erosion, and the remaining surface layer ranges in texture. In most places these soils are shallow, and they contain considerable amounts of shale and small fragments of sandstone. There are some outcrops of rock.

Because of the steep slopes and severe hazard of erosion, these soils are best suited to trees. *Capability unit VIIe-3; woodland suitability group 7.*

Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes (TrC).—These soils contain large blocks of sandstone and fragments of rock that have broken off higher lying ledges and rock outcrops. The Teas and Calvin soils make up slightly more than half of the complex.

These soils are moderate in fertility, but they are difficult to manage because of the large stones. Small areas that can be mowed, limed, and fertilized will produce fair bluegrass pasture. However, most areas are best suited to trees. *Capability unit VIIs-2; woodland suitability group 7.*

Teas-Calvin-Litz very stony complex, 25 to 45 percent slopes (TrE).—This complex is similar to the Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes, except that the Teas and Calvin soils make up a larger part of the complex, and there are more sandstone boulders on the surface.

Because of the steep slopes, stoniness, and susceptibility to erosion, the best use for these soils generally is forest. *Capability unit VIIs-2; woodland suitability group 7.*

Teas-Calvin-Litz very stony complex, 45 to 60 percent slopes (TrF).—These soils occur mainly on steep, short slopes. There are many large sandstone boulders on the surface, and there are some outcrops of sandstone. The Teas and Calvin soils make up as much as two-thirds of the complex.

Generally, the best use for this land is forest. *Capabilility unit VIIs-2; woodland suitability group 7.*

Tilsit Series

The Tilsit series consists of deep, moderately well drained, residual soils that developed in material weathered from acid shale and sandstone of the uplands. A slowly permeable fragipan occurs at a depth of about 2 feet.

The surface layer is grayish-brown silt loam or fine sandy loam, and the upper part of the subsoil is light olive-brown loam or silt loam. The fragipan is mottled, dense, firm, yellowish-brown silt loam or loam.

The Tilsit soils occupy the smoothest parts of the acid uplands in Monroe County. The silt loam occurs mostly on the broad, smooth ridgetops near Ballard and Bozoo in the southwestern part of the county, where the underlying rock is mostly shale and siltstone. The fine sandy loam is on the top of Flattop Mountain and on Swoopes Knobs in the northwestern part of the county, where the underlying rock is shale and sandstone. These soils are moderate in available moisture holding capacity and are low in content of organic matter and in plant nutrients. They are extensive and are important agricultural soils.

Representative profile of Tilsit silt loam, 2 to 8 percent slopes, in a meadow [12]—

Ap—0 to 9 inches, grayish-brown (2.5Y 5/2) silt loam; very weak, fine, granular structure, friable; medium acid; abrupt, smooth boundary.

A2—9 to 14 inches, light yellowish-brown (2.5Y 6/4) silt loam; moderate, thin, platy structure; friable; strongly acid; clear, wavy boundary.

B1—14 to 19 inches, light olive-brown (2.5Y 5/4) silt loam; few streaks of brown (7.5YR 5/4); moderate, fine and medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B21m—19 to 27 inches, yellowish-brown (10YR 5/6) silt loam; common medium mottles of red (2.5YR 4/6) and light brownish gray (2.5YR 6/2); weak fragipan; massive, breaking to moderate, thin and medium, platy structure; firm; strongly acid; clear, wavy boundary.

B22m—27 to 40 inches, light olive-brown (2.5Y 5/4) heavy silt loam; many medium mottles of red (2.5YR 5/6) and light brownish gray (2.5Y 6/2); fragipan; massive, breaking to strong, medium, platy structure; firm to very firm; continuous thin clay films; strongly acid; gradual, wavy boundary.

C—40 to 62 inches, dark yellowish-brown (10YR 4/4) silty clay loam; many coarse mottles of strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2); massive, breaking to moderate, coarse, blocky structure; friable; 25 percent channery-sized siltstone fragments; strongly acid; clear boundary.

Dr—62 inches +, gray siltstone.

Range in characteristics: The subsoil ranges from silty clay loam to fine sandy loam, depending on the amount of sandstone in the parent material. The depth to the fragipan ranges from about 20 to 28 inches. The depth to sandstone or shale ranges from 36 to 72 inches.

Location: Smooth ridgetops underlain by acid shale and sandstone.

Slope: Gently sloping to strongly sloping.

Drainage: Moderately well drained.

Permeability: Slow in the fragipan.

Tilsit fine sandy loam, 3 to 8 percent slopes (TsB).—A profile of this soil is similar to the one described as representative of the series, except that the surface layer is fine sandy loam, the upper part of the subsoil is loam or fine sandy loam, and the fragipan is loam or fine sandy loam. This soil generally occurs at higher elevations than the Tilsit silt loams. It is underlain by sandstone that is somewhat weathered on top.

Most of this soil has been cleared. It is suitable for all crops commonly grown in the county but is not highly productive of alfalfa. It is low in content of organic matter and in plant nutrients. Manure and fertilizer are needed, especially if row crops are grown. *Capability unit IIe-13; woodland suitability group 3.*

Tilsit silt loam, 2 to 8 percent slopes (TtB).—A profile of this soil is the one described as representative of the series. Included in mapping were some small seepy spots and some soils that have a redder, finer textured subsoil.

This soil makes up about 90 percent of the approximately 6,500 acres of Tilsit soils in the county. It is suitable for all crops commonly grown in the county, but it is low or very low in content of organic matter and in plant nutrients. It needs a suitable crop rotation and applications of manure and fertilizer. It is not highly productive of bluegrass, but if lime and fertilizer are applied, it will

[12] Chemical and physical data for profile S58WVa-32-13-(1-6) appears in the section "Laboratory Data on Selected Soil Profiles."

produce fair bluegrass pasture. Alfalfa responds to some extent to boron. *Capability unit IIe-13; woodland suitability group 3.*

Tilsit silt loam, 8 to 15 percent slopes (TtC).—A profile of this soil is similar to the one described as representative of the series, but it is slightly less thick over bedrock. Surface drainage is fair to good.

This soil occurs in small areas, generally adjacent to the steeper Teas-Calvin-Litz complex. It has about the same needs as those described for Tilsit silt loam, 2 to 8 percent slopes, except that the rotation should be longer, and crops should be grown in contour strips. *Capability unit IIIe-13; woodland suitability group 3.*

Tumbez Series

The Tumbez series consists of very shallow to shallow, well-drained, gently sloping to steep, very rocky soils that developed in material weathered from Greenbrier limestone, which generally is parallel to the surface and smooth. The limestone contains a considerable amount of clay and has a distinctive, flat upper surface. Areas of exposed limestone, from 5 to 15 feet across, are common. The exposed limestone generally has an even surface but is characterized by small cracks and fissures.

These soils show little soil development. They have a surface layer of very dark gray or black silty clay and a very dark gray, clayey subsoil. They are erodible and droughty. The reaction is neutral to slightly alkaline throughout. The depth to limestone ranges from 10 to 18 inches.

In Monroe County, the Tumbez soils occur in such intricate patterns with the Chilhowie soils that they could not consistently be separated in mapping. Consequently, they were mapped in a complex with the Chilhowie soils, and the complexes are described under the heading "Chilhowie-Tumbez Complexes."

Representative profile of Tumbez very rocky silty clay, 15 to 25 percent slopes, in a pasture—

Ap—0 to 6 inches, very dark gray (10YR 3/1) to black (10YR 2/1) very rocky silty clay; strong, medium, granular structure; friable; many roots; neutral; clear, wavy boundary.

B2—6 to 13 inches, very dark gray (10YR 3/1) clay; moderate, medium and fine, subangular blocky structure; firm when moist, plastic and sticky when wet; neutral; gradual, wavy boundary.

C—13 to 16 inches, very dark gray (10YR 3/1) clay; massive and weakly cemented with lime; firm when moist, slightly sticky when wet; 20 to 30 percent shot-sized and flattish lime concretions, as much as ½ inch in size; slightly alkaline; breaks abruptly to limestone.

Dr—16 inches +, impure limestone with a smooth surface.

Wellston Series

The Wellston series consists of deep, well-drained residual soils that developed in material weathered from acid, gray sandstone and siltstone. These soils are strongly acid throughout and are moderately permeable.

The surface layer is friable, brown loam or silt loam, and the subsoil is yellowish-brown or strong-brown silty clay loam.

These soils occur on gently sloping to strongly sloping, smooth ridges in the western part of the county. They are associated with the sandier Hartsells soils; with the more shallow, less strongly developed Dekalb soils; and with the moderately well drained Tilsit soils.

In Monroe County, the Wellston soils are mapped in undifferentiated units with the Hartsells soils, and these units are described under the heading "Hartsells Series." Most of the acreage is used for general farming.

Representative profile of Wellston loam, 3 to 10 percent slopes, in a meadow—

Ap—0 to 7 inches, brown (10YR 4/3) loam; weak, fine, granular structure; friable; many fine roots; medium acid; abrupt, smooth boundary.

A2—7 to 10 inches, yellowish-brown (10YR 5/4) loam; weak, fine, granular structure and very weak, medium, platy structure; friable, but somewhat firm and massive in place; strongly acid; clear, wavy boundary.

B21—10 to 17 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, fine and medium, subangular blocky structure; few discontinuous clay films; friable to firm; few small sandstone fragments; strongly acid; clear, wavy boundary.

B22—17 to 26 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; common thin clay films; somewhat firm; about 5 percent small sandstone fragments.

C—26 to 37 inches, yellowish-brown (10YR 5/6) heavy loam that becomes coarser textured with depth; common small splotches of strong brown (7.5YR 5/8) around weathered sandstone; massive; firm in place, but friable if broken out; about 35 percent small sandstone fragments that increase with depth; strongly acid; gradual, wavy boundary.

Dr—37 inches +, gray acid sandstone.

Range in characteristics: The texture of the surface layer is loam or silt loam but ranges to fine sandy loam. The B horizon is silty clay loam or clay loam. The lower part of the B horizon may be somewhat firm.

Formation and Classification of Soils

In this section the factors that have affected the formation of soils in Monroe County are discussed. Also discussed is the classification of the soils by higher categories.

Factors of Soil Formation

Soils are intimate mixtures of broken and partly or completely weathered rock, of minerals, of organic matter, of living plants and animals, and of water and air. They occur as a part of the natural landscape and differ from place to place. Some of the ways in which they differ are in occurrence and degree of development of various horizons; in mineral content; in depth over rock; and in texture, color, and slope. The nature of the soil depends on five soil-forming factors: (1) climate; (2) living organisms; (3) parent material; (4) topography; and (5) time. All of these factors have an influence on the genesis of every soil, but their relative importance varies from place to place. One factor may outweigh others in the formation of a soil and may determine most of its properties. For example, a very young alluvial soil may show only faint horizonation because of the short time the soil-forming factors have had to work, but a level soil that formed in residuum from bedrock may show distinct hori-

zons because the soil material has remained largely in place and all of the soil-forming factors have been active for a long time. Thus, combinations of the five major factors have determined the character of the soils in Monroe County.

Climate

Monroe County has a humid, temperate climate that is fairly uniform throughout the county. The average annual precipitation is about 37 inches. The frost-free season is about 150 days. The average summer temperature is about 70° F., and the average winter temperature is about 34°. Summers are warm, with short hot spells; winters are relatively mild, with frequent freezing and thawing. On Peters and Potts Mountains and at other high elevations, the climate is somewhat cooler; the precipitation, particularly snowfall, is greater; and fogs are more common. In these higher, cooler areas, soils may be a little darker colored and may contain a little more organic matter than those at lower elevations. This is evident in the Summers soil, which occurs on the highest, coolest mountain ridges. This soil contains considerably more organic matter than soils that formed from the same parent material but at lower elevations.

There is not enough difference in climate within the county to account for all the differences in the soils. The climate of Monroe County tends to develop strongly weathered, leached, moderately fertile, acid soils. The mature soils in the county have these characteristics and generally are in the Red-Yellow Podzolic great soil group.

Living organisms

The natural vegetation of Monroe County was a mixed forest of hardwoods. Oak was dominant, but there were some hickory, chestnut, yellow-poplar, and other hardwoods. Conifers were scattered, and pure stands were not extensive. These forests generally were uniform throughout the county, and, therefore, their influence on the soils was about the same.

Soils that develop under hardwoods have a thin, mull-type organic surface layer, or A1 horizon. Hardwoods use much of the calcium and other bases in the soil, but these bases are returned at least partially each year in the fallen leaves. In this humid, temperate climate, this recycling, or return of soluble bases, helps to counteract the tendency of the soils to lose bases through leaching.

Micro-organisms, earthworms, and other small fauna tend to break down, mix, and incorporate organic matter in the soil, particularly in the surface horizon. This helps to form a mull-type horizon.

Since the forests of the county are uniform, the character of the forest litter and the organic surface horizon are also uniform. Therefore, it is assumed that the soil organisms are somewhat uniform throughout the county, and that they have about the same influence on all soils.

There is a tendency for soils under grass to develop deeper organic horizons than soils under trees, but cropping and erosion may slow or reverse this process. Although much of the smoother parts of Monroe County have been used for crops or pasture for many years, most of the plow layer, or Ap horizon, of the soils on the uplands are low or very low in content of organic matter.

Parent material

The parent materials in each of the three physiographic areas in Monroe County have distinct characteristics that influenced the soils in these areas (*17*). For this reason, the geology and parent materials are discussed by areas, starting from the west, near Wayside, and moving eastward and southward toward Waiteville.

Figure 12 shows a cross section of the physiographic areas and the major soils that occur in each. Following is a description of the three areas.

Mississippian shale, siltstone, and sandstone of the dissected plateau.—Rocks of the Mauch Chunk series of Mississippian age underlie the dissected plateau that occupies the western third of Monroe County. Strata are flat bedded or dip gently to the west. The Mauch Chunk series contains gray shale; interbedded red and gray siltstone, some of which contains lime; scattered thin-bedded sandy limestone; and interbedded gray, massive or flaggy sandstone. The lower member of the Mauch Chunk series, or Bluefield group, contains less red siltstone and more gray shale and limestone than the upper member, or Hinton group. The shaly Litz soils are predominant on the Bluefield group, and the Teas-Calvin-Litz soils are predominant on the Hinton group. Rocks of the Mauch Chunk series weather to form soils that are relatively high in silt and low in clay. The parent rocks are moderate in content of easily weathered minerals, and the soils may vary in color and depth within short distances.

The Dekalb, Hartsells, and Wellston soils occur on the smooth ridges and benches underlain by sandstone. The Dekalb soils also occur on the steep slopes where sandstone is predominant. The deeply weathered Tilsit soils occur on smooth ridges and benches where silty parent materials predominate. From the ridges, the descent generally consists of a succession of rather steep slopes broken by resistant rock benches, until the valley floor is reached. The reddish Teas and Calvin soils, which formed in material weathered from red siltstone, and the brownish Litz soils, which formed in material weathered from gray siltstone, occur on these slopes. These soils are shallow to moderately deep and occur commonly in a banded or mixed pattern.

The soil material on the bottom lands is somewhat mixed but is medium textured and generally high in bases. However, there are both acid and lime-influenced soils on the bottom lands. The colluvial soils generally occur in small individual areas and are influenced by lime. The Clarksburg soils, which formed in colluvial material, are relatively young and are not strongly weathered.

Mississippian limestone and shale of the limestone valley.—Greenbrier limestone of Mississippian age forms most of the underlying rock in the broad, rolling valley in the north-central part of the county. Small areas of Mauch Chunk rocks occur at the higher elevations within this general area. A narrow strip of the Maccrady series underlies the Greenbrier limestone on the eastern edge of the valley.

The Greenbrier series consists of thick, essentially flat-bedded limestone. It ranges from 700 to 1,800 feet in thickness, from very dark gray to medium gray in color, and from nearly pure to highly siliceous in composition. Chert is common and is especially abundant in the lower part. Most of the chert is angular, but some is rounded.

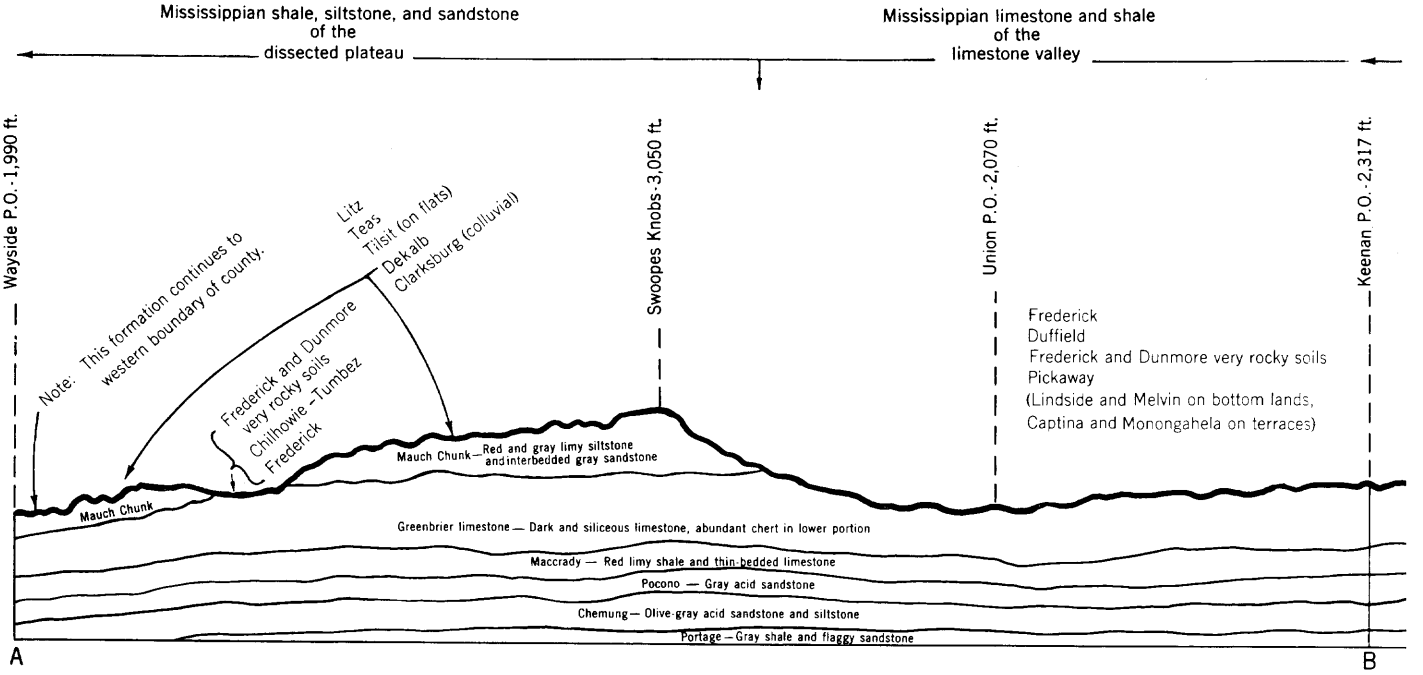


***Figure 12.*—Schematic cross section of physiographic areas,**

The soils in this area have developed mostly in material weathered in place. Although similar in general characteristics, they reflect the differences that occur in the various members of the Greenbrier limestone. For example, the Frederick soils have a fairly high content of chert; the lighter colored, more silty Duffield soils reflect the effect of the siliceous Pickaway member of the Greenbrier limestone that weathers to a soft, buff-colored, silty "soapstone;" and the fine-textured Chilhowie and Tumbez soils developed on strata that weathers readily to material high in content of clay. Outcrops of limestone are common throughout the valley, especially on the steeper slopes, and total acreage of rocky soils is fairly large.

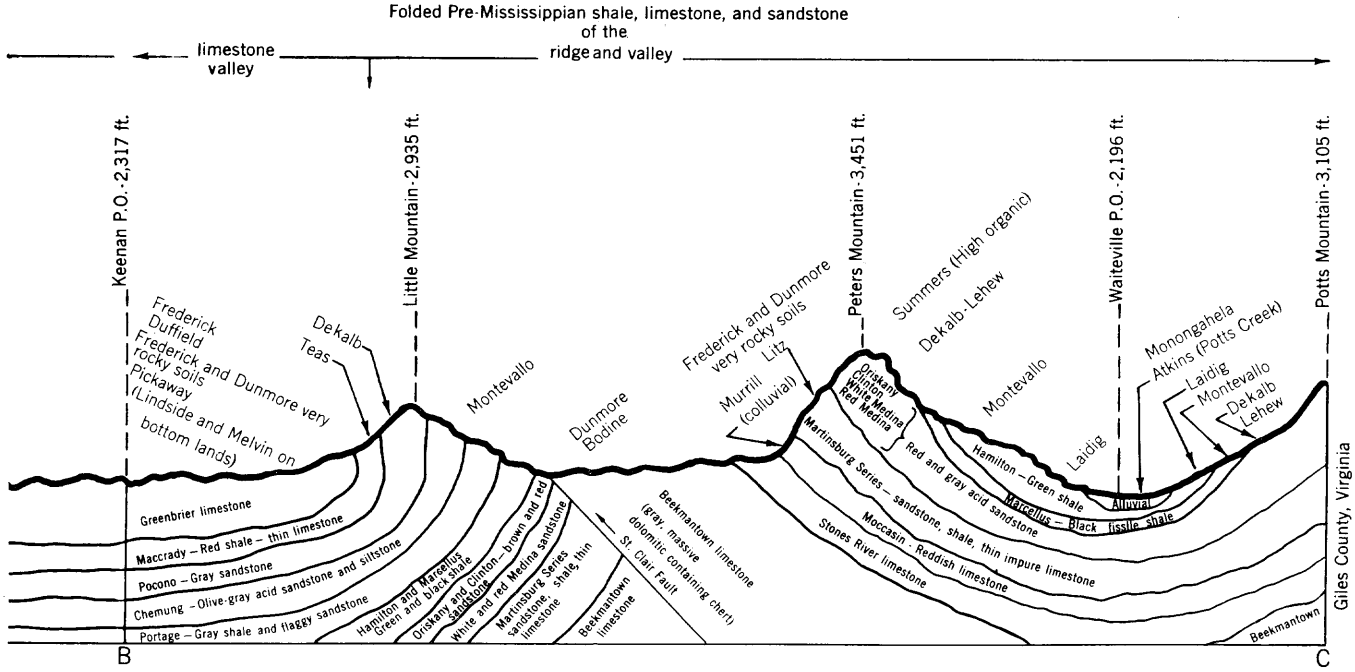
The residual soils that developed in material weathered from Greenbrier limestone are typically deep, productive, moderately or strongly weathered, acid soils that are fairly high in content of silt. Colluvial material is not extensive, but small inclusions occur on the bottom of sinkholes. The lime-influenced Lindside and related soils, which occur on bottom lands in the valley, are slightly acid to neutral and are highly productive when not too wet.

The Maccrady series of the Mississippian age, which occurs on the eastern edge of the valley, consists of limy red shale and thin limestone. This series dips rather strongly to the west. The Teas and Calvin soils in the limestone valley developed principally in materials weathered from this formation. The parent material of these soils, however, tends to be somewhat mixed because it lies between the Greenbrier limestone to the west and the higher Pocono sandstone to the east.

Folded pre-Mississippian shale, sandstone, and limestone of the ridge and valley.—These rocks underlie an area that occupies a narrow belt along the southern edge and the entire part of Monroe County (*4*). The rocks in this area are faulted and are strongly folded. The nearly vertically bedded Pocono sandstone of Mississippian age forms the northern and western edges of the area. The Dekalb soils occur on the steep slopes and narrow, gently sloping ridges. Devonian shale and siltstone, mainly of the Portage and Chemung series, extend southward to the St. Clair fault line at the base of Little Mountain. These rocks dip sharply to the west. Slopes are steep, and soils are shallow. The shallow, infertile Montevallo soils developed in material weathered from these rocks.

South of the St. Clair fault, the Beekmantown dolomitic limestone forms a rolling valley. This Ordovician limestone is overturned and dips strongly to the east. The Dunmore soils, which are high in kaolinitic clay, and the cherty Bodine soils occur on this limestone. Ordovician limestone forms the southern edge of this valley. Colluvial material from the sandstone slopes of Peters Mountain has accumulated here. The very acid Laidig soils formed where the colluvium is very deep. The Murrill soils occur where the colluvium is more shallow over limestone and the lower part of their subsoil is influenced to some extent by lime, apparently because ground water has percolated through limestone material. Peters Mountain occurs south of this valley. The Martinsburg series of Ordovician age consists of shale and limestone. It dips to the west and forms the east or escarpment face of Peters Mountain. The shallow Litz soils and other limestone soils, which are mostly rocky, developed in material weathered from these rocks. Above the Martinsburg series is Silurian sandstone of the Red Medina, White Medina, and Clinton series. This resistant sandstone forms the top of Peters Mountain. The Dekalb and Lehew soils are dominant on these very steep slopes.

Devonian rocks extend southward from Peters Mountain and form the synclinal Potts Valley. Potts Creek drains this valley. Much of the area is poorly drained. The very acid Philo soil and related soils occur on the bottom lands. The Monongahela soils occur on the terraces and



showing major geologic strata and dominant soils on them.

in places are only 5 to 6 feet in depth to folded Devonian shale. Colluvial deposits are extensive at the base of the steep mountain slopes. The Laidig soils, which developed in these materials, are fairly old since they have, for the most part, distinctly formed horizons.

Soils in this area are closely related to their parent material (see fig. 12). However, because of the steep slopes and folded rocks, the parent material of most of the soils is somewhat mixed.

Topography

Position on the landscape exerts an important influence on the soils of Monroe County because of its relationship to other soil-forming factors, particularly time and parent material.

The four general topographic positions in the county are (1) uplands, (2) colluvial slopes, (3) terraces, and (4) flood plains. Table 12 shows the topographic position, depth, drainage, and parent materials of all of the soils in the county except the miscellaneous land types. Following is a discussion of these topographic positions and their influence on the soils.

Uplands. Soils on uplands characteristically have developed in material weathered from the underlying rocks. They occupy about 86 percent of the county. A difference in slope has a marked effect on soil development even if the parent materials are the same. On gentle slopes the soil material remains in place, and a mature profile develops. The Hartsells and Wellston soils, which are on sandstone flats on dissected uplands, are good examples of mature soils. On steep slopes there is more runoff, less percolation, and more soil creep. Movement of soil material does not allow the soil-forming processes to act on the same material for a long time. The result is weakly developed soils, such as the DeKalb and Montevallo. Most of the soils on the uplands are well drained or are moderately well drained.

Colluvial slopes. These slopes consist of soil material that has collected, through creep and wash, at the base of steep slopes or mountains. Extensive areas of colluvial soils occur as narrow bands at the base of Peters and Potts Mountains. These soils formed in colluvial material weathered mostly from acid sandstone. In places they are underlain at a moderate depth by limestone.

Small areas of other colluvial soils occur at the base of fairly long slopes throughout the county. Colluvial soils that developed in material weathered from lime-influenced shale are fairly extensive in the western part of the county.

Colluvial deposits range from fairly recent, such as the colluvium in which the Clarksburg soils developed, to quite old, such as the colluvium in which the Laidig soils developed. Most slopes are concave and receive runoff from high slopes. Lateral underground seepage from higher areas is fairly common, and the soils may be influenced by carbonates or other bases carried in the ground water. Colluvial soils make up about 9 percent of the county.

Old stream terraces. These terraces are the former flood plains of the county. The soil material was deposited when the streambeds were at a higher level than at present, and it has been subject to soil-forming processes for a relatively long time. This material consists of two general types, (1) material that has been washed mainly from acid uplands, such as the material in which the Monongahela soils developed, and (2) material that has been washed from lime-influenced and limestone uplands, such as the material in which the Captina soils developed. The Captina soils still show some effects of lime in the lower part of their profile.

TABLE 12.—*Soil series arranged to show topographic position, parent material, drainage, and depth*

Parent material	Well drained		Moderately well drained, deep	Somewhat poorly drained, deep	Poorly drained, deep
	Shallow and moderately deep	Deep			
UPLANDS					
Residuum from:					
Acid gray sandstone	Dekalb, Summers [1]	Hartsells, Wellston.			
Acid reddish sandstone	Lehew				
Acid gray shale, siltstone, and sandstone of Devonian age.	Montevallo				
Acid gray siltstone and some sandstone			Tilsit [2]		
Gray shale and siltstone that contain some calcareous strata.	Litz				
Reddish shale and siltstone that contain some calcareous strata.	Teas, Calvin				
Limestone—					
Greenbrier limestone that contains considerable chert.		Frederick			
Greenbrier limestone, silty strata		Duffield	Pickaway [2]	Guthrie [3]	
Greenbrier limestone, clayey strata	Chilhowie, Tumbez [4]				
Beekmantown limestone, high in kaolinitic clay.		Dunmore			
Beekmantown and Greenbrier limestone, very cherty strata.		Bodine			
COLLUVIAL SLOPES					
Colluvium from:					
Acid gray sandstone, colluvium underlain by sandstone and shale.		Laidig			
Acid gray shale, siltstone, and sandstone			Leadvale		
Acid gray sandstone, colluvium underlain by limestone.		Murrill			
Very cherty limestone, colluvium underlain by limestone.			Landisburg [2]		
Lime-influenced shale and siltstone and thin limestone strata.			Clarksburg		
TERRACES					
Material from acid shale, siltstone, and sandstone of the uplands.			Monongahela [2]		
Material from limestone and lime-influenced shale and siltstone of the uplands.			Captina [2]		Robertsville.
FLOOD PLAINS					
Alluvium from:					
Acid sandstone, siltstone, and shale of the uplands.		Pope	Philo		Atkins.
Limestone and lime-influenced shale and siltstone of the uplands.		Huntington	Lindside		Melvin.

[1] The Summers soils are mostly shallow, occur at elevations of more than 3,100 feet, and have a thick, dark-colored surface horizon.
[2] Fragipan in subsoil.
[3] Influenced by local limestone colluvium; ranges from moderately deep to deep and from somewhat poorly drained to poorly drained.
[4] The Tumbez soils are very shallow to shallow over limestone, are clayey and plastic, and are neutral in reaction.

The soils on terraces are moderately to strongly leached and have a strongly developed profile. They make up about 1 percent of the county.

FLOOD PLAINS AND BOTTOM LANDS. These areas are subject to flooding and periodically receive new deposits of soil materials. Soils that formed in these deposits show only weak profile development. They are nearly level and range from well drained to poorly drained. The poorly drained soils show effects of gleying. There are two general types of alluvial deposits in Monroe County, (1) material that has been washed from uplands of acid sandstone and shale, such as the material in which the Pope soils developed, and (2) material that has been washed from lime-influenced or limestone uplands, such as the material in which the Huntington soils developed. Soils on flood plains make up about 4 percent of the county.

Time

The length of time that climate, vegetation, and topography have acted on soil material affects the character of the soil. An old, strongly developed soil shows well-defined genetic horizons. A young, less well-developed soil shows only faint or weakly developed horizons. The soils of Monroe County range from young soils on bottom lands to old soils on smooth, upland flats.

Periodic flooding keeps alluvial soils in a state of change. Consequently, most soils on flood plains are weakly developed. Some of the alluvial soils in Monroe County, such as the Huntington and Philo, have not been in place long enough to form genetic horizons.

In steep and very steep areas, soil material is either removed by creep and washing or mixed by solifluction before it has had sufficient time to develop a deep soil profile. As a result, shallow and weakly developed soils, such as the Montevallo and Dekalb, are common on steep slopes.

In smooth upland areas, soil material is relatively stable, and its removal is slow. Therefore, the soil-developing factors have had a long time to act on the same material, and mature soils that have distinct genetic horizons, such as the Frederick soils, have formed.

Classification of Soils

In this subsection the soil series of Monroe County are placed in great soil groups (*13*). The soils within each great soil group have several characteristics in common, but they may differ greatly in other characteristics. Generally, the soils have the same kind and number of horizons, although horizons of similar identity are not necessarily of the same thickness, nor are they expressed with the same degree of clarity.

Some of the soils have characteristics of more than one great soil group. Such soils are classified in one great soil group but are described as intergrades toward another group.

In the following list the soil series in Monroe County are classified into great soil groups. Following the list, there is a discussion of the great soil groups represented in the county.

Gray-Brown Podzolic soils:
- Central concept: Chilhowie, Clarksburg.
- Intergrading to Red-Yellow Podzolic soils: Captina, Duffield, Leadvale, Murrill, Wellston.

Red-Yellow Podzolic soils:
- Central concept: Dunmore, Frederick, Hartsells, Laidig, Landisburg, Monongahela, Pickaway, Tilsit.
- Intergrading to Lithosols: Litz.

Planosols:
- Central concept: Guthrie, Robertsville.

Sols Bruns Acides:
- Central concept: Bodine, Dekalb, Lehew, Summers.
- Intergrading to Lithosols: Calvin, Teas.

Lithosols:
- Intergrading to Sols Bruns Acides: Montevallo.

Low-Humic Gley soils:
- Central concept: Atkins, Melvin.

Rendzina soils:
- Central concept: Tumbez.

Alluvial soils:
- Central concept: Huntington, Lindside, Philo, Pope.

Gray-Brown Podzolic soils

Soils of this great soil group that have not been plowed have a thin, dark-colored, organic-mineral A1 horizon and a leached, lighter colored A2 horizon that extends to a depth of 8 to 10 inches. The illuvial B horizons are somewhat finer textured than the A horizons, have stronger colors, and have moderately well defined blocky or subangular blocky structure.

CENTRAL CONCEPT. The Gray-Brown Podzolic great soil group is represented in Monroe County by the Chilhowie and Clarksburg soils. However, many of these soils have been plowed and have a dark grayish-brown Ap horizon, about 8 inches thick, that is a mixture of the A1 and A2 horizon. A few inches of the A2 horizon may be intact, or the B horizon may be immediately below the Ap horizon. These soils exhibit rather distinct horizonation, but the leaching of bases is considered to be only moderate. The percentage of base saturation generally increases with depth and normally is more than 35 percent.

The Gray-Brown Podzolic soils in Monroe County developed in material weathered from limestone or in lime-influenced parent material. Exchangeable calcium commonly increases with depth and makes up a large part of the exchangeable bases. The Clarksburg soils are considered typical Gray-Brown Podzolic soils. A representative profile of Clarksburg silt loam is described in the section "Descriptions of Soils." The Chilhowie soils are moderately deep and rocky.

INTERGRADING TO RED-YELLOW PODZOLIC SOILS. The Captina, Duffield, Leadvale, Murrill, and Wellston soils show some characteristics of both the Gray-Brown Podzolic and the Red-Yellow Podzolic great soil groups.

These soils resemble the Gray-Brown Podzolic soils in sequence of horizons, in depth of solum, in color, and generally in degree of textural and structural development. However, they appear to be more strongly weathered than typical Gray-Brown Podzolic soils, and they are acid throughout the solum. Most of these soils developed in acid parent material. The Captina and Duffield soils developed in materials weathered from limestone but are moderately leached. The typical Gray-Brown Podzolic soils in Monroe County developed in material weathered

from limestone or in lime-influenced material and are not strongly leached.

These soils resemble the Red-Yellow Podzolic soils in low degree of base saturation and in low remaining content of readily weathered minerals. The percentage of base saturation generally is less than 35 percent. The Leadvale and Murrill soils have a compact layer in the lower part of the subsoil that approaches a fragipan, and the Captina soils have a fragipan in the lower part of the subsoil. Murrill channery loam is a good example of an intergrade between a Gray-Brown Podzolic soil and a Red-Yellow Podzolic soil. A representative profile of this soil is described in the section "Descriptions of Soils."

Red-Yellow Podzolic soils

Undisturbed Red-Yellow Podzolic soils have a thin, dark-colored A1 horizon, in which the organic matter is largely mixed with the mineral material, and a prominent, lighter colored A2 horizon that extends to a depth of 8 to 12 inches.

Central concept. The Red-Yellow Podzolic great soil group is represented in Monroe County by the Dunmore, Frederick, Hartsells, Laidig, Landisburg, Monongahela, Pickaway, and Tilsit soils. These soils are extensive and generally occupy the smoother slopes. Most of the soils have been cropped or maintained as pasture for many years, and an undisturbed soil is not common. Typically, the Ap horizon, which is from 7 to 8 inches thick, is dark grayish brown, friable, weakly granular, and low in content of organic matter. About 2 or 3 inches of the A2 horizon may be intact below the plow layer, or the plow layer may extend to the B horizon. The B horizons have pronounced clay accumulation and are one or more textural classes finer textured than the A2 horizon. They have moderate to strong blocky structure and are yellowish red, reddish brown, or yellowish brown. Clay coatings are prominent on peds and on root channels. In most places the B horizons are strongly acid. Base saturation generally is less than 35 percent and decreases with depth. The parent rock ranges from limestone to acid sandstone and siltstone.

The Monongahela, Pickaway, Landisburg, and Tilsit soils have a weak to moderately well developed fragipan in their subsoil.

Dunmore cherty silt loam is considered a typical Red-Yellow Podzolic soil. One representative profile of this soil is described in the section "Descriptions of Soils," and another is described in the section "Laboratory Data on Selected Soil Profiles."

Intergrading to Lithosols. The Litz soils in the county closely resemble Red-Yellow Podzolic soils but have some characteristics of Lithosols. They resemble Red-Yellow Podzolic soils in having a B horizon that, although thin, is appreciably finer textured than the A horizon, and in having generally low base saturation, characteristic Red-Yellow Podzolic colors, and clay films on many peds. The Litz soils resemble Lithosols in that they are shallow to bedrock and have a high content of shaly material throughout the profile.

Planosols

Planosols typically have eluviated or somewhat leached surface horizons that are underlain by moderately well developed to well developed illuvial B horizons, which are distinctly higher in percentage of clay than the layers above. Planosols are characterized chiefly by having one or more horizons that because of high clay content, cementation, or compaction change abruptly from and contrast with adjacent horizons. These layers may be part of the B horizon or may lie below the solum as part of the C horizon.

The Guthrie and Robertsville soils represent Planosols in Monroe County. These soils range from somewhat poorly drained to poorly drained. They have a slowly permeable subsoil that is finer textured than the surface layer and that shows moderate structure and development. The content of clay in the various horizons changes rather abruptly, especially in the uppermost part of the C horizon. A representative profile of Guthrie silty clay loam is described in the section "Descriptions of Soils."

Sols Bruns Acides

Soils of this great soil group have a thin, weak A1 horizon and a thin, lighter colored, weak A2 horizon. The B horizons show slight, if any, increase in content of clay and have weak or very weak structure but are a little stronger colored, or browner, than the horizons above or below. The percentage of base saturation is low, and generally the soils are strongly or very strongly acid.

Central concept. The Bodine, Dekalb, Lehew, and Summers soils represent Sols Bruns Acides in Monroe County (*3*). Except for the Bodine soils, these soils developed in rather coarse-textured parent material that contained a small amount of fine-textured material. The Bodine soils are somewhat finer textured and cherty. They are deep, well-drained soils that formed from material weathered from the cherty strata in limestone.

The Dekalb and Lehew soils are shallow to moderately deep, are somewhat excessively drained, and have low available moisture holding capacity. The Dekalb very stony loams that are on steep slopes are considered typical Sols Bruns Acides. A representative profile of Dekalb very stony loam is described in the section "Descriptions of Soils." The Dekalb soils that are on smoother, less steep slopes are a little more leached than the typical soils, and they have a more developed A2 horizon. The reddish Lehew soils developed in material weathered from red sandstone and, except for color, are similar in profile characteristics to the Dekalb soils. The Summers soils are darker colored, higher in organic-matter content, and slightly less acid than the other soils in this group.

Intergrading to Lithosols. The Calvin and Teas soils closely resemble Sols Bruns Acides but also have some characteristics of Lithosols. They resemble Sols Bruns Acides in the sequence and color of their A, B, and C horizons and in being strongly acid. They resemble Lithosols in that they have a thin solum, are weakly developed, and contain considerable rock. The films in the B horizons appear to be orientated silt instead of clay.

A profile of Calvin silt loam, 15 to 25 percent slopes, is described in the section "Descriptions of Soils."

Lithosols

Lithosols do not have evident genetically related horizons. Typically they have weak A horizons but do not have B horizons. Lithosols consist of freshly and imperfectly weathered rock fragments, and they are shallow or

very shallow to bedrock. Many of the soils classed as Lithosols are stony. Most, but not all, are in hilly, steep, or mountainous regions.

None of the soils in Monroe County are typical Lithosols. Some, however, are classified as Lithosols intergrading to Sols Bruns Acides. Others are classified as Sols Bruns Acides intergrading to Lithosols and are discussed in the foregoing paragraphs.

INTERGRADING TO SOLS BRUNS ACIDES. The Montevallo soils in Monroe County have characteristics of Lithosols but in some ways also resemble Sols Bruns Acides. They are essentially like Lithosols in that they are shallow, are high in content of rock, and have weak horizonation. They resemble Sols Bruns Acides in having weak, thin B horizons that have weak structure and that are slightly finer textured and stronger colored than the A horizons. One representative profile of Montevallo channery silt loam is described in the section "Descriptions of Soils," and another is described in the section "Laboratory Data on Selected Soil Profiles."

Low-Humic Gley soils

Low-Humic Gley soils have a thin, dark-colored surface layer that has a moderately high content of organic matter. The subsoil shows the effects of waterlogging and of exclusion of air for long periods. Gleization is strong. This process results in grayish colors and in intense mottling. There has been little eluviation, or downward movement of fine materials into the subsoil. However, the surface horizon generally is coarser textured than the subsurface horizons.

The Low-Humic Gley great soil group is represented in Monroe County by the Atkins and Melvin soils, which are on bottom lands that are subject to overflow. These soils reflect the influence of poor drainage caused by the higher water table, by the slowly permeable subsurface layers, and by their position in level or depressed areas. In cultivated areas, the Ap horizon is typically dark grayish brown.

Atkins silt loam is a typical Low-Humic Gley soil. This soil developed in material washed from acid uplands. A representative profile of this soil is described in the section "Descriptions of Soils." The Melvin soil, which developed in material washed from lime-influenced uplands, is slightly browner, has somewhat better structure, and has a more permeable subsoil than the Atkins soil.

Rendzina soils

Rendzina soils generally have a dark-gray or black, friable, granular surface horizon that is underlain by grayish or yellowish calcareous material. These soils have a high content of clay but show little increase in clay content in the subsurface horizons. They are high in bases, especially calcium. In many places the percentage of base saturation in the subsurface layers is 100 percent.

The Rendzina great soil group is represented in Monroe County by the Tumbez soils. These soils developed under a mixed forest of hardwoods, in material weathered from the pure but apparently soft strata in Greenbrier limestone. They are shallow and range from about 10 to 18 inches in depth to limestone. A representative profile of Tumbez very rocky silty clay is described in the section "Descriptions of Soils."

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Alluvial soils

Alluvial soils occur on bottom lands near streams that are subject to overflow. Consequently, new sediments are deposited faster than the soil-forming processes can bring about significant changes in the soils already in place.

The Huntington, Lindside, Philo, and Pope soils represent the Alluvial great soil group in Monroe County. These soils are well drained and moderately well drained. The moderately well drained soils show slight gleization in the lower part of the subsoil.

The Huntington and Lindside soils developed in materials washed from lime-influenced uplands and are slightly acid to neutral throughout. The Philo and Pope soils developed in materials washed from uplands of acid sandstone and shale and are strongly acid. The soils in this group are productive and have a relatively high content of organic matter. Huntington silt loam is a typical Alluvial soil. A representative profile of this soil is described in the section "Descriptions of Soils."

Laboratory Data on Selected Soil Profiles[13]

This section includes laboratory data and profile descriptions for eight selected soil series. The physical and chemical properties of these soils are shown in tables 13 and 14. The data will be helpful in characterizing and classifying the soils and in understanding their genesis. The information will also be useful in interpretations for use and management and will serve as a check against field methods and determinations.

The soils from which samples were taken are considered representative of their respective series. One of the Frederick soils tested is in adjacent Greenbrier County, but this soil is considered essentially the same as a soil of the same series in Monroe County. Samples were collected from each horizon in the soil profile. The laboratory analyses were made at the Soil Survey laboratories at Beltsville, Md., and at Lincoln, Nebr.

Particle size distribution was determined by the pipette method (*6*, *7*). Organic carbon was determined by wet combustion (*9*). Total nitrogen was determined by the Kjeldahl method (*2*). Exchangeable cations and exchange capacity were determined by a method developed by Peech, Alexander, Dean, and Reed (*9*), except that sodium and potassium were determined by flame spectrophotometry. Free iron oxides were determined by a method which involves reducing and dissolving the iron by means of sodium hydrosulphite and titration with potassium dichromate.

Bulk densities were determined by the plastic-coated clod method, measuring water displaced. Moisture tensions were determined by use of a pressure plate and pressure membrane on fragmented samples. Clay mineralogy was determined by X-ray diffraction and differential thermal analysis method (*5*).

[13] Interpretations of laboratory data in this section were suggested by KLAUS W. FLACH, Soil Survey Laboratory, Soil Conservation Service.

TABLE 13.—*Particle-size distribution*

Soil type and sample number	Depth	Horizon	Particle-size distribution: Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)
	Inches		*Percent*	*Percent*	*Percent*	*Percent*
Duffield silt loam, S58WVa-32-2-(1-6).	0–7	Ap	0.9	1.5	0.5	0.7
	7–10	A2	.3	.7	.4	.4
	10–19	B21	.2	.3	.2	.3
	19–29	B22	.1	.1	.1	.3
	29–33	B3	<.1	<.1	.1	.6
	33–38	C	.3	2.0	1.3	1.8
Duffield silt loam, S58WVa-32-3-(1-6).	0–7	Ap	.2	.4	.2	.4
	7–10	A2	.1	.2	.1	.3
	10–21	B21	<.1	.1	.2	.5
	21–30	B22	.5	.3	.1	.3
	30–36	B3	1.2	.4	.1	.3
	36–46+	C	<.1	.7	1.4	2.9
Dunmore cherty silt loam, S58WVa-32-4-(1-6).	0–7	Ap	3.9	3.4	2.2	3.4
	7–12	A2	2.9	2.2	1.5	2.7
	12–17	B1	1.6	1.1	.8	1.6
	17–27	B2	.2	.2	.2	.5
	27–48	B or C	<.1	.6	.7	2.1
	48–55+	C	.7	1.7	1.2	2.1
Dunmore cherty silt loam, S58WVa-32-12-(1-6).	0–8	Ap	3.5	2.7	1.6	2.6
	8–11	A2	1.7	1.7	1.0	1.9
	11–15	B1	.2	1.6	1.1	1.5
	15–25	B2	.2	1.6	1.2	1.3
	25–40	B or C	<.1	1.6	1.1	1.4
	40–48+	C	.1	.4	.2	.7
Frederick cherty silt loam, S58WVa-13-1-(1-7).	0–7	Ap	2.4	1.6	.8	1.6
	7–14	A2	.8	.9	.4	1.0
	14–21	A3	.4	.6	.4	.9
	21–28	B21	.2	.6	.4	.9
	28–41	B22	.5	.5	.4	.7
	41–51+	C	.2	.4	.3	.6
Frederick cherty silt loam, S58WVa-32-8-(1-6).	0–7	Ap	3.9	1.8	1.4	3.5
	7–13	A2	5.0	1.7	1.2	3.0
	13–19	A3	3.2	1.2	1.0	2.8
	19–32	B21	.7	.8	.7	1.9
	32–48	B22	.5	.5	.3	.9
	48–63+	C	1.9	1.3	.5	.9
Litz silt loam, S58WVa-32-11-(1-4).	0–6	Ap	2.5	1.0	.2	.5
	6–9	A3	1.5	.8	.2	.3
	9–13	B2	1.6	.9	.3	.7
	13–18	C	.4	.8	.6	2.3
Litz silt loam, S58WVa-32-15-(1-4).	0–8	Ap	2.8	1.8	.6	.9
	8–11	A2	1.7	2.0	.8	1.2
	11–15	B2	1.7	3.1	1.4	2.1
	15–21	C	3.0	6.0	2.7	3.2
Montevallo channery silt loam, S58WVa-32-5-(1-3).	0–2	A1	6.2	2.2	.7	1.0
	2–8	A2	3.2	1.8	.6	.8
	8–13	B2	4.4	2.4	.9	1.2
Montevallo channery silt loam, S58WVa-32-6-(1-3).	0–3	A1	8.6	1.9	.6	.8
	3–8	A2	3.1	1.5	.5	.6
	8–13	B2	2.9	1.4	.5	.6
Pickaway silt loam, S58WVa-32-1-(1-6).	0–9	Ap	3.2	3.2	1.6	1.9
	9–15	A2	3.8	3.2	1.3	1.6
	15–21	B1	2.9	2.6	1.2	1.6
	21–30	B21	9.9	3.9	1.2	1.7
	30–44	B22m	7.8	3.1	1.0	1.5
	44–50	B3	8.7	3.4	1.0	1.6

and moisture data of selected soils

Particle-size distribution—Con.			Textural class	Moisture held at tensions of—			Bulk density
Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)		1/10 atmosphere	1/3 atmosphere	15 atmospheres	
Percent	*Percent*	*Percent*		*Percent*	*Percent*	*Percent*	*Gm./cc.*
1.8	76.8	17.8	Silt loam	37.7	26.9	6.8	1.40
1.6	63.3	33.3	Silty clay loam or silt loam	33.0	26.9	13.5	1.54
1.6	46.7	50.7	Silty clay or silty clay loam	41.1	35.3	21.8	1.46
2.3	37.4	59.7	Clay	50.0	38.3	25.9	1.40
3.5	45.6	50.2	Silty clay	51.2	37.8	23.3	1.37
6.9	67.2	20.5	Silt loam	41.9	29.6	11.7	----------
2.6	80.3	15.9	Silt loam	35.4	24.8	5.9	1.39
2.7	74.4	22.2	Silt loam	31.3	23.8	8.8	1.62
2.8	60.5	35.9	Silty clay loam	36.6	28.5	15.4	1.61
1.2	31.7	65.9	Clay or silty clay	53.4	42.7	27.0	1.35
2.2	47.8	48.0	Silty clay	55.4	42.4	20.6	1.26
4.7	70.9	19.4	Silt loam	68.8	57.8	8.5	----------
4.1	63.0	20.0	Silt loam	35.0	26.1	6.3	1.51
3.7	58.8	28.2	Silty clay loam or silt loam	32.1	24.3	9.4	1.66
2.5	48.6	43.8	Silty clay	36.1	27.3	15.5	1.61
1.3	28.6	69.0	Clay	43.2	33.8	23.9	1.50
4.9	38.7	53.0	Clay	44.4	33.8	21.6	1.41
4.1	35.1	55.1	Clay	50.6	38.4	23.1	1.34
3.8	68.2	17.6	Silt loam	36.6	35.9	5.3	1.54
4.4	57.2	32.1	Silty clay loam or silt loam	34.0	24.0	10.5	1.65
2.1	33.5	60.0	Clay or silty clay	44.6	32.3	22.6	1.51
1.1	37.9	56.7	Clay or silty clay	47.8	34.3	22.4	1.40
1.7	47.1	47.1	Silty clay or silty clay loam	49.6	34.8	18.8	1.42
1.5	51.5	45.6	Silty clay	52.6	35.6	17.7	1.45
4.3	76.3	13.0	Silt loam	32.8	25.5	5.2	1.55
3.1	67.3	26.5	Silt loam or silty clay loam	32.4	25.9	9.9	1.64
3.2	59.3	35.2	Silty clay loam	34.4	27.2	13.7	1.51
3.4	51.8	42.7	Silty clay	36.1	28.7	16.0	1.54
3.0	44.2	50.7	Silty clay or clay	40.0	32.6	20.2	1.47
2.5	41.0	55.0	Silty clay or clay	41.8	33.7	21.2	1.47
4.7	73.8	10.9	Silt loam	33.1	24.8	4.2	1.47
3.9	69.3	15.9	Silt loam	30.9	22.7	5.9	1.73
3.7	67.0	21.1	Silt loam	30.8	22.6	7.4	1.69
2.9	54.1	38.9	Silty clay loam or silty clay	36.6	27.8	15.1	1.62
1.8	37.8	58.2	Clay or silty clay	44.2	33.3	22.3	1.48
1.8	40.7	52.9	Silty clay or clay	43.4	32.3	20.3	1.50
8.6	74.3	12.9	Silt loam	34.8	21.9	5.0	1.49
8.2	73.2	15.8	Silt loam	31.3	21.7	6.2	1.69
12.7	65.1	18.7	Silt loam	29.7	21.3	8.4	1.82
20.0	60.2	15.7	Silt loam	30.1	19.8	8.1	1.91
1.3	66.1	26.5	Silt loam or silty clay loam	40.2	32.6	11.1	1.43
1.0	62.1	31.2	Silty clay loam or silt loam	34.9	31.0	12.3	1.45
1.7	52.6	37.4	Silty clay loam	30.4	27.0	12.9	1.58
2.3	47.3	35.5	Silty clay loam	22.8	19.4	10.2	1.72
1.9	71.6	16.4	Silt loam	45.9	32.7	8.1	----------
1.6	73.6	18.4	Silt loam	34.9	26.7	6.3	1.55
1.5	65.8	23.8	Silt loam	28.1	24.6	8.6	1.69
2.8	69.9	15.4	Silt loam	48.2	32.6	9.2	----------
2.7	72.0	19.6	Silt loam	37.7	28.6	7.5	1.56
2.4	68.8	23.4	Silt loam or silty clay loam	34.1	26.8	9.0	1.63
2.5	72.6	15.0	Silt loam	34.4	25.5	6.0	1.48
2.2	65.9	22.0	Silt loam	27.9	22.3	7.3	1.54
2.2	64.1	25.4	Silt loam	28.3	23.3	9.2	1.68
2.1	56.2	25.0	Silt loam	28.0	22.8	10.0	1.72
2.3	60.3	24.0	Silt loam	29.4	23.6	9.2	1.68
2.3	63.2	19.8	Silt loam	26.9	22.9	8.0	1.80

TABLE 13.—*Particle-size distribution*

Soil type and sample number	Depth	Horizon	Particle-size distribution			
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)
	Inches		*Percent*	*Percent*	*Percent*	*Percent*
Pickaway silt loam, S58WVa-32-9-(1-7).	0–9	Ap	3.1	3.1	1.9	2.4
	9–15	A2	2.1	3.8	2.0	2.6
	15–22	B1	2.8	3.2	1.8	2.3
	22–30	B21	.8	1.4	1.0	1.7
	30–39	B22m	1.5	1.1	.9	1.6
	39–45	B3	.5	.9	.7	1.7
	45–55	C	5	1.4	1.1	2.2
Teas silt loam, S58WVa-32-10-(1-3).	1–4	A2	4.4	4.6	2.0	1.8
	4–12	B2	5.9	3.9	1.7	1.7
	12–19	C	1.4	4.4	2.4	3.3
Tilsit silt loam, S58WVa-32-13-(1-6).	0–9	Ap	.8	.6	1.0	7.2
	9–14	A2	.4	.3	.6	5.4
	14–19	B1	.1	.1	.4	4.3
	19–27	B21m	.2	.1	.4	4.0
	27–40	B22m	.1	.1	.5	4.7
	40–62	C	1.4	.6	.4	2.9
Tilsit silt loam, S58WVa-32-14-(1-6).	0–9	Ap	.5	.5	.3	2.0
	9–13	A2	.6	.5	.2	1.5
	13–20	B1	.5	.1	.2	1.2
	20–28	B21m	<.1	.1	<.1	.7
	28–37	B22m	.1	.2	.2	1.7
	37–52	C	.6	1.1	1.0	7.4

Field pH tests were made at the time the soils were sampled, using bromcresol green and chlorphenol red indicators with a colorimetric scale. The field values averaged about 0.5 pH unit higher than the laboratory values. It is believed that this variability is due mainly to the effect of drying the soil samples.

In the range between pH 5.0 and 5.5, the data show little correlation between laboratory pH values and base saturation. The pH values above 5.5 generally are associated with a base saturation above 35 percent, and the pH values below 5.0 are rather consistently associated with a base saturation below 35 percent. The textural determinations generally confirm the field identification of texture. However, the clay content of the B horizons appears to be underestimated for the soils developed in material weathered from limestone, such as the Duffield, Dunmore, and Frederick soils.

Following are the profile descriptions of the eight selected soil series. Unless otherwise indicated, all colors are for moist soils.

DUFFIELD SOILS

The Duffield soils generally are classed as Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic. However, the two profiles described appear to be representative of Red-Yellow Podzolic soils. These profiles are in alfalfa and grass hayfields, and the relatively high base saturation in the upper horizons undoubtedly reflects the past treatment with soil amendments and the organic matter in the Ap horizon. Both profiles have more clay in the B horizons than in the A horizons, have moderate to strong structure, and have prominent continuous clay films. Bulk densities of the B3 and C horizons are significantly lower than that of the B2 horizon. This is attributed to the leaching of carbonates from the originally impure silty limestone, without collapse of the skeletal parent material or movement of clay to fill the voids thus formed.

As is true of the other deep soils sampled, the Duffield soils have a wide spread between the ⅓ atmosphere and 15 atmospheres tension, indicating their ability to supply large amounts of moisture that plants can use.

Duffield silt loam, S58WVa-32-2-(1-6).—Profile in a meadow, about 1 mile south of Sinks Grove, on State Highway No. 3, 100 yards east of junction of back road to Union. This profile is described on page 66, in the section "Descriptions of Soils."

Duffield silt loam, S58WVa-32-3-(1-6).—Profile in alfalfa and orchardgrass meadow, 250 yards east of back road to Union, 1.3 miles south of the junction of back road and State Highway No. 3.

Ap—0 to 7 inches, gray-brown (10YR 5/2) silt loam; very weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

A2—7 to 10 inches, light olive-brown (2.5Y 5/4) silt loam; weak, fine, granular structure and weak, fine, subangular blocky structure; very friable; medium acid; clear, wavy boundary.

B21—10 to 21 inches, yellowish-brown (10YR 5/8) silty clay loam; faces of yellowish brown (10YR 5/4); moderate, medium, blocky and subangular blocky structure; friable; continuous thin clay films; strongly acid; clear, wavy boundary.

and moisture data of selected soils—Continued

Particle-size distribution—Con.			Textural class	Moisture held at tensions of—			Bulk density
Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (less than 0.002 mm.)		1/10 atmosphere	1/3 atmosphere	15 atmospheres	
Percent	*Percent*	*Percent*		*Percent*	*Percent*	*Percent*	*Gm./cc.*
3. 7	68. 6	17. 2	Silt loam	36. 0	25. 3	6. 3	1. 49
4. 1	66. 0	19. 4	Silt loam	30. 3	21. 9	6. 3	1. 55
3. 5	59. 5	26. 9	Silt loam or silty clay loam	31. 0	23. 4	9. 0	1. 72
3. 2	58. 8	33. 1	Silty clay loam	31. 0	25. 2	10. 9	1. 74
3. 1	47. 4	44. 4	Silty clay or silty clay loam	35. 9	27. 7	16. 3	1. 67
2. 1	43. 3	50. 8	Silty clay or silty clay loam	43. 3	33. 8	19. 8	1. 55
2. 5	52. 4	39. 9	Silty clay loam or silty clay	42. 5	33. 7	16. 2	1. 68
2. 4	51. 7	33. 1	Silty clay loam or silt loam	35. 7	26. 5	11. 5	1. 62
2. 1	49. 8	34. 9	Silty clay loam	33. 0	25. 7	12. 6	1. 74
3. 2	45. 3	40. 0	Silty clay loam or silty clay	30. 9	24. 8	14. 0	1. 93
11. 0	70. 1	9. 3	Silt loam	29. 2	20. 4	3. 8	1. 53
8. 9	67. 8	16. 6	Silt loam	28. 3	22. 2	6. 4	1. 72
7. 9	63. 6	23. 6	Silt loam	27. 3	22. 9	9. 0	1. 82
8. 3	59. 7	27. 3	Silty clay loam or silt loam	29. 7	24. 3	10. 7	1. 71
8. 9	59. 9	25. 8	Silt loam	28. 2	24. 9	10. 6	1. 73
8. 2	54. 6	31. 9	Silty clay loam	33. 7	29. 8	15. 4	1. 54
18. 0	67. 1	11. 6	Silt loam	30. 5	19. 2	3. 6	1. 46
16. 5	65. 7	15. 0	Silt loam	25. 8	19. 5	4. 6	1. 67
13. 6	60. 7	23. 7	Silt loam	27. 4	22. 6	9. 0	1. 74
11. 5	47. 9	39. 8	Silty clay loam, silt loam, or silty clay	35. 0	29. 3	16. 0	1. 59
19. 9	39. 0	38. 9	Clay or silty clay loam	35. 8	29. 2	16. 8	1. 56
37. 6	35. 2	17. 1	Loam or silty clay loam	25. 7	18. 8	8. 8	----------

B22—21 to 30 inches, strong-brown (7.5YR 5/8) light silty clay; faces of brown (7.5YR 5/4); strong, coarse and medium, blocky structure; firm; prominent shiny continuous clay films; very strongly acid; clear, wavy boundary.

B3—30 to 36 inches, strong-brown (7.5YR 5/6) silty clay; few streaks of yellowish red (5YR 5/6); weakly massive, breaking readily to moderate, coarse and medium, blocky structure; contains from 15 to 20 percent material from C horizon, in thin layers and patches; common clay films; strongly acid; gradual, wavy boundary.

C—36 to 46 inches +, yellowish-brown (10YR 5/6–5/8) "soapstone" that gets harder with depth; massive but shows some natural coarse, blocky cleavage; black coats on some faces; strongly acid.

Dunmore soils

Both profiles are representative of Red-Yellow Podzolic soils. The relatively high base saturation in the upper horizons undoubtedly reflects the use of lime and fertilizer on fields. The lower horizons show low base saturation that decreases with depth and is characteristic of Red-Yellow Podzolic soils.

Both profiles show a sharp increase in content of clay in the B horizons, and both have well-developed structure and prominent clay films in the B horizons.

The Dunmore soils differ from the other Red-Yellow Podzolic soils sampled, namely the Duffield, Frederick, and Pickaway, in having significantly less free iron per unit of clay, lower base saturation in equivalent horizons, and much lower cation-exchange capacity per unit of clay.

The very low exchange capacities are apparently due to the predominance of kaolinite and nonclay materials, probably quartz, in the clay fraction and the small content of such clay minerals as mica and vermiculite. The low base saturation probably is caused partly by the low exchange capacity, because leaching per exchange site is more intense in a soil of low exchange capacity than in one of high exchange capacity.

Bulk densities and moisture tension values in the Dunmore soils are comparable to the other soils sampled, and these soils are able to hold and supply large amounts of water for plant use. Information on the clay mineralogy of the two Dunmore profiles is given in table 15.

Dunmore cherty silt loam, S58WVa-32-4-(1-6).—Profile in a pasture, formerly cultivated, on a 10 percent slope, about 2 miles southwest of Gap Mills, 200 feet west of Zenith Road, 200 yards south of Methodist and Presbyterian Churches. This profile is described on page 68, in the section "Descriptions of Soils."

Dunmore cherty silt loam, S58WVa-32-12-(1-6).—Profile in a meadow near Green Valley road, 1 mile northeast of the Green Valley Church. The B–C and C horizons of this profile contain more silt than the B–C and C horizons of profile 32–4.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) cherty silt loam; 30 percent chert; very weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

A2—8 to 11 inches, light yellowish-brown (10YR 6/4) cherty silt loam; 30 percent chert; moderate, fine, subangular blocky structure and weak, thin, platy structure; very friable; strongly acid; clear, wavy boundary.

TABLE 14.—*Chemical*

[Dashed lines indicate that the information

Soil type and sample number	Depth	Horizon	Reaction (1:1)	Organic matter			Free iron (Fe_2O_3)
				Organic carbon	Nitrogen	C/N ratio	
	Inches		*pH*	*Percent*	*Percent*		
Duffield silt loam, S58WVa-32-2 (1-6).	0-7	Ap	7.5	1.37	0.125	11.0	1.9
	7-10	A2	7.4	.38	.050	8	3.3
	10-19	B21	5.1	.27	.047	6	5.3
	19-29	B22	5.0	.13	.044	3	7.0
	29-33	B3	4.9	.11	----------	----------	7.1
	33-38	C	4.7	.13	----------	----------	5.4
Duffield silt loam, S58WVa-32-3 (1-6).	0-7	Ap	5.9	1.03	.099	10.4	1.5
	7-10	A2	5.1	.41	.050	8	1.9
	10-21	B21	4.7	.25	.050	5	3.3
	21-30	B22	4.7	.18	.054	3	6.8
	30-36	B3	4.7	.21	----------	----------	6.9
	36-45+	C	4.9	.07	----------	----------	6.4
Dunmore cherty silt loam, S58WVa-32-4-(1-6).	0-7	Ap	5.4	1.40	.110	12.7	1.3
	7-12	A2	4.9	.17	.019	9	2.1
	12-17	B1	4.9	.15	.019	8	3.4
	17-27	B2	4.9	.06	.020	3	5.4
	27-48	B or C	4.8	.05	----------	----------	4.7
	48-55+	C	4.9	.07	----------	----------	5.2
Dunmore cherty silt loam, S58WVa-32-12-(1-6).	0-8	Ap	6.0	1.46	.107	13.6	1.0
	8-11	A2	4.7	.25	.024	10	2.2
	11-15	B1	4.8	.20	.024	8	5.3
	15-25	B2	4.7	.12	.021	6	5.6
	25-40	B or C	4.7	.08	----------	----------	5.1
	40-48+	C	4.6	.08	----------	----------	4.7
Frederick cherty silt loam, S58WVa-13-1-(1-7).	0-7	Ap	5.4	1.28	.111	11.5	1.1
	7-14	A2	5.1	.21	.026	8	2.1
	14-21	A3	4.8	.13	.019	7	2.8
	21-28	B21	4.7	.12	.022	5	3.8
	28-41	B22	4.7	.13	----------	----------	5.1
	41-51+	C	4.7	.14	----------	----------	5.4
Frederick cherty silt loam, S58WVa-32-8-(1-6).	0-7	Ap	5.3	1.08	.093	11.6	1.4
	7-13	A2	5.0	.22	.023	10	1.8
	13-19	A3	5.0	.10	.017	6	1.9
	19-32	B21	4.9	.08	.023	3	4.1
	32-48	B22	4.8	.09	----------	----------	6.3
	48-63+	C	4.9	.10	----------	----------	5.7
Litz silt loam, S58WVa-32-11-(1-4).	0-6	Ap	4.9	1.16	.093	12.5	1.4
	6-9	A3	5.2	.34	.038	9	1.8
	9-13	B2	4.8	.17	.028	6	2.5
	13-18	C	4.7	.10	.025	4	2.5
Litz silt loam, S58WVa-32-15-(1-4).	0-8	Ap	5.9	2.68	.248	10.8	3.7
	8-11	A2	5.7	.58	.074	8	5.2
	11-15	B2	5.1	.20	.046	4	5.8
	15-21	C	5.0	.08	.026	3	3.7
Montevallo channery silt loam, S58WVa-32-5-(1-3).	0-2	A1	4.8	3.99	.147	27.1	1.8
	2-8	A2	4.5	.87	.065	13	2.5
	8-13	B2	4.5	.41	.063	6	2.6
Montevallo channery silt loam, S58WVa-32-6-(1-3).	0-3	A1	3.9	5.61	.183	30.6	2.2
	3-8	A2	4.3	.95	.062	15	2.5
	8-13	B2	4.6	.37	.048	8	2.8
Pickaway silt loam, S58WVa-32-1-(1-6).	0-9	Ap	6.6	1.37	.124	11.0	2.3
	9-15	A2	6.4	.21	.033	6	3.1
	15-21	B1	6.0	.12	.032	4	3.3
	21-30	B21	6.1	.08	.032	2	4.6
	30-44	B22m	5.2	.05	----------	----------	3.8
	44-50	B3	5.3	.04	----------	----------	3.6

data of selected soils

was not determined for that horizon]

Cation exchange capacity (NH_4Ac)	Extractable cations (meq./100 g of soil)					Base saturation (NH_4Ac)	Base saturation (sum)	Sum of cations other than H	Sum of cations including H	Ca/Mg ratio
	Ca	Mg	H	Na	K					
						Percent	*Percent*	*meq./100 g*	*meq./100 g*	
8. 7	10. 4	0. 6	1. 5	<0. 1	0. 2	129	88	11. 2	12. 7	17. 3
10. 6	8. 9	. 3	2. 2	<. 1	. 2	89	81	9. 4	11. 6	29. 7
16. 0	7. 7	1. 0	11. 3	<. 1	. 2	56	44	8. 9	20. 2	7. 7
19. 8	2. 3	1. 4	21. 0	<. 1	. 3	20	16	4. 0	25. 0	1. 6
18. 2	1. 1	1. 0	19. 0	<. 1	. 3	13	11	2. 4	21. 4	1. 1
8. 7	. 6	. 4	8. 8	<. 1	. 3	15	13	1. 3	10. 1	1. 5
7. 4	4. 9	. 5	4. 2	<. 1	. 2	76	57	5. 6	9. 8	9. 8
7. 3	3. 4	. 6	5. 4	<. 1	. 2	58	44	4. 2	9. 6	5. 7
11. 8	2. 6	1. 7	10. 6	<. 1	. 3	39	30	4. 6	15. 2	1. 5
21. 3	1. 3	5. 3	19. 3	<. 1	. 6	34	27	7. 3	26. 6	. 2
16. 0	. 8	3. 2	15. 6	<. 1	. 6	29	23	4. 7	20. 3	. 2
6. 3	. 1	1. 3	7. 0	<. 1	. 3	27	20	1. 7	8. 7	. 1
6. 9	2. 7	. 4	6. 6	<. 1	. 3	49	34	3. 4	10. 0	6. 8
4. 5	1. 0	. 2	4. 6	<. 1	. 2	31	23	1. 4	6. 0	5. 0
7. 8	2. 1	. 5	7. 5	<. 1	. 2	36	27	2. 8	10. 3	4. 2
11. 2	1. 3	. 7	12. 8	<. 1	. 3	20	15	2. 3	15. 1	1. 8
9. 6	<. 1	. 5	10. 9	<. 1	. 3	8	7	. 8	11. 7	----------
10. 4	<. 1	. 3	11. 0	<. 1.	. 3	6	5	. 6	11. 6	----------
6. 0	3. 2	1. 3	4. 1	<. 1	. 1	77	53	4. 6	8. 7	2. 5
6. 4	1. 1	. 6	5. 8	<. 1	. 1	28	24	1. 8	7. 6	1. 8
13. 3	1. 8	. 9	12. 7	<. 1	. 2	22	18	2. 9	15. 6	2. 0
14. 8	. 9	1. 0	13. 2	<. 1	. 2	14	14	2. 1	15. 3	. 9
10. 4	. 8	. 6	10. 5	<. 1	. 2	15	13	1. 6	12. 1	1. 3
10. 1	. 1	. 6	10. 5	<. 1	. 2	9	8	. 9	11. 4	. 2
6. 6	3. 2	. 3	5. 6	<. 1	. 2	56	40	3. 7	9. 3	10. 7
8. 4	4. 6	. 2	5. 8	<. 1	. 2	60	46	5. 0	10. 8	23. 0
10. 8	3. 5	. 2	10. 2	<. 1	. 2	36	28	3. 9	14. 1	17. 5
13. 4	2. 3	. 8	13. 2	<. 1	. 2	25	20	3. 3	16. 5	2. 9
16. 5	1. 6	. 7	17. 5	<. 1	. 2	15	12	2. 5	20. 0	2. 3
16. 8	1. 3	. 7	18. 5	<. 1	. 2	13	11	2. 2	20. 7	1. 8
5. 3	2. 1	<. 1	5. 6	<. 1	. 1	42	28	2. 2	7. 8	----------
5. 2	2. 1	. 4	4. 4	<. 1	. 2	52	38	2. 7	7. 1	5. 2
6. 2	2. 9	. 6	4. 1	<. 1	. 2	60	47	3. 7	7. 8	4. 8
10. 6	4. 2	1. 6	8. 8	<. 1	. 2	57	40	6. 0	14. 8	2. 6
18. 8	3. 1	2. 4	13. 1	<. 1	. 4	42	38	7. 9	21. 0	2. 1
14. 4	4. 2	2. 1	10. 8	<. 1	. 4	46	38	6. 7	17. 5	2. 0
7. 4	2. 2	. 3	6. 8	<. 1	. 3	38	29	2. 8	9. 6	7. 3
6. 4	1. 5	. 2	6. 5	<. 1	. 2	28	23	1. 9	8. 4	7. 5
9. 3	1. 1	. 4	10. 0	<. 1	. 2	18	14	1. 7	11. 7	2. 8
10. 4	. 8	. 5	11. 7	<. 1	. 2	14	11	1. 5	13. 2	1. 6
15. 4	7. 6	1. 4	8. 8	<. 1	1. 4	68	54	10. 4	19. 2	5. 4
10. 4	5. 2	1. 4	6. 3	<. 1	. 6	69	53	7. 2	13. 5	3. 7
12. 3	5. 0	1. 8	7. 6	<. 1	. 6	60	49	7. 4	15. 0	2. 8
12. 8	5. 3	2. 4	7. 1	<. 1	. 4	63	53	8. 1	15. 2	2. 2
11. 9	4. 2	1. 0	11. 4	<. 1	. 5	48	33	5. 7	17. 1	4. 2
6. 2	. 4	. 2	9. 9	<. 1	. 3	14	8	. 9	10. 8	2. 0
7. 1	. 4	. 1	7. 8	<. 1	. 2	10	8	. 7	8. 5	4. 0
16. 7	. 5	. 7	20. 5	<. 1	. 3	9	7	1. 5	22. 0	. 7
7. 7	. 1	. 5	10. 7	<. 1	. 3	10	7	. 8	11. 5	----------
6. 6	. 1	. 6	8. 3	<. 1	. 2	12	9	. 8	9. 1	----------
8. 6	6. 7	<. 1	4. 1	<. 1	. 2	80	63	6. 9	11. 0	----------
7. 4	5. 5	. 2	3. 3	<. 1	. 2	80	64	5. 9	9. 2	27. 5
8. 2	5. 8	. 4	3. 9	<. 1	. 2	78	62	6. 4	10. 3	14. 5
9. 4	5. 7	. 6	4. 7	<. 1	. 2	69	58	6. 5	11. 2	9. 5
8. 3	2. 2	. 4	7. 1	<. 1	. 2	34	28	2. 8	9. 9	5. 5
7. 3	2. 6	. 2	5. 6	<. 1	. 2	41	35	3. 0	8. 6	13. 0

TABLE 14.—*Chemical data*

Soil type and sample number	Depth	Horizon	Reaction (1:1)	Organic matter			Free iron (Fe_2O_3)
				Organic carbon	Nitrogen	C/N ratio	
	Inches		*pH*	*Percent*	*Percent*		
Pickaway silt loam, S58WVa-32-9-(1-7).	0-9	Ap	7. 4	1. 20	0. 112	10. 7	2. 4
	9-15	A2	7. 2	. 29	. 039	7	3. 3
	15-22	B1	6. 4	. 17	. 030	6	3. 6
	22-30	B21	5. 8	. 11	. 029	4	3. 2
	30-39	B22m	5. 3	. 13	----------	----------	4. 6
	39-45	B3	5. 1	. 17	----------	----------	5. 8
	45-55	C	5. 6	. 17	----------	----------	4. 5
Teas silt loam, S58WVa-32-10-(1-3).	1-4	A2	4. 9	1. 34	. 117	11. 4	3. 8
	4-12	B2	4. 7	. 71	. 176	9	4. 0
	12-19	C	5. 1	. 29	. 044	6	4. 1
Tilsit silt loam, S58WVa-32-13-(1-6).	0-9	Ap	5. 4	. 78	. 054	14	. 8
	9-14	A2	4. 7	. 22	. 021	10	1. 4
	14-19	B1	4. 6	. 08	. 013	6	2. 2
	19-27	B21m	4. 4	. 06	. 012	5	2. 9
	27-40	B22m	4. 6	. 07	----------	----------	3. 0
	40-62	C	4. 7	. 05	----------	----------	5. 9
Tilsit silt loam, S58WVa-32-14-(1-6).	0-9	Ap	5. 1	. 92	. 069	13	. 9
	9-13	A2	4. 8	. 16	. 017	9	1. 3
	13-20	B1	4. 6	. 09	. 015	6	1. 3
	20-28	B21m	4. 8	. 08	. 021	4	4. 3
	28-37	B22m	4. 6	. 09	----------	----------	5. 1
	37-52	C	4. 6	. 08	----------	----------	4. 2

B1—11 to 15 inches, strong-brown (7.5YR 5/6) silty clay loam; 20 percent chert; moderate, fine, subangular blocky structure; friable; discontinuous clay films; strongly acid; clear, wavy boundary.

B2—15 to 25 inches, strong-brown (7.5YR 5/6) silty clay; faces and common streaks of red (5YR 5/6); 25 percent chert; firm, waxy; plastic and slightly sticky; prominent clay films; strongly acid; clear, wavy boundary.

B or C—25 to 40 inches, strong-brown (7.5YR 5/8) silty clay loam; some faces of red (5YR 5/6); friable; continuous clay films containing 30 percent weathered "soapstone"; few irregular lumps of pale yellow silty clay or clay (2.5Y 7/4); strongly acid; gradual, irregular boundary.

C—40 to 48 inches +, strong-brown (7.5YR 5/6) weathered "soapstone" that crushes readily to silt loam; some cracks and faces of red (5YR 5/6); friable; strongly acid.

FREDERICK SOILS

The profiles of these soils are similar, in most respects, to those of the Duffield soils. Clay percentages increase greatly with depth, and evidence of the downward movement of clay, indicated by well-defined structural aggregation and clay films, is pronounced. Base saturation decreases with depth. This is characteristic of Red-Yellow Podzolic soils. The cation-exchange capacity of the clay fraction, calculated from clay percentages and cation exchange values, is about 40 milliequivalents per 100 grams of clay. Such values are typical of Red-Yellow Podzolic soils in which the clay fraction is dominated by kaolinite and vermiculite.

As in the other soils for which data are shown, free iron is closely related to clay percentages. There are from 8 to 11 parts of free iron per 100 parts of clay. This is in the same order of magnitude, relative to clay content, for the reddish B horizon of the Frederick soils as for the silty olive-brown B horizon of the Tilsit soils.

There is a wide spread between the water held at ⅓ atmosphere, assumed field capacity, and at 15 atmospheres, assumed wilting point. This means that these soils have high available moisture capacity.

TABLE 15.—*Clay mineralogy*

[The amount of kaolinite present is indicated in percentage. The amount of mica or vermiculite is indicated by x if the amount is small, and by xx if the amount is moderate. Dashes indicate the mineral is not present or that the amount is too small to be significant]

Horizon	Depth	Mica	Vermiculite	Kaolinite
Dunmore cherty silt loam, S58WVa-32-4-(1-6)				
	Inches			*Percent*
Ap	0-7	----------	x	15
A2	7-12	----------	x	20
B1	12-17	x	x	30
B2	17-27	x	x	35
B or C	27-48	x	x	35
C	48-55+	x	x	35
Dunmore cherty silt loam, S58WVa-32-12-(1-6)				
Ap	0-8	----------	----------	20
A2	8-11	----------	x	20
B1	11-15	x	x	20
B2	15-25	xx	x	20
B or C	25-40	xx	x	10
C	40-48+	xx	x	20

of selected soils—Continued

Cation exchange capacity (NH_4Ac)	Extractable cations (meq./100 g of soil)					Base saturation (NH_4Ac)	Base saturation (sum)	Sum of cations other than H	Sum of cations including H	Ca/Mg ratio
	Ca	Mg	H	Na	K					
						Percent	*Percent*	*meq./100 g*	*meq./100 g*	
9. 5	11. 0	0. 3	2. 7	<0. 1	0. 2	21	81	11. 5	14. 2	36. 7
6. 3	5. 2	. 3	2. 9	<. 1	. 1	89	66	5. 6	8. 5	17. 3
8. 9	6. 6	<. 1	3. 4	<. 1	. 2	76	67	6. 8	10. 2	----------
10. 0	7. 1	. 5	5. 1	<. 1	. 2	78	60	7. 8	12. 9	14. 2
16. 3	9. 0	1. 4	10. 1	<. 1	. 2	65	51	10. 6	20. 7	6. 4
19. 4	10. 1	1. 3	13. 6	. 1	. 3	61	46	11. 8	25. 4	7. 8
17. 5	12. 5	1. 6	7. 4	. 1	. 3	83	66	14. 5	21. 9	7. 8
12. 6	2. 7	1. 4	12. 2	<. 1	. 3	35	26	4. 4	16. 6	1. 9
12. 7	. 9	1. 3	12. 7	<. 1	. 2	19	16	2. 4	15. 1	. 7
13. 6	4. 6	4. 9	6. 6	<. 1	. 4	23	60	9. 9	16. 5	. 9
4. 1	1. 4	. 8	3. 6	<. 1	. 1	56	39	2. 3	5. 9	1. 8
5. 0	. 9	. 5	5. 3	<. 1	. 1	30	22	1. 5	6. 8	1. 8
7. 5	1. 0	. 4	8. 3	<. 1	. 1	20	15	1. 5	9. 8	2. 5
10. 0	. 5	. 4	9. 5	<. 1	. 1	10	10	1. 0	10. 5	1. 2
8. 1	. 1	. 5	9. 0	<. 1	. 1	9	7	. 7	9. 7	. 2
11. 5	<. 1	. 5	8. 3	<. 1	. 1	5	7	. 6	8. 9	----------
4. 9	1. 4	. 4	5. 1	<. 1	. 1	39	27	1. 9	7. 0	3. 5
3. 9	1. 0	. 2	3. 9	<. 1	. 1	33	25	1. 3	5. 2	5. 0
6. 8	1. 4	. 5	6. 8	<. 1	. 1	29	23	2. 0	8. 8	2. 8
12. 6	1. 0	. 9	13. 5	<. 1	. 1	16	13	2. 0	15. 5	1. 1
14. 9	. 5	. 8	16. 5	<. 1	. 2	10	8	1. 5	18. 0	. 6
7. 1	. 1	. 2	8. 8	<. 1	. 1	6	4	. 4	9. 2	. 5

Frederick cherty silt loam, S58WVA-13-1-(1-7).—This profile is in Greenbrier County, W. Va., which joins Monroe County on the north, and is representative of the Frederick soil in both counties. Profile is 1 mile south of Fairlea on Davis Stuart Road, in a field 200 feet directly north of lane to Gray Rock Farm.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) cherty silt loam; 20 percent chert; weak, fine, granular structure; very friable; medium acid; abrupt, wavy boundary.

A2—7 to 14 inches, brown (10YR 5/4) cherty silt loam; 20 percent chert; weak, thin, platy structure and weak fine, subangular blocky structure; friable; medium acid; clear, wavy boundary.

A3—14 to 21 inches, reddish-brown (2.5YR 4/4) silty clay loam; faces of brown (10YR 5/4); 15 percent chert; moderate, fine, subangular blocky structure; friable; medium acid; clear, wavy boundary.

B21—21 to 28 inches, red (2.5YR 5/6) silty clay; faces of reddish brown (5YR 5/4), and common flecks and streaks of yellowish brown (10YR 5/4); 15 percent chert; strong, medium and fine, blocky structure; firm; continuous clay films; slightly plastic; strongly acid; gradual, wavy boundary.

B22—28 to 41 inches, red (2.5YR 5/6) clay; faces of yellowish red (5YR 5/6), and common flecks and narrow streaks of yellowish brown (10YR 5/4); 15 percent chert; strong, medium, blocky structure; firm; plastic; prominent clay films; strongly acid; gradual, wavy boundary.

C—41 to 51 inches +, dark-red (2.5YR 3/6) clay; many pockets, streaks, and flecks of yellowish red (5YR 5/6) and yellowish brown (10YR 5/4); about 20 percent clay limestone remnant material; massive, breaking to weak, medium, subangular blocky structure; plastic and slightly sticky; medium acid; abrupt, irregular boundary.

Frederick cherty silt loam, S58WVa-32-8-(1-6).—Profile in a field near Sinks Grove and Ronceverte Road, ¼ mile north of turn to Neffs Orchard. This profile is modal for the Frederick soils in Monroe County. It is described on page 69, in the section "Descriptions of Soils."

Litz soils

The Litz soils show enough increase in clay in the B horizon, over the A horizon, to qualify as soils with textural B horizons, but evidence of the movement of clay is not pronounced. Profile S58WVa-32-15-(1-4) is much higher in content of clay and in base saturation than profile S58WVa-32-11-(1-4) and shows some characteristics of Gray-Brown Podzolic soils. In considering both profiles, however, the Litz soils are classed as Red-Yellow Podzolic soils intergrading to Lithosols.

Litz silt loam, S58WVa-32-11-(1-4).—Profile in a pasture, 100 yards north of the intersection of Lindside, Orchard, and Hands Creek Roads. This profile is more silty and is lower in content of clay than most of the Litz soils in Monroe County.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; strongly acid; clear, wavy boundary.

A3—6 to 9 inches, light yellowish-brown (10YR 6/4) silt loam; weak, fine and medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B2—9 to 13 inches, yellowish-brown (10YR 5/6), heavy silt loam; 10 percent siltstones; weak, medium, subangular blocky structure; friable; few clay films, very strongly acid; clear, wavy boundary.

C—13 to 18 inches, yellowish-brown (10YR 5/6) silt loam; 75 percent siltstones as much as 3 inches in size; massive, some breakage to weak, fine and medium, subangular blocky structure; friable; very strongly acid; gradual boundary.

Dr—18 inches +, gray siltstones.

Litz silt loam, S58WVa-32-15-(1-4).—Profile on a 10 percent slope, in pasture at Creamery, W. Va., 25 feet north of edge of cemetery; profile is typical of the silt loams; the shaly soils have a thinner solum.

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; strongly acid; abrupt, smooth boundary.

A2—8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; 10 percent ¼- to ½-inch shale chips; weak, fine, subangular blocky structure and very weak, thin, platy structure; friable; strongly acid; clear, wavy boundary.

B2—11 to 15 inches, strong-brown (7.5YR 5/6) silty clay loam; 15 percent shale chips; moderate, fine and medium, subangular blocky structure; friable; discontinuous clay films; strongly acid; clear, wavy boundary.

C—15 to 21 inches, strong-brown (7.5YR 5/6) silty clay loam; 75 percent ¼- to 1-inch shale chips; massive, some breakage to weak, fine, subangular blocky structure; friable to very friable; strongly acid; gradual boundary.

Dr—21 inches +, gray platy and blocky siltstones and shale.

Montevallo soils

Both profiles of the Montevallo soils have relatively large amounts of organic matter in the surface layer, or A1 horizon, and reflect the influence of the forest cover. Both profiles have more clay in the B2 horizon than in the A horizon. This increase, however, is not large and may be due to the weathering of the fine-textured strata in the bedrock rather than to the movement of clay from the A horizon to the B2 horizon. This theory is supported by the fact that the evidence of movement of clay into the B horizon is not pronounced. Clay films are thin and discontinuous; these coatings reflect mainly preferred orientation of plate-shaped silt- and clay-sized material rather than illuviation of clay. In both profiles the structure of the B horizon is weak, and base saturation and pH are low.

The Montevallo soils generally have a thin solum and faint differences between horizons. They are classed as Lithosols intergrading to Sols Bruns Acides. The two profiles described appear to fit this classification.

These soils normally are low in productivity because they are shallow to bedrock and consequently are low in available moisture capacity, even though their silt content provides high available moisture capacity per unit of depth. They also have low base saturation.

Montevallo channery silt loam, S58WVa-32-5-(1-3).—Profile in a wooded area, on a 25 percent slope, 1.8 miles north of State Highway No. 3 and 200 feet west of road to Gap Mills. This profile is described on page 79, in the section "Descriptions of Soils."

Montevallo channery silt loam, S58WVa-32-6-(1-3).—Profile in a wooded area, on a 30 percent slope, 4.3 miles north of State Highway No. 3 and 200 feet west of Cove Creek Road, near Gap Mills.

A00—2 inches to ¼ inch, continuous cover of hardwood leaf litter.

A0—¼ inch to 0, partly decomposed leaf litter.

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam; 10 percent channery-sized siltstones; weak, fine, granular structure; very friable; very strongly acid; clear, wavy boundary.

A2—3 to 8 inches, yellowish-brown (10YR 5/4) silt loam; 10 percent channery-sized siltstones; weak, fine, subangular blocky structure; very friable; strongly acid; clear, wavy boundary.

B2—8 to 13 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, fine and medium, subangular blocky structure; thin, discontinuous clay films; friable; very strongly acid; gradual, wavy boundary.

C—13 to 16 inches, yellowish-brown (10YR 5/6) silt loam; 60 percent channery-sized siltstones; massive; friable to firm; very strongly acid; gradual boundary.

Dr—16 inches +, siltstones and sandstone; somewhat platy and broken on top.

Pickaway soils

The Pickaway soils are moderately well drained Red-Yellow Podzolic soils that have a fragipan. They occur in close association with the Duffield and Frederick soils. The two profiles that were sampled are in hayfields. Profile S58WVa-32-1-(1-6) is typical of a moderately well drained Red-Yellow Podzolic soil, except that base saturation in the B and C horizons is unusually high for a soil of this classification. Profile S58WVa-32-9-(1-7) has characteristics that suggest the presence of a lithological discontinuity below the B21 horizon. This is indicated by an erratic pattern of clay distribution, cation-exchange capacity, and base saturation.

As is true of most of the other soils that are in crop fields, base saturation is high in the upper horizons. This may be attributed to liming and fertilizing. The relatively high exchange capacity of these horizons is due to small but significant amounts of organic matter.

The firmness of the fragipan is not reflected in high bulk densities. In both profiles the fragipan, or B22m horizon, contains about 37 percent pore space, and bulk densities are not significantly higher than those in the overlying and underlying horizons. Apparently, the firmness of the pan cannot be entirely the result of the dense packing of particles.

Pickaway silt loam, S58WVa-32-1-(1-6).—Profile in a crop field at Pickaway, W. Va., 100 yards northwest of Trinity Methodist Church. The Pickaway series were established at this location. This profile is described on page 82, in the section "Descriptions of Soils."

Pickaway silt loam, S58WVa-32-9-(1-7).—Profile in a crop field, on a 2 percent slope, 1.1 miles north of Pickaway on U.S. Highway No. 219.

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; very weak, fine, granular structure; very friable; slightly acid; abrupt, smooth boundary.

A2—9 to 15 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure and very weak, thin, platy structure; very friable; slightly acid; clear, wavy boundary.

B1—15 to 22 inches, yellowish-brown (10YR 5/4) silt loam; moderate, fine, subangular blocky structure; friable; discontinuous clay films; few manganese concretions; medium acid; clear, wavy boundary.

B21—22 to 30 inches, yellowish-brown (10YR 5/4) silty clay loam; common medium mottles of light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/8); moderate, fine and medium, subangular blocky structure; friable to firm; common manganese concretions; medium acid; clear, wavy boundary.

B22m—30 to 39 inches, yellowish-brown (10YR 5/4) silty clay loam; faces of light brownish gray (2.5Y 6/2); massive fragipan; breaks to moderate, medium, platy structure and moderate, medium, subangular blocky structure; firm; hard, discontinuous clay films; many manganese concretions as much as ½ inch in size, and clusters as much as 2 inches; very strongly acid; gradual boundary.

B3—39 to 45 inches, yellowish-brown (10YR 5/4) silty clay loam; 20 percent "soapstone"; common medium mottles of strong brown and light brownish gray (2.5Y 6/2); weakly massive, breaking readily to weak, medium, subangular blocky structure; friable; common manganese concretions; very strongly acid; gradual, wavy boundary.

C—45 to 55 inches, yellowish-brown (10YR 5/4) "soapstone"; 10 percent material from B3 horizon in cracks; massive; very strongly acid; clear, wavy boundary.

Dr—55 inches +, limestone; fairly smooth surface.

Teas soils

These soils are on the Maccrady formation of the Mississippian period. The profile is in a grazed forested area. The particle-size distribution data show only a little more clay in the B horizon than in the A2 horizon. Base saturation is moderately low in the A and B horizons but increases sharply in the C horizon. This contributes to better plant composition and growth on the Teas soils than on the associated Calvin soils.

Examination of thin sections of peds from the B horizon under a petrographic microscope failed to confirm field observations of clay skins. Films, which under field examination with low-power hand lenses appeared to be oriented clay skins, proved to be approximately the same particle size as the interior of the peds. Apparently the so-called "clay skins" in the B horizon of the Teas soils are not formed by illuviated clay but are zones along ped surfaces on which silt and plate-shaped clay particles are preferentially aligned, parallel to the ped surfaces.

The data for Teas soils show a wide spread in moisture tensions between ⅓ atmosphere and 15 atmospheres and consequent high available moisture capacity per unit of depth. This is similar to the other soils relatively high in silt.

The Teas soils are classified as Sols Bruns Acides intergrading to Lithosols.

They are classed as Sols Bruns Acides because of their lack of textural B horizons, and they are classed as intergrades to Lithosols because of the thinness of their solum.

Teas silt loam, S58WVa-32-10-(1-3).—Profile in a grazed woodlot, on a 25 percent slope, 2.2 miles north of Second Creek, 300 feet west of Monroe Draft Road. This soil is on the Maccrady geological formation.

A1—0 to 1 inch, dark reddish-brown (5YR 3/3) silt loam; moderate, fine, granular structure; very friable; medium acid; clear, wavy boundary.

A2—1 inch to 4 inches, reddish-brown (5YR 4/3), heavy silt loam; moderate, medium, platy structure and moderate, fine, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B2—4 to 12 inches, reddish-brown (2.5YR 4/4) silty clay loam; faces of reddish brown (2.5YR 5/4); moderate, fine and medium, subangular blocky structure; friable; discontinuous clay films; strongly acid; clear, wavy boundary.

C—12 to 19 inches, reddish-brown (2.5YR 4/4) silty clay loam; 80 percent channery-sized siltstones; massive; medium acid; clear boundary.

Dr—19 inches +, red blocky siltstone; somewhat broken on top.

Tilsit soils

The Tilsit soils generally are considered to be among the most typical Red-Yellow Podzolic soils in West Virginia. Base saturation in the lower horizons of both soil profiles is very low, and evidence of clay movement, indicated by prominent clay films and increase in content of clay from A to B horizons, is pronounced. In profile S58WVa-32-13-(1-6), however, the C horizon has a higher content of clay than any other horizon. This abnormality is apparently due to a lithological discontinuity. Furthermore, the exchange capacity per unit of clay is significantly lower in the C horizon than in the B horizon.

Base saturation in the fragipan horizon is very low and is much lower than in the fragipan of the Pickaway soils. This difference is evidently a reflection of the difference in the parent material of the two soils. Like the Pickaway soils, the bulk density of the fragipan is not significantly higher than that of the overlying B horizon, and the available moisture capacity, even in the fragipan, is quite high.

Tilsit silt loam, S58WVa-32-13-(1-6).—Profile in a meadow, on a 3 percent slope, on a broad ridgetop, 1 mile north of Ballard on Red Sulphur Springs Road, 300 yards west of church. This profile is described on page 87, in the section "Descriptions of Soils."

Tilsit silt loam, S58WVa-32-14-(1-6).—Profile on Bozoo road, on a 5 percent slope, 2.5 miles east of Peterstown.

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; very weak, fine, granular structure, essentially structureless and very weakly massive; friable; medium acid; abrupt, smooth boundary.

A2—9 to 13 inches, light-brown (2.5Y 6/4) silt loam; moderate, thin, platy structure; friable but noticeably brittle; strongly acid; clear, wavy boundary.

B1—13 to 20 inches, light olive-brown (2.5Y 5/6) silt loam; weak, fine and medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B21m—20 to 28 inches, light olive-brown (2.5Y 5/6) silt loam; common medium mottles of red (2.5YR 4/6) and light brownish gray (2.5Y 6/2); massive, weak fragipan breaking to moderate, medium, subangular blocky structure and weak, medium, platy structure; strongly acid; gradual, wavy boundary.

B22m—28 to 37 inches, yellowish-brown (10YR 5/6) light silty clay loam; common medium mottles of red (5YR 4/6) and olive (5Y 5/3); massive fragipan breaking to moderate, medium, platy structure and moderate, medium, subangular blocky structure; firm to very firm; few manganese concretions; prominent clay films; strongly acid; gradual, wavy boundary.

C-37 to 52 inches, yellowish-brown (10YR 5/6) light silty clay loam; 80 percent soft weathered sandstone with exterior colors of brownish yellow, and interior colors of red (2.5YR 5/6); some clay films; soft sandstone seems somewhat layered, with B22m material between layers; friable; strongly acid; gradual, wavy boundary.

Dr—52 inches +, sandstone; somewhat soft on top, becoming harder and massive with depth.

General Nature of the County

This section gives general information about the county. It discusses the climate, physiography, and water supply in the county, and it gives some agricultural statistics.

Climate

Monroe County has a humid, temperate climate. Summers are rather short and warm. Winters are cold but are not severe. Climatic data from the U.S. Weather Bureau at Union are summarized in table 16. These data are fairly representative of the climate of the rest of the county, although in some years local variations may occur. Such areas as Swoopes Knobs and Peters and Potts Moun-

tains may have more snow and normally have slightly lower temperatures than the lower lying valleys.

The average annual temperature is about 53° F. Temperatures in an average year do not often exceed 92° in summer or drop much below 0° in winter. However, extremes of 102° and −34° have been recorded.

Summer temperatures are moderate. Maximum temperatures above 90° F. may occur for a few days at a time. Fogs are not common over most of Monroe County, and the average humidity is not high.

Winters are changeable. Very cold spells are frequent but generally are of short duration, and there are many bright days. Snow normally lasts for only short periods and cannot be counted on to protect winter crops. Unprotected soils may freeze to a depth of 12 to about 18 inches. Some winter damage may occur on winter crops, especially on wet soils.

The average frost-free period at Union is 148 days. The average date of the last frost in spring is May 10, and the average date of the first frost in fall is October 5. Frosts may occur later in spring and earlier in fall on the higher mountains and in valleys that receive cold air from mountainous areas. The normal grazing period in all parts of the county extends from about May 1 to November 1.

The average annual precipitation is about 37 inches. About 17 inches of rain falls during the growing season, and this rainfall is fairly well distributed. However, the average September rainfall is only about 2.6 inches. During this period, pastures on the more shallow soils may be affected. Extended periods of drought are not common, but short periods normally occur annually. At times local areas are affected by drought. Rainstorms late in summer are often spotty. Heavy rains late in winter and in spring cause some flooding along streams, but flood damage generally is not extensive.

TABLE 16.—*Temperature and precipitation at Union, Monroe County, W. Va.*

[Elevation, 1,975 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1930)	Wettest year (1948)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
January	33. 3	75	−16	3. 07	2. 39	1. 74	6. 2
February	35. 2	75	−10	2. 80	1. 84	3. 41	6. 3
March	43. 4	90	−1	3. 51	1. 99	4. 70	4. 7
April	51. 8	94	9	2. 85	1. 33	4. 49	. 8
May	60. 9	95	21	3. 09	1. 13	3. 01	(3)
June	67. 8	99	32	3. 81	1. 06	6. 89	0
July	71. 6	102	37	4. 03	. 91	3. 50	0
August	70. 2	100	36	3. 54	1. 93	4. 26	0
September	66. 1	98	25	2. 57	. 88	2. 67	0
October	54. 4	93	10	2. 56	1. 10	2. 11	. 5
November	42. 4	87	−31	2. 26	2. 09	4. 37	1. 0
December	34. 0	73	−34	2. 65	2. 18	5. 84	4. 7
Year	52. 6	102	−34	36. 74	18. 83	46. 99	24. 2

[1] Average temperature based on a 51-year record, through 1955; highest temperature on a 47-year record, and lowest temperature on a 47-year record, through 1952.

[2] Average precipitation based on a 55-year record, through 1959; wettest and driest years based on a 49-year record, in the period 1910–1959; snowfall based on a 39-year record, through 1952.

[3] Trace.

Physiography, Relief, and Drainage

Physiographically, Monroe County consists of (1) a dissected plateau; (2) a broad, rolling limestone valley; and (3) parallel narrow ridges and valleys (fig. 13). These three areas are part of two major physiographic provinces. The dissected plateau occupies the southern tip of the Allegheny Plateau. The broad limestone valley and the ridges and valleys are part of the Ridge and Valley province (*4*). Following is a discussion of the three areas.

The dissected plateau occupies the western third of Monroe County. It is characterized by medium to broad, smooth ridges and rather steep, irregular side slopes. Flattop Mountain, Wolf Creek Mountain, and Swoopes Knobs form an escarpment along the eastern boundary. This escarpment, which in places has elevations as much as 3,200 feet, is less pronounced to the south.

From the eastern boundary, the area slopes to the west and southwest. Near Ballard and Bozoo, in the southwestern part, it descends to about 2,100 feet.

The area is well supplied with streams that are rather deeply entrenched. Most stream drainage is at about 1,600 feet. Narrow flood plains and small terraces have formed along the streams. Indian Creek, Brush Creek, Hands Creek, and Rich Creek are some of the larger streams. The New River bounds the extreme southwestern corner of the county for a short distance, and the Greenbrier River bounds the northwestern corner for a few miles. Drainage is to these two rivers, which are part of the Kanawha and Ohio River drainage pattern.

The broad limestone valley, which is about 7 to 8 miles wide, occupies the north-central part of Monroe County (fig. 14). It is bounded on the west by the higher dissected plateau and on the east and south by the higher ridge and valley area. It continues northward into Greenbrier County, where it is commonly known as the Greenbrier Valley.

This valley has a general elevation of about 2,200 feet. It is rolling, and local relief is only about 100 feet. Surface streams are not numerous or deeply entrenched. Much of the drainage is through sinkholes into underground streams. Flood plains are not wide, and terraces are narrow and inextensive. Second Creek, which has an elevation of about 1,800 feet, forms much of the northern boundary. Wolf Creek drains part of the northwestern edge. Drainage from this area is to the Greenbrier River.

The ridge and valley area occupies the eastern part of Monroe County and extends in a narrow belt along the entire southeastern edge. The area is characterized by a series of roughly parallel mountains with narrow ridges and narrow intervening valleys (fig. 15). The mountain slopes are steep, and local relief is strong.

The fairly broad northeastern part of this area consists of Eads Ridge, Daniels Ridge, Brushy Mountain, Cove Mountain, and intervening narrow but somewhat poorly defined lowlands. Although the ridges generally are narrow, there are some moderately wide ridges, particularly on Eads Ridge near Hollywood. Elk Knob on Cove Mountain has an elevation of about 3,400 feet. Valleys have elevations of about 2,100 to 2,300 feet. The area is well supplied with small streams, including Laurel and Devil Creeks.

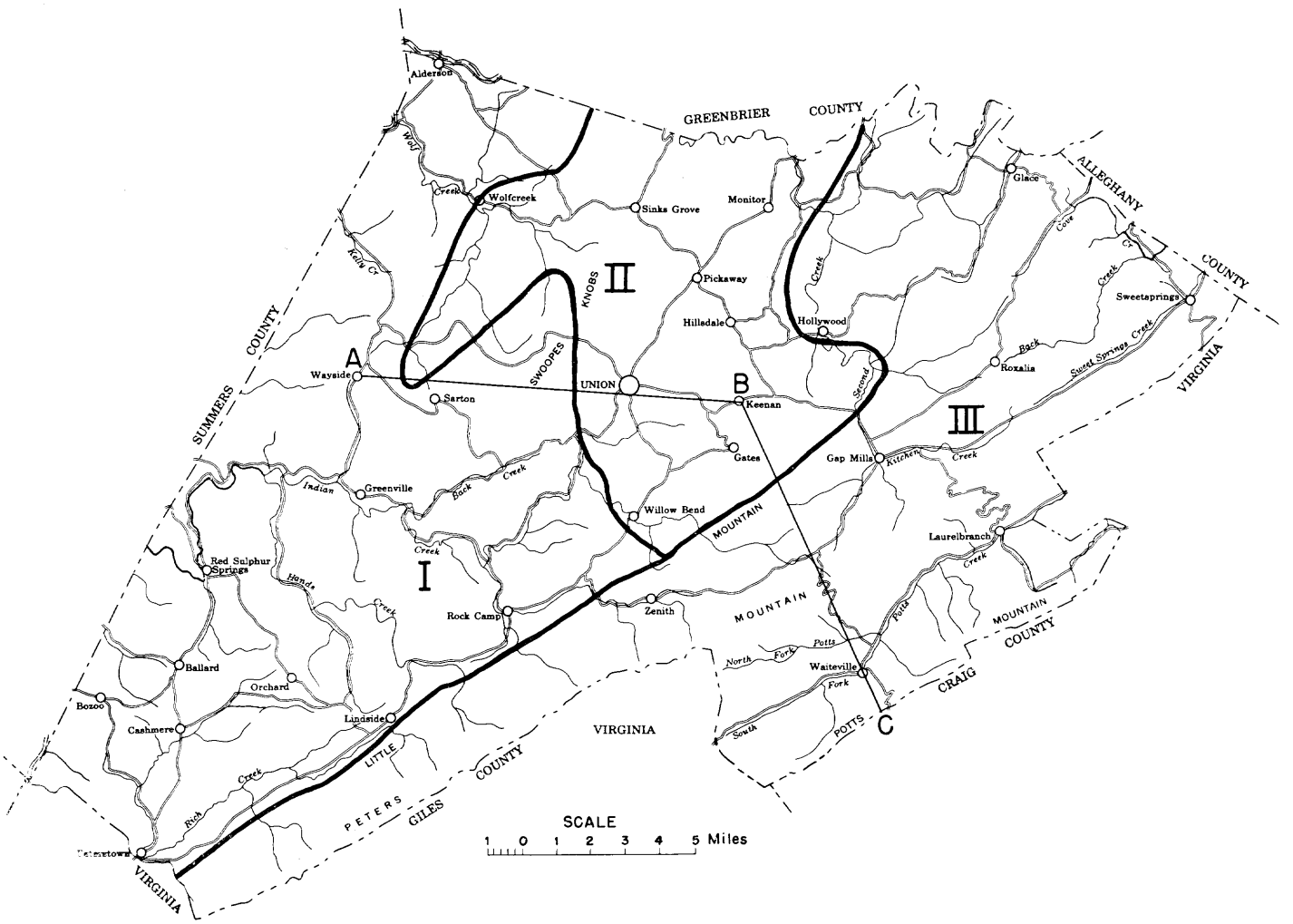

Figure 13.—**General physiographic areas in Monroe County: (I) dissected plateau; (II) limestone valley; and (III) ridges and valleys. Lines AB and BC are routes of geologic cross sections shown in figure 12.**

Along the southeastern edge of the county, three narrow ridges and intervening valleys form a long, narrow belt. Two of these ridges, Little Mountain and Peters Mountain, extend across the county. Near Gap Mills, Little Mountain divides into Gap Mountain and Middle Mountain. The elevation ranges from about 3,000 feet in the northeastern part of the county to about 2,500 feet near Peterstown. Peters Mountain is continuous and ranges from about 3,000 to 4,000 feet in elevation. Its crest forms much of the southeastern boundary. The valley between these ridges is rolling and is about 2,200 to 2,300 feet in elevation. It broadens somewhat near Sweetsprings. The third principal ridge in this area is Potts Mountain, which occupies the offset in the southeastern county line. It is similar to Peters Mountain. Potts Creek Valley, which has an elevation of about 2,100 feet, occurs between Peters and Potts Mountains. There are fairly large flood plains and terraces along Potts Creek. Colluvial deposits are common at the base of steep northern slopes.

The ridge and valley area drains to two large drainage systems. Potts Creek and other streams near Sweetsprings flow northeastward to the Jackson River and eastward to the James River. The rest of the area drains westward to the New and Greenbrier Rivers and thence to the Ohio River.

Water Supply

All of Monroe County, except the limestone areas, is well supplied with surface streams. These small streams are ample for local needs but are not large enough for extensive industrial use. However, the New River, which bounds the southwestern corner of the county, and the Greenbrier River, which bounds the northwestern corner, are large enough for commercial use.

Most towns in the county depend on wells for their water supply. The wells vary in depth, especially in the limestone areas. Springs are especially strong in areas underlain by limestone, but they are less numerous than in areas underlain by standstone and shale.

Runoff water is available for the use of livestock, if suitable catchments can be provided. Limestone soils are not well suited to ponds, and many fields are without water. Areas underlain by sandstone and shale generally are suitable for small impoundments.

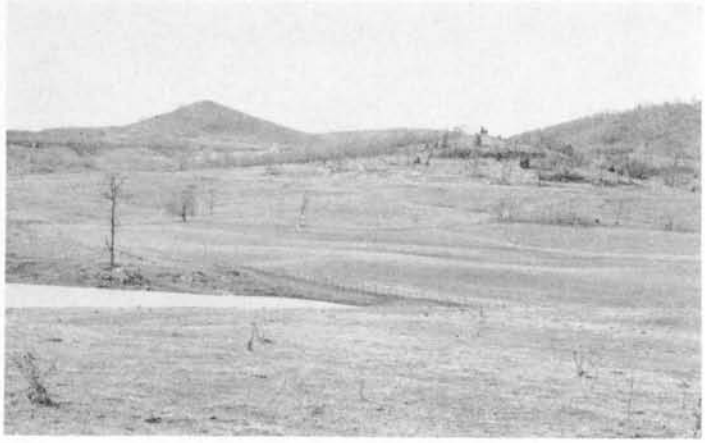

Figure 14.—**View of rolling limestone valley just northwest of Union. Swoopes Knobs in background.**

Settlement and Population

Monroe County was created from Greenbrier County on July 14, 1799, by an act of the Virginia Legislature. The early settlers came from communities established to the east and north. Many settlers were Scotch-Irish, and to a large extent the present population is composed of their descendants.

Late in the 1800's, Monroe County had several popular summer resorts, or watering places. These were located at sites of strong limestone springs, which were noted for their healing qualities. The most noted was Sweetsprings, in the southeastern part of the county. Others included Salt Sulphur Springs and Red Sulphur Springs. These resorts became inoperative early in the 1900's.

The population of Monroe County is largely rural and is well distributed. The mountainous areas in the extreme eastern and southern parts, which includes Potts Creek Valley, are sparsely settled.

In 1920 the population of the county was 13,141. At that time Alderson, which is partly in Greenbrier County, had a population of 1,401, and Union, the county seat, had a population of 439. In 1960, the population of the county had decreased to 11,584. Alderson had a population of 1,225; Union 441; and Peterstown, 616. Other towns in the county include Sinks Grove, Sweetsprings, Pickaway, Greenville, Lindside, and Gap Mills.

High schools are maintained at Union, Peterstown, Alderson, Greenville, and Gap Mills. Banks are located at Union, Peterstown, Alderson, and Greenville.

Transportation and Markets

Monroe County has a good network of roads. There are about 83 miles of primary highways and about 575 miles of graveled or improved all-weather secondary roads. U.S. Highway No. 219 extends from Peterstown northward, roughly bisecting the county, and intersects with U.S. Highway No. 60 at Lewisburg, which is about 20 miles north of Union, in Greenbrier County. Most public roads are open to traffic throughout the year except for short periods when there is a deep snow.

The main line of the Chesapeake and Ohio Railroad passes through Alderson, where there is a livestock market. Livestock is also marketed at Narrows, Va., and at Ronceverte, in Greenbrier County. Wood for pulp is marketed at a papermill in Covington, Va.

Union, the county seat, is the principal business center. There are no airports in the county.

Figure 15.—**View from Hanging Rock on Peters Mountain looking toward Sweetsprings. Parallel ridges and narrow valleys are typical of the Ridge and Valley province.**

Industries

Monroe County is mainly agricultural. However, there are fairly extensive woodlands in the southern and eastern parts. The principal livestock enterprise is the sale of beef animals, sheep, and chickens. A livestock market is operated at Alderson, which is situated on the Chesapeake and Ohio Railroad. The sale of dairy products is also important.

Except for small limestone quarries that are used mainly to supply road materials, there are no heavy industries in the county. Small manganese mines have operated sporadically in the vicinity of Sweetsprings but are now largely abandoned. A papermill at nearby Covington, Va., and coal mines in adjacent counties to the west and south are important to the woodland economy of the county. The processing of wood products for these industries is extensive. There are also a few portable sawmills in the county that process sawlogs into lumber.

Vegetation

Slightly more than half of Monroe County is forested. These forests are dominated chiefly by oaks, but hickory and other hardwoods generally are present. Yellow-popular and walnut occur on the deep, moist soils. Beech, sugar maple, and white ash occur on protected mountain slopes. At one time chestnut was abundant, especially in mountainous areas, but this species has been destroyed by blight.

Originally, hardwood forests covered the entire county. Conifers were not extensive in the original vegetation, but there were some Virginia pine, pitch pine, and white pine. In recent years, Virginia pine and pitch pine have seeded extensively in abandoned fields, particularly in the steeper areas in the western third of the county. There are no large swamps in the county. More detailed information on the forests is given in the subsection "Use of Soils for Woodland."

Agricultural Statistics

The statistics given in this section are based mainly on reports of the 1959 U.S. Census of Agriculture.

Agriculture is the leading occupation in Monroe County. Of the 302,720 acres in the county, 183,099 acres are in farms. There are 1,199 farms, and they average 152.7 acres in size.

It is interesting to compare some of the changes that have occurred in the county. In 1880, there were 1,248 farms, and 117,658 acres in farms. Corn was grown on 9,992 acres; wheat, on 6,744 acres; oats, on 3,786 acres; and hay, on 9,487 acres. By 1900, the number of farms had increased to 1,794, and the acreage in farms had increased by about half. By 1920, there were 1,834 farms, but the acreage in principal crops had not increased to any extent. The 1925 census reported 1,961 farms. The land in farms amounted to 237,497 acres, of which 44,036 acres were in crops, 105,960 acres in pasture, and the rest in woods, some of which was pastured.

Land use

Land use is stable in Monroe County, although there has been a trend in the last decade to let steep, eroded pastures revert to woods. In 1959, land use was reported as follows:

	Acres
Cropland:	
Harvested	26,153
Used only for pasture	6,760
Not harvested and not pastured	2,332
Woodland:	
Pastured	34,294
Not pastured	32,297
Other pasture (not cropland and not woodland)	75,890
Other land (house lots, roads, etc.)	5,373

Crops

Following is a list of the principal crops grown in the county in 1959, and the acreage for each.

Crops	*Acres*
Corn for all purposes	4,828
Small grains, threshed or combined:	
Wheat	2,274
Oats	947
Barley	156
Buckwheat	34
Rye	9
Soybeans grown for all purposes	25
Hay crops, total	17,934
Alfalfa and alfalfa mixtures	7,063
Clover, timothy, and mixtures of clover and grasses	8,320
Small grains cut for hay	619
Lespedeza cut for hay	104
Other hay cut	1,245
Irish potatoes	42

The 1959 census reported 308 acres in orchards and vineyards in the county. Most of this acreage is in apple orchards. One large commercial orchard near Sinks Grove makes up more than a third of the total. Farms that have less than 20 trees or grapevines are not recorded.

Livestock

The raising of cattle, especially beef cattle, is the chief agricultural enterprise of the county, but dairying is also important.

The census of 1959 reported 20,345 cattle and calves in the county. Of these, 4,733 were milk cows; 4,849 were heifers and heifer calves; and 5,450 were steers and bulls, including steer and bull calves. Of the 18,656 sheep and lambs reported, 14,040 were ewes, 3,886 were lambs, and 730 were rams and wethers.

There were 1,027 horses and mules on the farms in 1959. The number of hogs and pigs totaled 5,662, and the number of chickens, 4 months old and over, 75,356.

Size of farms

Farms averaged 152.7 acres in size in 1959. The 1959 census groups the farms by size as follows:

Acres	*Number*	*Acres*	*Number*
Under 10	34	180 to 219	76
10 to 49	247	220 to 259	71
50 to 69	137	260 to 499	123
70 to 99	178	500 to 999	39
100 to 139	166	1,000 and over	10
140 to 179	118		

Type of farms

More than half of the classified farms in the county are livestock farms. In 1959, the farms in the county were classified as follows:

Livestock farms, other than dairy and poultry	278
Dairy farms	116
Poultry farms	55
Cash grain	10
Tobacco	10
General, miscellaneous, and unclassified farms	730

Farm tenure

Most farmers in Monroe County own the land on which they work. The following list shows the number of farms operated by owners, managers, and tenants in 1959.

Type	*Number*	*Type*	*Number*
Full owners	1,036	Managers	9
Part owners	123	All tenants	31

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Aspect (forestry). The direction toward which a slope faces. Synonym: Exposure.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry, and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small, individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Erodible. Susceptible to erosion.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented when dry, has a hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, usually in the subsoil or substratum, as a result of poor aeration and drainage; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gley soil.

Great soil group. Any one of several broad groups of soils that have fundamental characteristics in common.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

A horizon.—The mineral horizons at the surface. It has an accumulation of organic matter, has been leached of soluble minerals and clay, or shows the effects of both.

B horizon.—The horizon in which clay minerals or other material has accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the effects of both processes.

C horizon.—The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least part of the overlying solum has developed.

D horizon.—Any layer, or stratum, underlying the C horizon, or the B horizon if no C horizon is present. If this stratum is rock that presumably was the source of material in the C horizon, it is designated Dr.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Karst topography. Relief marked by sinks interspersed with abrupt ridges and protuberant rocks and by caverns and underground streams.

Leached layer. A layer from which the soluble materials have been dissolved and washed away by percolating water.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notations. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material (soil). The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Pedology. The science that treats of soil.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Quartzite. A massive, hard, light-colored rock with a flinty sheen; a metamorphosed sandstone.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction, because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have consolidated into sandstone.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. In mature soils, the solum includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetation barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C or D horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

Table 1, p. 21, shows the estimated average acre yield of principal crops; table 3, p. 26, gives certain factors affecting woodland management; table 11, p. 60, gives the acreage and proportionate extent of the soils. To find the engineering properties of the soils, see section beginning on p. 38]

Map symbol	Soil name	Capability unit			Woodland suitability group	
		Page	Symbol	Page	Number	Page
Ad	Alluvial land	59	VIw-1	19	11	36
At	Atkins silt loam	59	IIIw-1	14	11	36
BcB	Bodine very cherty silt loam, 5 to 12 percent slopes	61	IVs-26	17	1	31
BcC	Bodine very cherty silt loam, 12 to 25 percent slopes	62	IVs-26	17	1	31
BcD	Bodine very cherty silt loam, 25 to 35 percent slopes	62	VIs-1	19	1	31
BrC	Bodine very stony loam, 12 to 25 percent slopes	62	VIIs-1	20	1	31
BrD	Bodine very stony loam, 25 to 35 percent slopes	62	VIIs-1	20	1	31
BrE	Bodine very stony loam, 35 to 50 percent slopes	62	VIIs-1	20	1	31
CaA	Captina silt loam, 0 to 3 percent slopes	63	IIw-2	11	3	32
CaB	Captina silt loam, 3 to 8 percent slopes	63	IIe-14	10	3	32
CaC	Captina silt loam, 8 to 15 percent slopes	63	IIIe-14	13	3	32
CbC	Chilhowie-Tumbez very rocky silty clays, 5 to 15 percent slopes	64	VIs-1	19	9	35
CbD	Chilhowie-Tumbez very rocky silty clays, 15 to 25 percent slopes	64	VIs-1	19	9	35
CbE	Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes	64	VIIs-1	20	9	35
CbE3	Chilhowie-Tumbez very rocky silty clays, 25 to 45 percent slopes, severely eroded	64	VIIs-1	20	9	35
CkB	Clarksburg silt loam, 3 to 8 percent slopes	64	IIe-14	10	2	31
CkC	Clarksburg silt loam, 8 to 15 percent slopes	64	IIIe-14	13	2	31
DaB	Dekalb channery loam, 5 to 12 percent slopes	65	IIIe-12	12	5	33
DaC	Dekalb channery loam, 12 to 25 percent slopes	65	IVe-5	16	5	33
DaD	Dekalb channery loam, 25 to 35 percent slopes	65	VIe-4	18	5	33
DbB	Dekalb fine sandy loam, 5 to 12 percent slopes	65	IIIe-12	12	5	33
DbC	Dekalb fine sandy loam, 12 to 25 percent slopes	65	IVe-5	16	5	33
DbD	Dekalb fine sandy loam, 25 to 35 percent slopes	65	VIe-4	18	5	33
DeC	Dekalb very stony loam, 10 to 25 percent slopes	66	VIIs-2	20	5	33
DeD	Dekalb very stony loam, 25 to 35 percent slopes	66	VIIs-2	20	5	33
DeE	Dekalb very stony loam, 35 to 50 percent slopes	66	VIIs-2	20	5	33
DeF	Dekalb very stony loam, 50 to 70 percent slopes	66	VIIs-2	20	5	33
DfB	Duffield silt loam, 3 to 10 percent slopes	66	IIe-1	9	1	31
DfC	Duffield silt loam, 10 to 20 percent slopes	66	IIIe-1	11	1	31
DfD	Duffield silt loam, 20 to 30 percent slopes	67	IVe-1	15	1	31
DfD3	Duffield silt loam, 20 to 30 percent slopes, severely eroded	67	VIe-1	17	1	31
DfE	Duffield silt loam, 30 to 45 percent slopes	67	VIe-1	17	1	31
DkB	Duffield silt loam, karst, 3 to 10 percent slopes	66	IIIe-1	11	1	31
DkC	Duffield silt loam, karst, 10 to 20 percent slopes	67	IVe-1	15	1	31
DrC	Duffield very rocky silt loam, 5 to 20 percent slopes	67	VIs-1	19	9	35
DrD	Duffield very rocky silt loam, 20 to 30 percent slopes	67	VIs-1	19	9	35
DrE	Duffield very rocky silt loam, 30 to 45 percent slopes	67	VIIs-1	20	9	35
DtB	Dunmore cherty silt loam, 3 to 8 percent slopes	68	IIe-1	9	1	31
DtC	Dunmore cherty silt loam, 8 to 15 percent slopes	68	IIIe-1	11	1	31
DtD	Dunmore cherty silt loam, 15 to 25 percent slopes	68	IVe-1	15	1	31
DuD3	Dunmore cherty silty clay loam, 15 to 25 percent slopes, severely eroded	68	VIe-1	17	1	31
DvB	Dunmore silt loam, 3 to 8 percent slopes	68	IIe-1	9	1	31
DvC	Dunmore silt loam, 8 to 15 percent slopes	68	IIIe-1	11	1	31
DvD	Dunmore silt loam, 15 to 25 percent slopes	68	IVe-1	15	1	31
FcB	Frederick cherty silt loam, 3 to 8 percent slopes	69	IIe-1	9	1	31
FcC	Frederick cherty silt loam, 8 to 15 percent slopes	69	IIIe-1	11	1	31
FcD	Frederick cherty silt loam, 15 to 25 percent slopes	69	IVe-1	15	1	31
FcE	Frederick cherty silt loam, 25 to 45 percent slopes	69	VIe-1	17	1	31
FdB	Frederick silt loam, 3 to 8 percent slopes	69	IIe-1	9	1	31
FdC	Frederick silt loam, 8 to 15 percent slopes	70	IIIe-1	11	1	31
FdD	Frederick silt loam, 15 to 25 percent slopes	70	IVe-1	15	1	31
FdE	Frederick silt loam, 25 to 45 percent slopes	70	VIe-1	17	1	31
FkB	Frederick cherty silt loam, karst, 3 to 8 percent slopes	69	IIIe-1	11	1	31
FkC	Frederick cherty silt loam, karst, 8 to 15 percent slopes	69	IVe-1	15	1	31
FmB	Frederick silt loam, karst, 3 to 8 percent slopes	70	IIIe-1	11	1	31
FmC	Frederick silt loam, karst, 8 to 15 percent slopes	70	IVe-1	15	1	31
FrF	Frederick and Bodine very rocky soils, 45 to 60 percent slopes	70	VIIs-1	20	9	35
FsC	Frederick and Dunmore very rocky soils, 3 to 15 percent slopes	70	VIs-1	19	9	35
FsD	Frederick and Dunmore very rocky soils, 15 to 25 percent slopes	70	VIs-1	19	9	35
FsE	Frederick and Dunmore very rocky soils, 25 to 45 percent slopes	71	VIIs-1	20	9	35
Gu	Guthrie silty clay loam	71	IVw-1	17	11	36
HaB	Hartsells and Wellston fine sandy loams, 3 to 10 percent slopes	72	IIe-4	9	5	33
HaC	Hartsells and Wellston fine sandy loams, 10 to 20 percent slopes	72	IIIe-4	12	5	33
Hu	Huntington silt loam	72	I-6	8	10	36
LaB	Laidig channery loam, 3 to 8 percent slopes	73	IIe-4	9	2	31
LaC	Laidig channery loam, 8 to 15 percent slopes	73	IIIe-4	12	2	31
LaD	Laidig channery loam, 15 to 25 percent slopes	73	IVe-3	15	2	31
LaE	Laidig channery loam, 25 to 45 percent slopes	73	VIe-4	18	2	31
LbC	Laidig very stony loam, 3 to 15 percent slopes	73	VIIs-2	20	2	31
LbD	Laidig very stony loam, 15 to 25 percent slopes	73	VIIs-2	20	2	31
LbE	Laidig very stony loam, 25 to 45 percent slopes	73	VIIs-2	20	2	31

GUIDE TO MAPPING UNITS—Continued

Map symbol	Soil name	Page	Capability unit: Symbol	Capability unit: Page	Woodland suitability group: Number	Woodland suitability group: Page
LcB	Landisburg cherty silt loam, 3 to 10 percent slopes	74	IIe-14	10	2	31
LdB	Leadvale silt loam, 3 to 10 percent slopes	75	IIe-13	10	2	31
LhD	Lehew very stony loam, 25 to 35 percent slopes	75	VIIs-2	20	5	33
LhE	Lehew very stony loam, 35 to 50 percent slopes	75	VIIs-2	20	5	33
Ln	Lindside silt loam	75	IIw-7	11	10	36
LsB	Litz shaly silt loam, 3 to 10 percent slopes	76	IIIe-31	14	6	34
LsC	Litz shaly silt loam, 10 to 20 percent slopes	76	IVe-31	16	6	34
LsD	Litz shaly silt loam, 20 to 30 percent slopes	77	VIe-31	18	6	34
LsE	Litz shaly silt loam, 30 to 45 percent slopes	77	VIIe-3	20	6	34
LsF	Litz shaly silt loam, 45 to 60 percent slopes	77	VIIe-3	20	6	34
LtB	Litz silt loam, 3 to 8 percent slopes	77	IIe-11	10	7	34
LtC	Litz silt loam, 8 to 15 percent slopes	77	IIIe-11	12	7	34
LtC3	Litz silt loam, 8 to 15 percent slopes, severely eroded	77	IVe-2	15	7	34
LtD	Litz silt loam, 15 to 25 percent slopes	77	IVe-2	15	7	34
LtD3	Litz silt loam, 15 to 25 percent slopes, severely eroded	77	VIe-2	18	7	34
LtE	Litz silt loam, 25 to 45 percent slopes	77	VIIe-2	19	7	34
LtE3	Litz silt loam, 25 to 45 percent slopes, severely eroded	77	VIIe-2	19	7	34
LtF	Litz silt loam, 45 to 60 percent slopes	77	VIIe-2	19	7	34
LvD	Litz very rocky soils, 10 to 30 percent slopes	77	VIIs-1	20	9	35
LvE	Litz very rocky soils, 30 to 45 percent slopes	77	VIIs-1	20	9	35
LvE3	Litz very rocky soils, 30 to 45 percent slopes, severely eroded	77	VIIe-4	20	9	35
LxF	Litz-Rock land complex, 45 to 60 percent slopes	77	VIIs-1	20	9	35
Mb	Melvin silt loam	78	IIIw-1	14	11	36
MgA	Monongahela silt loam, 0 to 3 percent slopes	78	IIw-1	11	3	32
MgB	Monongahela silt loam, 3 to 8 percent slopes	79	IIe-13	10	3	32
MgC	Monongahela silt loam, 8 to 15 percent slopes	79	IIIe-13	13	3	32
MoC	Montevallo channery silt loam, 10 to 20 percent slopes	79	IVe-32	16	4	32
MoC3	Montevallo channery silt loam, 10 to 20 percent slopes, severely eroded	79	VIe-32	18	4	32
MoD	Montevallo channery silt loam, 20 to 30 percent slopes	80	VIe-32	18	4	32
MoD3	Montevallo channery silt loam, 20 to 30 percent slopes, severely eroded	80	VIIe-3	20	4	32
MoE	Montevallo channery silt loam, 30 to 45 percent slopes	80	VIIe-3	20	4	32
MoE3	Montevallo channery silt loam, 30 to 45 percent slopes, severely eroded	80	VIIe-3	20	4	32
MoF	Montevallo channery silt loam, 45 to 65 percent slopes	80	VIIe-3	20	4	32
MoF3	Montevallo channery silt loam, 45 to 65 percent slopes, severely eroded	80	VIIe-3	20	4	32
MsB3	Montevallo shaly silt loam, 3 to 10 percent slopes, severely eroded	80	IVe-31	16	6	34
MsC3	Montevallo shaly silt loam, 10 to 20 percent slopes, severely eroded	80	VIe-31	18	6	34
MsD3	Montevallo shaly silt loam, 20 to 30 percent slopes, severely eroded	80	VIIe-3	20	6	34
MuB	Murrill channery loam, 3 to 8 percent slopes	81	IIe-1	9	2	31
MuC	Murrill channery loam, 8 to 15 percent slopes	81	IIIe-1	11	2	31
MuD	Murrill channery loam, 15 to 25 percent slopes	81	IVe-1	15	2	31
MuE	Murrill channery loam, 25 to 45 percent slopes	81	VIe-1	17	2	31
MvC	Murrill very stony loam, 8 to 15 percent slopes	81	VIs-1	19	2	31
MvD	Murrill very stony loam, 15 to 25 percent slopes	81	VIs-1	19	2	31
MvE	Murrill very stony loam, 25 to 45 percent slopes	81	VIIs-1	20	2	31
Ph	Philo silt loam	82	IIw-7	11	10	36
PkB	Pickaway silt loam, 3 to 10 percent slopes	82	IIe-14	10	3	32
Po	Pope fine sandy loam	83	I-6	8	10	36
Ro	Robertsville silt loam	84	IVw-1	17	11	36
SoD	Sloping eroded land, shale materials	84	VIIe-4	20	8	35
SpE	Steep eroded land, shale materials	84	VIIe-4	20	8	35
SrF	Steep rock land	84	VIIIs-1	21	12	36
SvC	Summers very stony loam, 5 to 20 percent slopes	84	VIIs-2	20	5	33
TaB	Teas and Calvin silt loams, 3 to 8 percent slopes	85	IIe-11	10	7	34
TaC	Teas and Calvin silt loams, 8 to 15 percent slopes	85	IIIe-11	12	7	34
TaC3	Teas and Calvin silt loams, 8 to 15 percent slopes, severely eroded	85	IVe-2	15	7	34
TaD	Teas and Calvin silt loams, 15 to 25 percent slopes	85	IVe-2	15	7	34
TaE	Teas and Calvin silt loams, 25 to 45 percent slopes	85	VIIe-2	19	7	34
TcD3	Teas and Calvin soils, 15 to 25 percent slopes, severely eroded	85	VIe-2	18	7	34
TcE3	Teas and Calvin soils, 25 to 45 percent slopes, severely eroded	85	VIIe-2	19	7	34
TlB	Teas-Calvin-Litz silt loams, 3 to 8 percent slopes	86	IIe-11	10	7	34
TlC	Teas-Calvin-Litz silt loams, 8 to 15 percent slopes	86	IIIe-11	12	7	34
TlD	Teas-Calvin-Litz silt loams, 15 to 25 percent slopes	86	IVe-2	15	7	34
TlE	Teas-Calvin-Litz silt loams, 25 to 45 percent slopes	86	VIIe-2	19	7	34
TmB3	Teas-Calvin-Litz complex, 3 to 8 percent slopes, severely eroded	86	IIIe-11	12	7	34
TmC3	Teas-Calvin-Litz complex, 8 to 15 percent slopes. severely eroded	86	IVe-2	15	7	34
TmD3	Teas-Calvin-Litz complex, 15 to 25 percent slopes, severely eroded	86	VIe-2	18	7	34
TmE3	Teas-Calvin-Litz complex, 25 to 45 percent slopes, severely eroded	86	VIIe-2	19	7	34
TmF	Teas-Calvin-Litz complex, 45 to 55 percent slopes	86	VIIe-2	19	7	34
TmF3	Teas-Calvin-Litz complex, 45 to 55 percent slopes, severely eroded	87	VIIe-3	20	7	34
TrC	Teas-Calvin-Litz very stony complex, 10 to 25 percent slopes	87	VIIs-2	20	7	34
TrE	Teas-Calvin-Litz very stony complex, 25 to 45 percent slopes	87	VIIs-2	20	7	34
TrF	Teas-Calvin-Litz very stony complex, 45 to 60 percent slopes	87	VIIs-2	20	7	34
TsB	Tilsit fine sandy loam, 3 to 8 percent slopes	87	IIe-13	10	3	32
TtB	Tilsit silt loam, 2 to 8 percent slopes	87	IIe-13	10	3	32
TtC	Tilsit silt loam, 8 to 15 percent slopes	88	IIIe-13	13	3	32