SOIL SURVEY

McCreary-Whitley Area, Kentucky

OUR SOIL ★ OUR STRENGTH

Issued June 1970

UNITED STATES DEPARTMENT OF AGRICULTURE
Forest Service and Soil Conservation Service
In cooperation with
KENTUCKY AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1962–64. Soil names and descriptions were approved in 1963. Unless otherwise indicated, statements in this survey refer to conditions in the Area in 1964. This survey was made cooperatively by the Forest Service, the Soil Conservation Service, and the Kentucky Agricultural Experiment Station; it is part of the technical assistance furnished to the McCreary County and the Whitley County Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or can be purchased, on individual order, from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of the McCreary-Whitley Area contains information that can be applied in managing forests, woodlots, and farms; in selecting sites for roads, ponds, buildings, or other structures; in managing watersheds; and in estimating the suitability of tracts of land for agriculture, industry, or recreation.

Locating Soils

All of the soils of the McCreary-Whitley Area are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the Area in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit and woodland suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and in the section that discusses management of soils for crops and pasture.

Foresters and others can refer to the section "Use of Soils as Woodland," where the soils of the Area are grouped according to their suitability for trees.

Community planners and others concerned with community development can read about the soil properties that affect the choice of homesites, industrial sites, schools, and parks in the section "Use of Soils for Recreational and Community Developments."

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the section "Use of Soils for Wildlife."

Hydrologists and watershed planners can read about characteristics of soils that affect absorption of rainwater, runoff, and the flow of streams in the section "Use of Soils as Watersheds."

Engineers and builders will find under "Engineering Uses of Soils" tables that give engineering descriptions of the soils in the Area and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the McCreary-Whitley Area may 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 Area."

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SOIL SURVEY OF THE McCREARY-WHITLEY AREA, KENTUCKY

BY JAMES G. BYRNE, CRAIG K. LOSCHE, CHARLES R. GASS, G. DEAN BOTTRELL, PETER E. AVERS, JOHN K. LONG, AND LEWIS G. MANHART, FOREST SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND SOIL CONSERVATION SERVICE IN COOPERATION WITH THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

THE McCREARY-WHITLEY AREA consists of all of McCreary County and the western part of Whitley County and is in the southeastern part of Kentucky (fig. 1). The Area occupies 407,080 acres, or about 636 square miles. Interstate Highway No. 75 forms the eastern boundary, and the southern boundary is the Kentucky-Tennessee State line. Whitley City is the county seat of McCreary County. Williamsburg, the county seat of Whitley County, is outside the survey area.

About 85 percent of the McCreary-Whitley Area is forested. Nearly all the wooded areas are within the proclamation boundary of the Cumberland National Forest, recently changed to the Daniel Boone National Forest. Some of these wooded areas are owned by the Federal Government, and some are privately owned. Scattered farms are along the broader ridgetops and on bottom lands along streams. Forest products and coal are the primary natural resources.

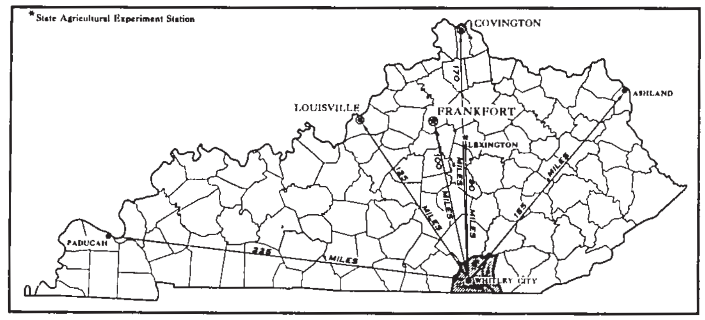

Figure 1.—**Location of the McCreary-Whitley Area in Kentucky.**

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the McCreary-Whitley Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is also useful in determining the value of the associations for a watershed, for growing wood products, for wildlife habitat, for engineering work, for recreational areas, and for community development. A general soil map, however, is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The general soil map of the McCreary-Whitley Area shows eight soil associations. Seven associations are on mountainsides, ridgetops, side slopes, benches, and plateaus of the uplands, and one is on flood plains and terraces.

1. Atkins-Pope-Tate Association

Deep, poorly drained to well-drained, nearly level to gently sloping soils on flood plains and stream terraces

This association consists of soils along Marsh and Rock Creeks in McCreary County and Jellico Creek, Clear Fork, and Spruce Creek, and the Cumberland River in Whitley County. The Atkins and Pope soils are dominant (fig. 2). This association makes up about 4 percent of the McCreary-Whitley Area.

Together the Atkins and Pope soils make up about 30 percent of this association; the Tate soils, about 10 percent; and minor soils, the remaining 60 percent. The percentage of the major soils varies from one area of this association to another. Along Spruce and Marsh Creeks, most of this association consists of soils that are somewhat poorly drained and poorly drained; but along Rock Creek, Jellico Creek, Clear Fork, and the Cumberland River most of the soils are well drained.

The Atkins soils are on flood plains. They are poorly drained silt loams that have a seasonal high water table. The Pope soils also are on flood plains but have variable texture and are well drained. The higher lying, well-drained Tate soils are loamy. They occur on stream terraces and generally are not subject to annual flooding.

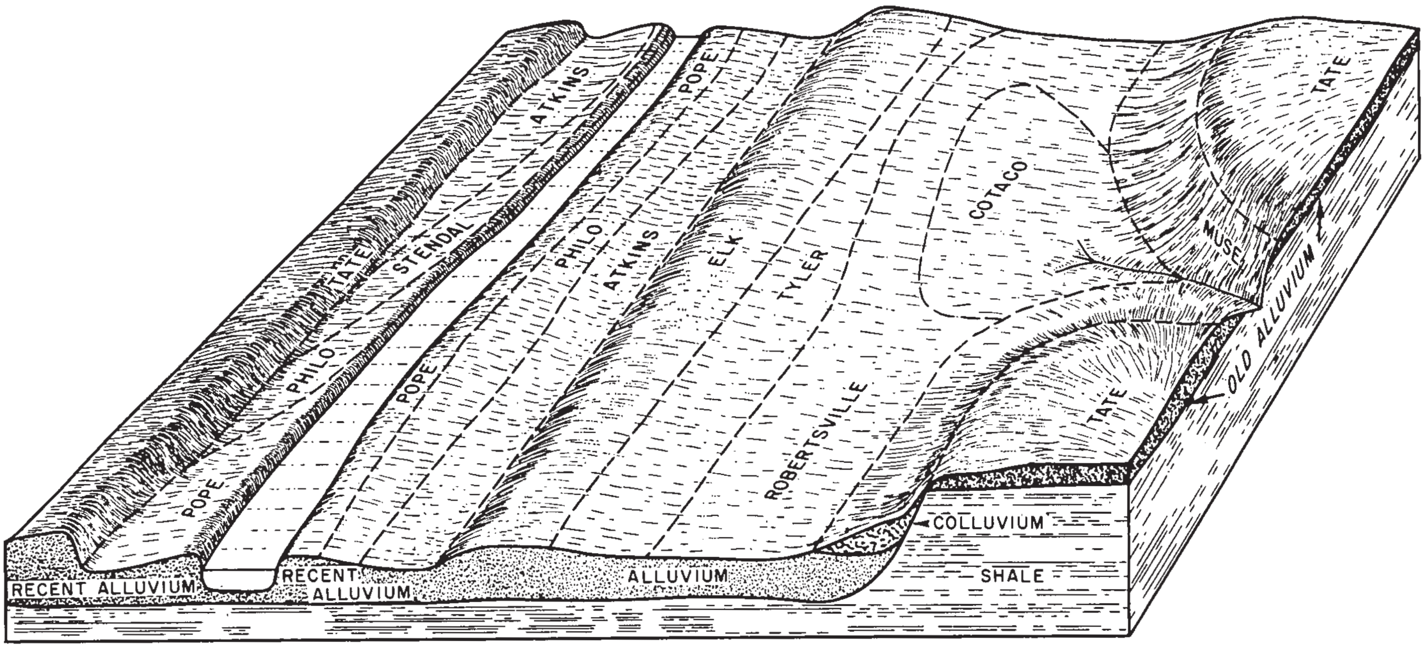

Figure 2.—**General location of the Atkins, Pope, and Tate soils on flood plains and streams terraces in association 1.**

The minor soils are the Huntington, Philo, and Stendal on flood plains and the Allegheny, Captina, Robertsville, Tyler, and Elk soils on stream terraces.

Most of the crops produced in the McCreary-Whitley Area can be grown on most soils of this association. Growth of crops is limited mostly by a seasonal high water table, particularly in the Atkins soils, and by seasonal flooding. Where drainage is needed, it improves the growth of crops. Except in wet areas, farm machinery can be operated easily. Although farming is the dominant use of soils in this association, the soils also are suited to trees. Some areas are well suited to recreational developments, mainly for fishing, swimming, and camping.

2. Muse-Shelocta Association

Deep, well-drained, very stony, dominantly steep soils on rough mountainsides

This association consists of soils that have long slopes and are on the Jellico Mountains in the southeastern part of the Area (fig. 3). The ridgetops commonly are 1,200 feet higher than the valley floors. This association is dissected by many drainageways, and small areas of sandstone cliffs are common. Stones and boulders occur in pockets or as chains along steep drainageways and, in places, cover as much as 10 percent of the surface. Bedrock dominantly is shale, but it is sandstone in some places. This association makes up about 14 percent of the McCreary-Whitley Area.

The Muse soils make up about 60 percent of this association; Shelocta soils, about 25 percent; and minor soils, the remaining 15 percent.

The Muse soils occur on smooth to convex parts of mountainsides. They have a silty clay loam or silty clay subsoil. The Shelocta soils occur in smooth to concave areas, normally at the lower parts of slopes and on slopes facing north. Shelocta soils typically have a silty clay loam subsoil. Both Muse and Shelocta soils have common to many coarse fragments in their subsoil.

The minor soils in this association are the Weikert, Gilpin, and Trappist on ridgetops and steep side slopes and the Renox in north-facing coves at an elevation of about 1,500 feet.

Much of this association is forested. Dominant on ridgetops and side slopes facing south are hickory, blackgum, chestnut oak, and other hardwoods that favor a dry site. North-facing mountainsides support more tulip-poplar, northern red oak, and buckeye. The lower part of some slopes and bottom lands in this association are farmed or pastured. Steepness, stoniness, and a high hazard of erosion seriously limit the use of soils in this association for farming. Good uses are for producing timber and wildlife.

3. Muse-Wellston-Trappist Association

Deep and moderately deep, well-drained, gently sloping to steep soils on ridgetops and side slopes

This association consists of soils on broad and narrow, rounded ridgetops and on convex side slopes along many narrow drainageways of intermittent streams (fig. 4). This association is highly dissected; streams, on the average, are 230 feet below the ridgetops. The bedrock dominantly is shale, but in some places it is sandstone. This association occurs as a narrow north-south belt that extends from about Spruce Creek in Whitley County through McCreary County to the State line. It covers about 13 percent of the Area.

The Muse soils make up about 60 percent of this association; the Wellston soils, about 20 percent; the Trap-

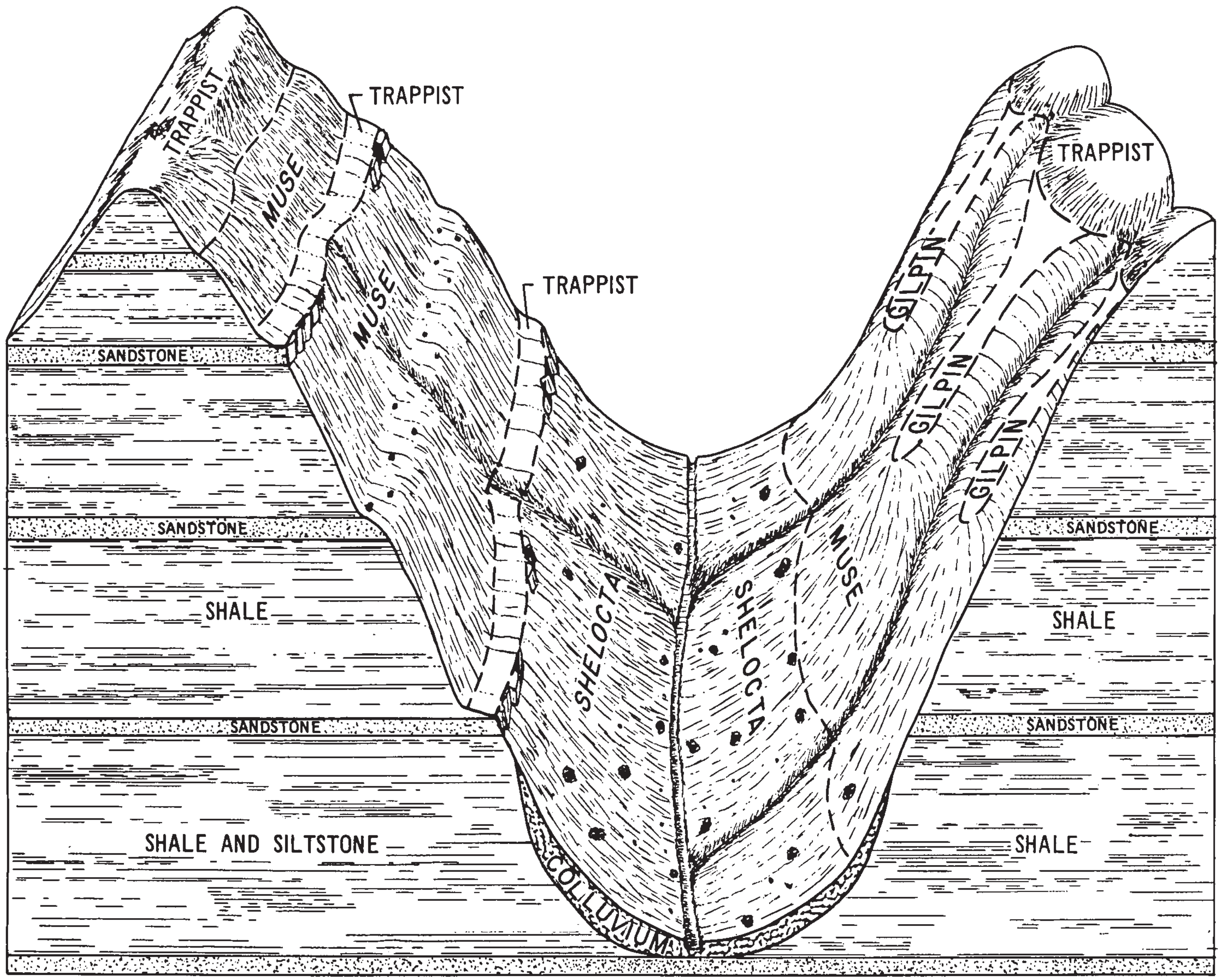

***Figure 3.*—General location of the Muse and Shelocta soils in a typical area of the Jellico Mountains. Small areas of sandstone cliffs are common.**

pist soils, about 10 percent; and minor soils, the remaining 10 percent.

The Muse and Trappist soils are on the side slopes, narrow ridgetops, and small knobs on broad ridgetops. These soils have a clayey subsoil. Less than 1 percent of their surface is covered with stones. The Wellston soils are on the broad, smooth to slightly convex ridgetops. These soils have a loamy subsoil.

The minor soils are the Clymer, Dekalb, and Tate. The Clymer and Dekalb soils are on ridgetops, and the Tate soils are on side slopes near scattered outcrops of rock.

Most of this association is privately owned. Except on ridgetops in a few cleared areas that are farmed, this association is forested. Southern yellow pine and hickory are dominant on most ridgetops and south-facing slopes, and mixed oaks are dominant on most of the north-facing slopes. Past farming of the ridgetops and south-facing slopes destroyed the hardwoods and allowed the pine to become established. Steepness and the hazard of erosion limit the use of these soils. Good uses for the soils of this association are for timber, wildlife, and watershed protection. The soils on the broad ridgetops are suited to most farm crops.

4. Wellston-Muse-Clymer Association

Deep, well-drained, gently sloping to moderately steep soils on gently rolling to rolling uplands

This association consists of soils on broad, gently rolling to rolling uplands in the north-central part of Whitley county (fig. 5). The difference in elevation between

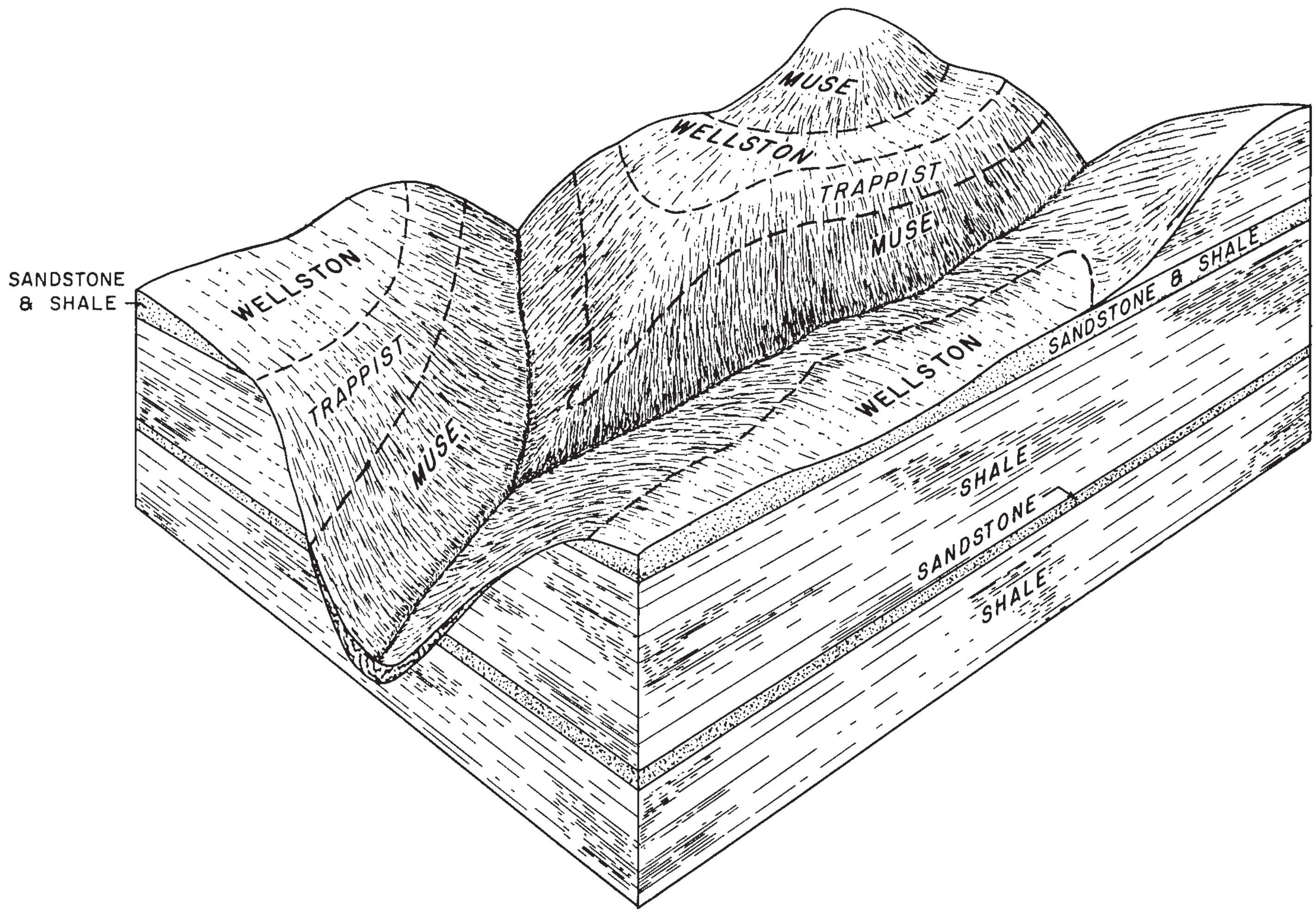

Figure 4.—General location of Muse, Wellston, and Trappist soils on ridgetops and side slopes in association 3.

the ridgetops and streams is more than 100 feet in only a few places. All of the soils are underlain by sandstone and shale. This association makes up about 3 percent of the Area.

The Wellston and Muse soils together make up about 75 percent of this association; the Clymer soils, about 10 percent; and minor soils, the remaining 15 percent.

The Muse soils are on short side slopes and low rounded knobs adjacent to Wellston soils, which are on broad ridgetops. The Clymer soils are on narrow ridgetops and on short side slopes along drainageways. The Muse soils have a dominantly clayey subsoil. The subsoil of both Clymer and Wellston soils is loamy, but more sand is in the subsoil of the Clymer.

The minor soils in this association are the poorly drained Atkins on flood plains and the Dekalb and Tilsit on uplands.

In this association, the gently sloping soils on broad ridgetops are used mostly for cultivated crops. The more strongly sloping soils on narrow ridgetops are chiefly in pasture. On side slopes and knobs, the soils have been cleared and farmed in most places, but farming was later abandoned. Now these soils are mostly reforested with yellow pine and mixed oaks.

5. Tate-Trappist Association

Deep and moderately deep, well-drained, strongly sloping to steep soils on ridgetops and long, stony side slopes

This association consists of strongly sloping soils on ridgetops and of steep soils on long, stony side slopes along narrow drainageways (fig. 6). The side slopes commonly are crossed by sandstone cliffs from 40 to 60 feet high. The hilly ridgetops are about 800 feet higher than the narrow valley floors. The soils of this association are underlain by acid shale and sandstone in beds about equally thick. This association covers about 32 percent of the Area.

The Tate soils make up about 60 percent of this association; the Trappist soils, about 25 percent; and minor soils, the remaining 15 percent.

The Tate soils are on stony side slopes and in coves, generally downslope from sandstone cliffs. These steep soils are deep, are very strongly acid, and have a loamy subsoil. The Trappist soils are moderately deep, are very strongly acid, and have a clayey subsoil. They are on ridgetops, noses, benches, and the upper one-third of side slopes. In most places Trappist soils are strongly sloping to moderately steep, but they are steep in some areas.

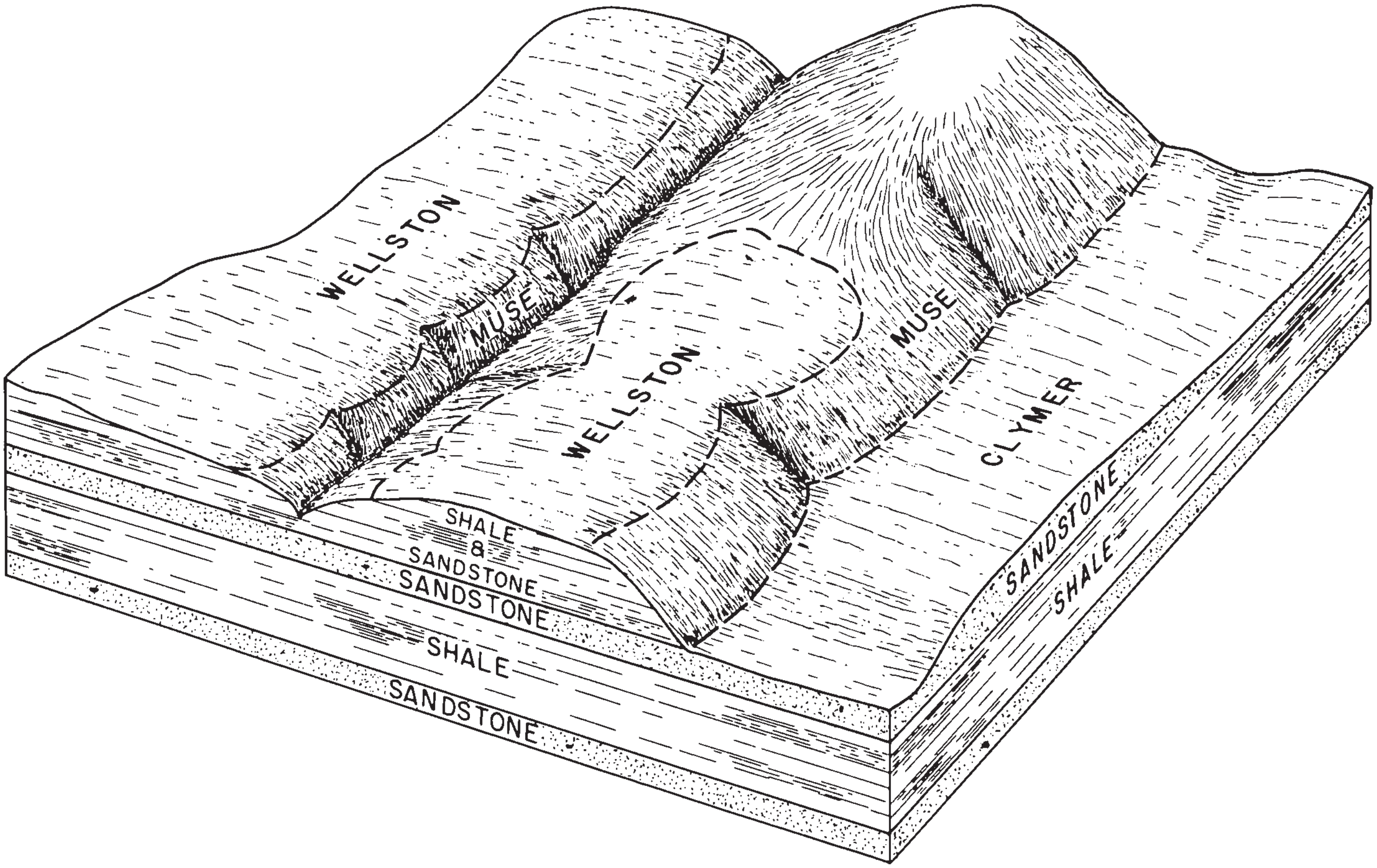

Figure 5.—**General location of Wellston, Muse, and Clymer soils on broad, gently rolling to rolling uplands in association 4.**

The minor soils of this association are the Clymer, Dekalb, and Wellston on ridgetops and Shelocta on the lower part of side slopes.

Except for a few farms on the wider ridgetops and on bottom lands, the soils in this association are mostly forested. The forest ranges from stands of pine and hardwoods on narrow ridges to pure hardwoods in coves, on north-facing slopes, and on lower slopes. Steepness, cliffs, stones, and boulders severely limit use, but the soils are suitable for producing timber, supporting wildlife, and providing attractive scenery.

6. Clymer-Dekalb Association

Moderately deep to deep, well-drained and somewhat excessively drained, gently rolling to moderately steep soils on plateaus and side slopes

The landscape in this association is a gently rolling to rolling plateau on which elevations vary more than 60 feet in only a few places (fig. 7). The soils are underlain chiefly by sandstone bedrock. This association occupies about 2 percent of the Area and occurs in the vicinity of Gilbreath and Pine Knot in McCreary County.

The Clymer soils make up about 65 percent of this association; Dekalb soils, about 20 percent; and minor soils, the remaining 15 percent.

The Clymer soils occur on broad ridgetops and are gently sloping to sloping in most places. They are moderately deep to deep and well drained. The Dekalb soils are moderately deep, are somewhat excessively drained, and range from sloping to strongly sloping. Both Clymer and Dekalb soils have a loamy subsoil, but more sand and less clay are in the subsoil of the Dekalb.

The minor soils of this association are the moderately well drained Cotaco and Philo soils along stream channels, the Tate soils on side slopes, and the Wellston, Tilsit, and Muse soils on ridgetops.

The farms of this association are mostly privately owned. They are small and are used for pasture, hay, and cultivated crops. The steeper areas are mainly pasture or woodland.

7. Tate-Clymer-Dekalb Association

Deep and moderately deep, well-drained and somewhat excessively drained, sloping to steep soils on ridgetops and side slopes

This association consists of deep valleys, generally rimmed by high sandstone cliffs that have narrow ridges above and steep side slopes below (fig. 8).

The average height of the ridgetops above the streams is 450 feet. In this association the bedrock is sandstone

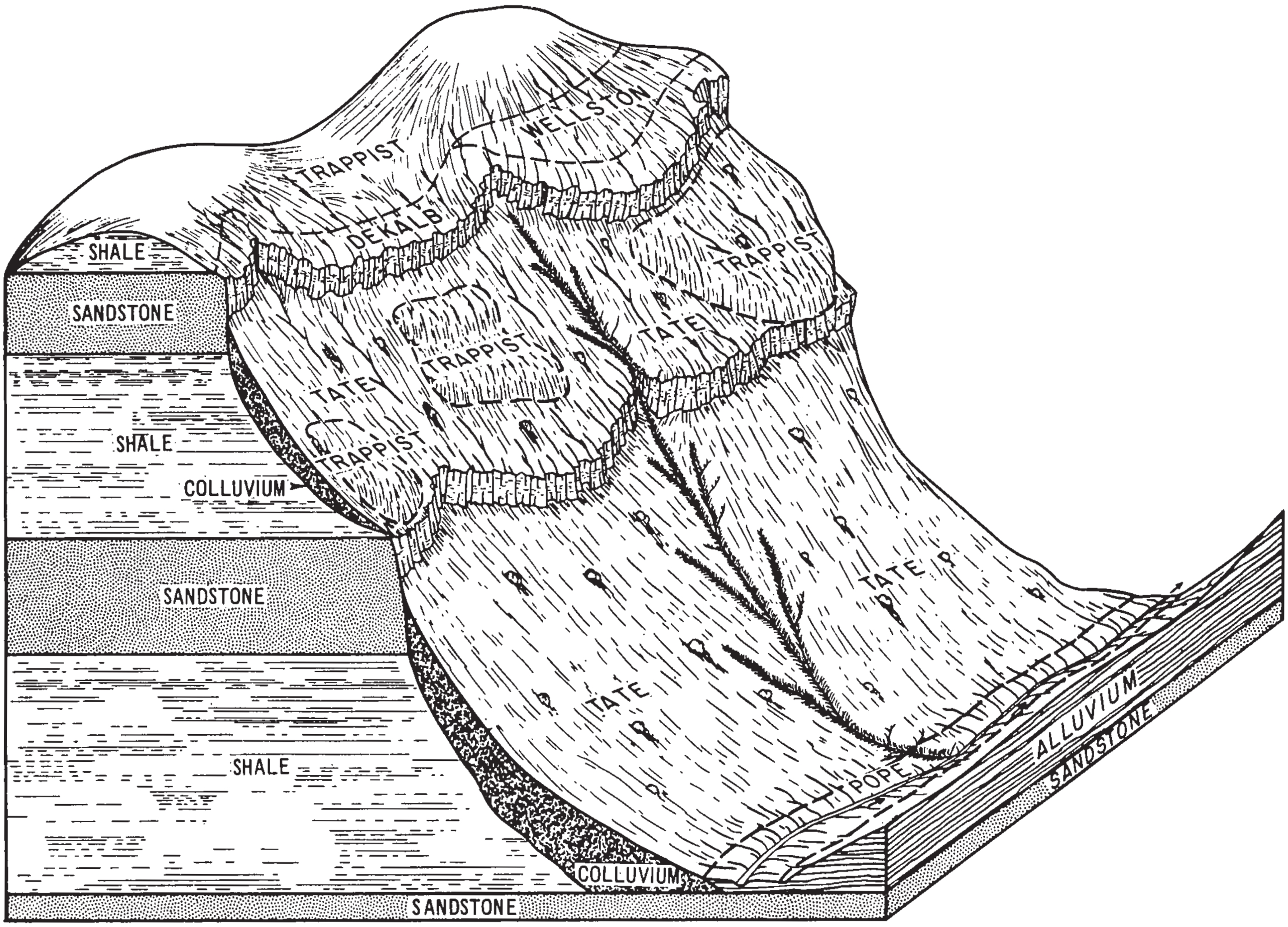

***Figure 6.*—General location of Tate and Trappist soils on ridgetops and long, steep side slopes in association 5.**

and shale, but sandstone is dominant. This association occupies about 27 percent of the Area.

The Tate soils make up about 50 percent of this association; the Clymer and Dekalb soils together, about 25 percent; and minor soils, the remaining 25 percent.

The Tate and Clymer soils are well drained. The Tate soils are dominantly steep. They developed in thick colluvium on side slopes and have a clayey subsoil. The Clymer soils are on the broadest part of ridgetops, are sloping to strongly sloping, and are moderately deep or deep. They have a loam to clay loam subsoil. The Dekalb soils are in more narrow parts of ridgetops, are strongly sloping to moderately steep, and are moderately deep. They have a sandy loam subsoil.

The minor soils in this association are the Wellston, Muse, and Ramsey on ridgetops, but the Muse soils also occur on side slopes.

Most of the acreage in this association is forested. Stands of yellow pine and oak are dominant on the Clymer and Dekalb soils and on south-facing slopes of Tate soils. On the north-facing slopes of Tate soils, the trees are mostly hardwoods, such as tulip-poplar, northern red oak, white oak, and hemlock. A small acreage of Clymer and Dekalb soils on ridgetops is cultivated. The almost continuous cliffs and steep, stony side slopes severely restrict the use of soils in this association for most purposes.

8. Tate-Shelocta Association

Deep, well-drained, sloping to steep soils on benches and side slopes

This association consists of strongly sloping to steep soils on side slopes and sloping to strongly sloping soils on benches (fig. 9). The benches are generally wider at the lower parts of slopes. The soils of this association are the only ones in the Area that are underlain by calcareous shale and limestone. In most places scattered stones and boulders cover from 3 to 20 percent of the surface.

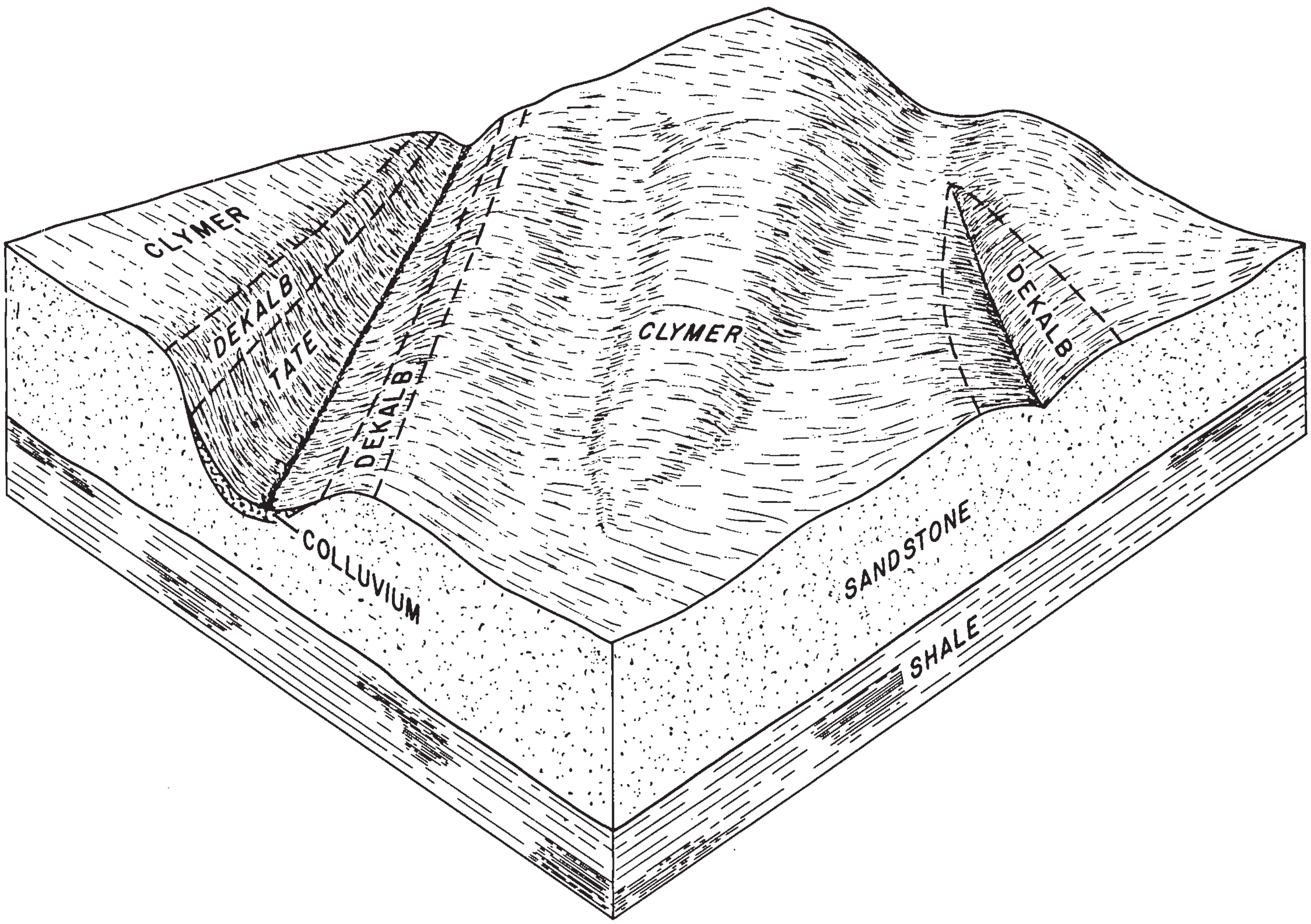

Figure 7.—**General location of the Clymer and Dekalb soils on a gently rolling to rolling plateau in association 6.**

This association occurs mainly in the western part of the Area along the Little South Fork and the larger western tributaries of the South Fork Cumberland River. The association covers about 5 percent of the Area.

The Tate and Shelocta soils together make up about 65 percent of this association, and minor soils about 35 percent.

The Tate and Shelocta soils are strongly acid to medium acid. They developed in deep, acid colluvium. The Tate soils are generally above the Shelocta soils and have a clay loam subsoil. The subsoil of the Shelocta soils is generally silty clay loam.

Among the minor soils in this association are the neutral Colbert, mostly on the higher lying benches, the medium acid Talbott in the lower bench positions, and the very strongly acid Muse soils on the upper side slopes. Other minor soils are on narrow flood plains.

Stones, rock outcrops, and steep slopes severely limit the use of the soils in this association. Most of the acreage is wooded, but some of the less steep soils at lower elevations are used for pasture.

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How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in the McCreary-Whitley Area, where they are located, and how they can be used.

They went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the Area 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 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 into the parent 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 nationwide, uniform procedures. For successful use of this survey, it

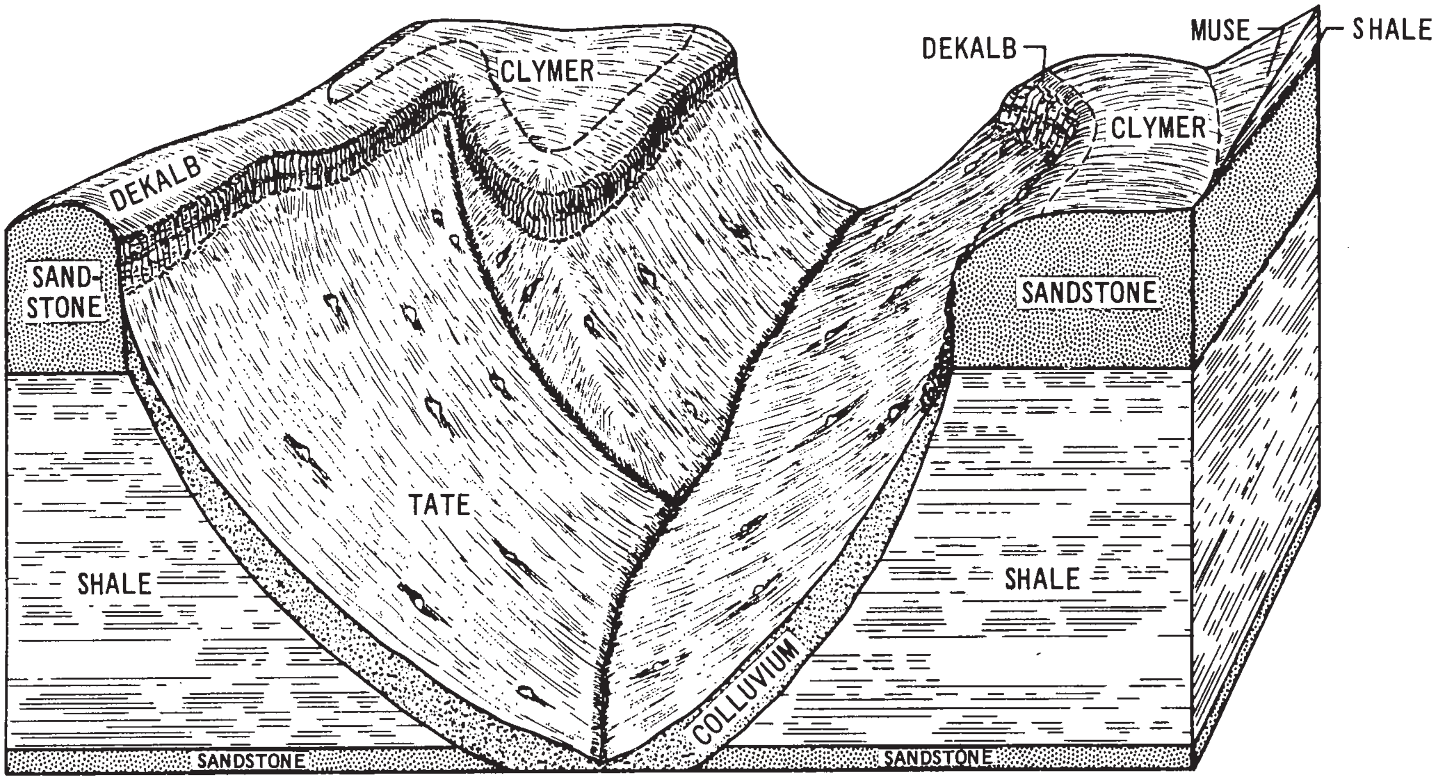

Figure 8.—**General location of Tate, Clymer, and Dekalb soils and of sandstone cliffs that are characteristic of association 7.**

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, all the soils of one series have major horizons that 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. Muse and Tate, 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 those characteristics that go with their behavior in the natural landscape. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in 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. Tate fine sandy loam and Tate loam are two soil types in the Tate series. The difference in texture of their surface layers is apparent from their names.

Some 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 phases. The name of a soil phase indicates a feature that affects management. For example, Tate loam, 6 to 12 percent slopes, is one of several phases of Tate loam, a soil type that ranges from sloping to very steep.

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

The areas shown on a 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 scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Tate-Very stony land complex.

Most surveys include areas where the soil material is so rocky, so shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on the map like other mapping units, but

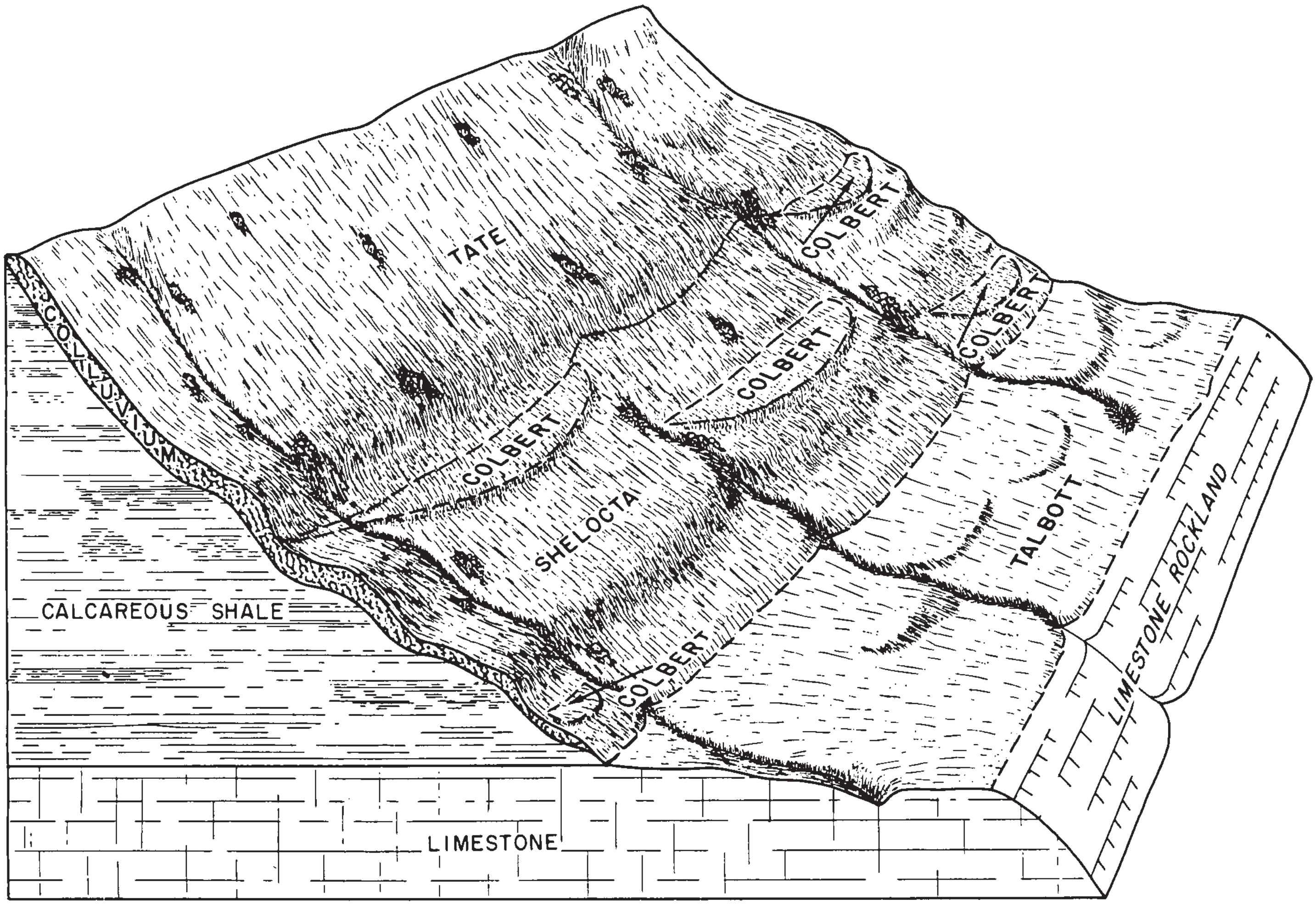

Figure 9.—**General location of Tate and Shelocta soils on a typical benched landscape in association 8.**

are given descriptive names, such as Rock outcrop or Strip mines, and are called land types. The soil scientist may also show as one mapping unit two or more soils or land types if the differences between them are so small that they do not justify separation for the purpose of the survey. Such a mapping unit is called an undifferentiated soil group; for example, Muse and Gilpin silt loams, 50 to 65 percent slopes.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey.

Descriptions of the Soils

In this section the soil series and the mapping units in each series are described. The description of a soil series mentions the features that apply to all the mapping units in that series. Each series contains a short description of a typical soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. Differences among the mapping units of one series are pointed out in the descriptions of the individual mapping units or are indicated in the names of the mapping units. Unless otherwise stated, the profile described for the principal mapping unit, or the first after the series description, is considered representative for all mapping units in the series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map, which is at the back of the survey. Listed at the end of each description is the capability unit and woodland suitability group assigned to the mapping unit.

For more generalized information about soils in the area surveyed, the reader can refer to the section "General Soil Map." The approximate acreage and proportionate extent of the mapping units are given in table 1, and a list of the units mapped, along with the capability unit and woodland suitability group of each, is given in the "Guide to Mapping Units" at the back of the survey. Many terms used in describing the soils are defined in the Glossary.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Mapping unit	McCreary County		Whitley County		McCreary-Whitley Area	
	Acres	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*
Allegheny gravelly loam, 6 to 12 percent slopes	250	0.1	190	0.1	440	0.1
Atkins silt loam	610	.2	2,060	1.4	2,670	.7
Captina silt loam, 2 to 6 percent slopes	0	-------	860	.6	860	.2
Clymer fine sandy loam, 2 to 6 percent slopes	710	.3	450	.3	1,160	.3
Clymer fine sandy loam, 6 to 12 percent slopes	10,120	3.9	5,410	3.7	15,530	3.8
Clymer and Dekalb fine sandy loams, 12 to 20 percent slopes	3,920	1.5	4,550	3.1	8,470	2.1
Colbert silty clay loam, 6 to 20 percent slopes	680	.3	0	-------	680	.2
Cotaco silt loam	1,160	.4	2,840	1.9	4,000	1.0
Dekalb fine sandy loam, 6 to 12 percent slopes	4,250	1.6	500	.3	4,750	1.2
Dekalb and Ramsey sandy loams, 12 to 20 percent slopes	7,170	2.7	2,940	2.0	10,110	2.5
Dekalb and Tate sandy loams, 20 to 30 percent slopes	5,710	2.2	750	.5	6,460	1.6
Dekalb and Tate sandy loams, 30 to 50 percent slopes	12,680	4.9	1,300	.9	13,980	3.4
Elk silt loam	180	.1	1,990	1.4	2,170	.5
Huntington silt loam	640	.2	0	-------	640	.2
Made land	100	([1])	70	([1])	170	([1])
Muse silt loam, 6 to 12 percent slopes	10,580	4.1	7,830	5.4	18,410	4.5
Muse silt loam, 12 to 20 percent slopes	10,980	4.2	6,040	4.1	17,020	4.2
Muse silty clay loam, 6 to 12 percent slopes, severely eroded	0	-------	450	.3	450	.1
Muse silty clay loam, 12 to 20 percent slopes, severely eroded	0	-------	280	.2	280	.1
Muse and Gilpin silt loams, 50 to 65 percent slopes	580	.2	40	([1])	620	.2
Muse-Shelocta stony silt loams, 20 to 40 percent slopes	2,130	.8	10,870	7.4	13,000	3.2
Muse-Shelocta-Gilpin stony silt loams, 40 to 60 percent slopes	9,730	3.7	24,920	17.2	34,650	8.5
Muse-Trappist silt loams, 20 to 30 percent slopes	5,870	2.2	6,100	4.2	11,970	2.9
Muse-Trappist silt loams, 30 to 50 percent slopes	10,730	4.1	12,580	8.6	23,310	5.7
Muse-Trappist silty clay loams, 20 to 30 percent slopes, severely eroded	130	([1])	980	.7	1,110	.3
Philo fine sandy loam	90	([1])	410	.3	500	.1
Philo silt loam	320	.1	940	.6	1,260	.3
Pope fine sandy loam, 4 to 20 percent slopes	100	([1])	530	.4	630	.2
Pope soils, 0 to 4 percent slopes	1,250	.5	930	.6	2,180	.5
Renox channery silt loam, 40 to 60 percent slopes	120	([1])	750	.5	870	.2
Robertsville silt loam	160	.1	670	.5	830	.2
Rock land-Talbott complex	2,300	.9	0	-------	2,300	.6
Rock outcrop	340	.1	60	([1])	400	.1
Stendal sandy loam	160	.1	200	.1	360	.1
Strip mines	1,560	.6	2,960	2.0	4,520	1.1
Talbott rocky silt loam, 6 to 12 percent slopes	230	.1	0	-------	230	.1
Talbott rocky silt loam, 12 to 20 percent slopes	500	.2	0	-------	500	.1
Talbott very rocky silty clay, 12 to 20 percent slopes, severely eroded	350	.1	0	-------	350	.1
Tate fine sandy loam, 0 to 6 percent slopes	270	.1	770	.5	1,040	.3
Tate loam, 6 to 12 percent slopes	330	.1	340	.2	670	.2
Tate loam, 12 to 20 percent slopes	1,360	.5	510	.3	1,870	.5
Tate loam, 20 to 30 percent slopes	2,760	1.1	1,850	1.3	4,610	1.1
Tate loam, 30 to 50 percent slpoes	25,400	9.7	17,000	11.7	42,400	10.4
Tate stony sandy loam, 12 to 20 percent slopes	820	.3	20	([1])	840	.2
Tate stony sandy loam, 20 to 30 percent slopes	770	.3	170	.1	940	.2
Tate stony sandy loam, 30 to 50 percent slopes	42,130	16.1	4,020	2.8	46,150	11.3
Tate-Trappist stony complex, 25 to 45 percent slopes	45,040	17.3	2,570	1.8	47,610	11.7
Tate, Shelocta, and Muse stony soils, 12 to 35 percent slopes	14,440	5.5	0	-------	14,440	3.5
Tate-Very stony land complex	1,470	.6	570	.4	2,040	.5
Tilsit silt loam, 2 to 6 percent slopes	690	.3	640	.4	1,330	.3
Trappist silty clay loam, 6 to 12 percent slopes, severely eroded	440	.2	870	.6	1,310	.3
Trappist silty clay loam, 12 to 20 percent slopes, severely eroded	30	([1])	1,400	1.0	1,430	.4
Trappist-Monongahela silt loams, 12 to 20 percent slopes	1,570	.6	1,840	1.3	3,410	.8
Trappist-Weikert silt loams, 12 to 20 percent slopes, severely eroded	40	([1])	950	.7	990	.2
Tyler silt loam	110	([1])	360	.2	470	.1
Wellston silt loam, 6 to 12 percent slopes	14,680	5.6	8,080	5.5	22,760	5.6
Wellston and Tilsit silt loams, 2 to 6 percent slopes	2,306	.9	2,570	1.8	4,930	1.2
Totals	261,100	100.0	145,980	100.0	407,080	100.0

[1] Less than 0.05 percent.

Allegheny Series

The Allegheny series consists of deep, moderately sloping to strongly sloping, well-drained soils. These soils occupy small alluvial fans throughout the survey area. They formed in sediments that washed from soils derived from acid sandstone and shale.

In a typical profile, the surface layer is dark grayish-brown gravelly loam about 7 inches thick. The subsoil extends to a depth of 32 inches. It consists of about 15 inches of yellowish-brown gravelly loam underlain by dark yellowish-brown gravelly clay loam. Below a depth of 32 inches is mottled yellowish-brown gravelly clay loam.

The Allegheny soils are strongly acid and have moderate natural fertility. Permeability is moderately rapid. These soils have a thick root zone and moderate to high available moisture capacity. They are easily tilled throughout a wide range of moisture content without clodding or crusting. Most of the acreage is pastured or farmed.

Typical profile of an Allegheny gravelly loam (1.3 miles north of the State line on the east side of Trammel Fork, on a slope of 8 percent):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, fine, granular structure; loose; 25 percent of volume is coarse fragments commonly 2 inches across; many fine roots; strongly acid; abrupt, smooth boundary.

B21t—7 to 22 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, very fine, subangular blocky structure; friable; faint, patchy clay films in pores; 30 percent of volume is coarse fragments commonly 3 inches across; few very fine roots; strongly acid; clear, wavy boundary.

B22t—22 to 32 inches, dark yellowish-brown (10YR 4/4) gravelly clay loam; moderate, very fine and fine, subangular blocky structure; friable; distinct, patchy clay films in pores; 40 percent of volume is coarse fragments commonly 3 inches across; few very fine roots; strongly acid; gradual, smooth boundary.

C—32 to 45 inches +, yellowish-brown (10YR 5/4) gravelly clay loam; common, medium, distinct mottles that have light brownish-gray (2.5Y 6/2) interiors and strong-brown (7.5YR 5/8) exteriors; massive; firm; distinct, broken clay films in pores; 70 percent of volume is coarse fragments commonly 3 to 10 inches across; strongly acid.

Stratified sand, silt, and clay underlie some profiles at a depth of more than 5 feet. In some places mottles are absent, or on slopes steeper than 8 percent they occur much deeper in the profile than those described in the typical profile.

The Allegheny soils occur near the Muse and Cotaco soils. They have less clay than the Muse soils and are not so bright colored. Allegheny soils are better drained than Cotaco soils.

Allegheny gravelly loam, 6 to 12 percent slopes (AgC).—This soil is on slightly convex alluvial fans and toeslopes. It is not extensive, and mapped areas average less than 3 acres in size.

Small areas of Cotaco and Muse soils were included with this soil in mapping.

Most of the acreage of this soil has been cleared. It is used intensively for truck crops or tobacco. (Capability unit IIIe-1; woodland suitability group 2)

Atkins Series

The Atkins series consists of deep, nearly level, poorly drained soils on flood plains throughout the survey area. These soils formed in sediments that washed from soils derived from acid sandstone and shale.

In a typical profile, the surface layer is dark grayish-brown silt loam about 8 inches thick. The underlying material is gray or grayish-brown loam, silt loam, or sandy clay loam. The underlying bedrock is at a depth of 6 to 8 feet or more.

The Atkins soils are very strongly acid and have moderate natural fertility. Permeability is moderate. These soils are saturated by water part of the year.

The vegetation consists mostly of grasses, shrubs, and trees that tolerate wetness.

Typical profile of Atkins silt loam (1.2 miles south of the junction of State Routes 92 and 1470, along Osborn Creek):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; many, medium, distinct mottles of brown (7.5YR 4/4) and yellowish brown (10YR 5/4); weak, fine, granular structure; friable; very strongly acid; abrupt, smooth boundary.

C1g—8 to 20 inches, grayish-brown (10YR 5/2) silt loam; common, medium, faint mottles of grayish brown (2.5Y 5/2) and distinct mottles of brown (7.5YR 4/4); massive; friable; very strongly acid; gradual, wavy boundary.

C2g—20 to 28 inches, grayish-brown (10YR 5/2) loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4) and strong brown (7.5YR 5/6); massive; friable; very strongly acid; gradual, wavy boundary.

C3g—28 to 42 inches +, gray (10YR 6/1) sandy clay loam; many, coarse, distinct mottles of strong brown (7.5YR 5/8) and reddish yellow (7.5YR 6/8); massive; friable to firm; very strongly acid.

Stratified material of variable texture occurs in the lower part of some profiles. Depth to bedrock ranges from 6 to 8 feet or more.

Atkins soils occur near the Philo, Cotaco, Pope, and Robertsville soils. They are more poorly drained than the moderately well drained Philo and Cotaco soils and the well drained Pope soils. Unlike the Robertsville soils, Atkins soils do not have a fragipan and are not so fine textured in the underlying material.

Atkins silt loam (0 to 2 percent slopes) (At).—This soil occupies slightly concave stream bottoms and is frequently flooded.

Included with this soil in mapping were small areas of Philo, Pope, and Robertsville soils. Also included were some permanent wet spots and areas that have slopes slightly steeper than 2 percent, such as old streambanks along abandoned channels.

Because of a high water table or frequent flooding, this soil is saturated for long periods. Therefore plants that tolerate wetness are suited. Windthrow of trees and root rot are common hazards. (Capability unit IIIw-5; woodland suitability group 1)

Captina Series

The Captina series consists of deep, gently sloping, moderately well drained soils. These soils occupy gently sloping or slightly convex terraces above the flood plains of the Cumberland River, Jellico Creek, and Clear Fork. They formed in old acid alluvial sediments that were deposited on stream terraces.

In a typical profile, the surface layer is yellowish-brown silt loam about 8 inches thick. The subsoil extends to a depth of about 42 inches. The upper part consists of brownish-yellow and yellowish-brown silt loam about 16 inches thick; the lower part is a fragipan of brownish-yellow silty clay loam that has many mottles. Depth to sandstone bedrock ranges from 40 to 70 inches.

The Captina soils are strongly acid and have moderate natural fertility and available moisture capacity. The fragipan restricts penetration by roots and water.

The natural vegetation consists largely of mixed oak, hickory, and yellow pine. Most of the acreage is used for crops and pasture.

Typical profile of a Captina silt loam (4 miles northwest of Redbird Bridge on a gravel road off State Route 895, on a slope of 4 percent):

Ap—0 to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine granular structure; friable; strongly acid; clear, smooth boundary.

B1—8 to 12 inches, brownish-yellow (10YR 6/6) silt loam; moderate, fine, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B2t—12 to 24 inches, yellowish-brown (10YR 5/8) silt loam; moderate, fine and medium, subangular blocky structure; friable, faint, patchy clay films in pores; very strongly acid; clear, wavy boundary.

Bx1—24 to 34 inches, brownish-yellow (10YR 6/6) silty clay loam; common, fine, faint mottles of light brownish gray (10YR 6/2), dark yellowish brown (10YR 4/4), and very pale brown (10YR 7/4); weak, fine, subangular blocky structure; very firm and brittle; faint, patchy clay films in the pores; very strongly acid; clear, wavy boundary.

Bx2—34 to 42 inches, brownish-yellow (10YR 6/6) silty clay loam; many, medium, faint mottles of yellowish brown (10YR 5/8), very pale brown (10YR 7/4), and yellowish red (5YR 5/8); massive; firm; 30 percent of volume is sandstone fragments 1 to 4 inches across; very strongly acid; clear, wavy boundary.

R—42 inches +, hard, yellowish-red (5YR 5/6), coarse-grained sandstone.

The coarse fragments generally make up less than 1 percent of the solum. Depth to the top of the fragipan ranges from 18 to 26 inches. The alluvial deposits generally overlie sandstone or hard shale. Typically, these deposits are about 42 to 45 inches thick, but they range from 40 to 70 inches in thickness.

Near the Captina soils are the well-drained Elk and Tate, the somewhat poorly drained Tyler, and the poorly drained Robertsville soils.

Captina silt loam, 2 to 6 percent slopes (CaB).—This soil occupies stream terraces along the main streams in the survey area.

Small areas of Tyler, Robertsville, and Elk soils were included with this soil in mapping.

This soil is suited to most crops grown in the survey area. In cultivated areas the hazard of erosion is moderate. Because this soil has a seasonal high water table and a root zone that is only moderately thick, it is poorly suited to alfalfa and other deep-rooted plants. (Capability unit IIe-7; woodland suitability group 3)

Clymer Series

The Clymer series consists of moderately deep to deep, well-drained soils. These soils occupy slightly convex ridgetops and broad, rolling flats throughout the survey area, but they are mainly near Pine Knot and Gilreath. They formed in material that weathered from sandstone.

In a typical profile, the surface layer is about 11 inches thick. It is dark grayish-brown fine sandy loam in the upper part and light yellowish-brown sandy loam in the lower part. The subsoil is yellowish-brown loam in the upper part and strong-brown clay loam and sandy clay loam in the lower part. Sandstone bedrock is at a depth of about 37 inches.

The Clymer soils are very strongly acid and have moderately low natural fertility. Permeability is moderate. These soils can be tilled throughout a wide range of moisture content. They have moderate to high available moisture capacity.

Most areas of these soils are farmed or pastured, but the smaller, rougher areas are forested, primarily with shortleaf pine.

Typical profile of a Clymer fine sandy loam (in an old field 1 mile north of Gilreath on the east side of a dirt road, on a slope of 4 percent):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

A2—6 to 11 inches, light yellowish-brown (10YR 6/4) sandy loam; weak, medium, subangular blocky structure that breaks to weak, medium, granular; friable; very acid; abrupt, wavy boundary.

B1t—11 to 21 inches, yellowish-brown (10YR 5/6) heavy loam; weak, fine, subangular blocky structure; friable; distinct, patchy clay films on peds; very strongly acid; clear, wavy boundary.

B2t—21 to 31 inches, strong-brown (7.5YR 5/6) light clay loam; moderate, medium, subangular blocky structure; friable; distinct, discontinuous clay films on peds; very strongly acid; clear, wavy boundary.

B3—31 to 37 inches, strong-brown (7.5YR 5/6) sandy clay loam; moderate, fine, subangular blocky structure; friable; lens of weathered sandstone; very strongly acid; abrupt, irregular boundary.

R—37 inches +, reddish-brown (2.5Y 5/4), soft, coarse-grained sandstone.

In some places the profile contains a C horizon of loose sand and many small, rounded pebbles of quartz. Depth to the sandstone bedrock ranges from 2 to 4 feet.

The Clymer soils are near the Dekalb, Ramsey, Wellston, Tilsit, Muse, and Shelocta soils. They have more clay in their subsoil than the Dekalb or Ramsey soils, and more sand than the Wellston, Tilsit, Muse, or Shelocta soils. Clymer soils are not so deep as Tate soils of the same texture.

Clymer fine sandy loam, 2 to 6 percent slopes (ClB).—This soil is on broad ridgetops that generally are smooth or slightly convex.

Small areas of Tilsit and of Dekalb soils were included with this soil in mapping. Also included were some small areas that are nearly level, some that are rolling, and some that are eroded.

This soil is suited to all crops commonly grown in the survey area. Where this soil is cultivated, the erosion hazard is moderate. (Capability unit IIe-9; woodland suitability group 12)

Clymer fine sandy loam, 6 to 12 percent slopes (ClC).—This soil occupies gently rolling ridgetops. Except that the surface layer is not so thick, the profile of this soil is similar to the one described as typical for the Clymer series.

Included with this soil in mapping were small areas of Wellston and Cotaco soils. Also included were some areas that are eroded, some that are nearly level, and some that are strongly sloping.

This soil is suited to all crops commonly grown in the survey area. Where it is cultivated, however, the hazard of erosion is high. (Capability unit IIIe–1; woodland suitability group 12)

Clymer and Dekalb fine sandy loams, 12 to 20 percent slopes (CmD).—This undifferentiated group of soils occurs on steep side slopes below broad uplands. In some places this unit is made up of only Clymer soil; and others of only Dekalb soil. Generally, this mapping unit is 60 percent of one of these soils, about 40 percent of the other soil, and a small percentage of included soils. Both Clymer and Dekalb soils have convex to smooth slopes; however, the Dekalb soil generally has steeper, more convex slopes or occurs in areas where the bedrock is more resistant. Except for slightly coarser texture throughout, the profile of each soil is similar to the one described as typical for the respective series.

Included with this group in mapping were a small acreage of Tate and Muse soils and some small moderately eroded to severely eroded areas.

The Dekalb soil in this group has rapid permeability, low natural fertility, and low to moderate available moisture capacity. Because the hazard of erosion is very high where row crops are grown and growth is moderately poor, the soils in this group are better suited to pasture than to cultivated crops. (Capability unit VIe–8; woodland suitability group 12)

Colbert Series

The Colbert series consists of moderately deep to deep, well-drained soils. These soils occupy wide, convex benches on hillsides and moderately wide ridgetops mostly in the Rock Creek and Little South Fork watersheds. They formed in material that weathered from multicolored, calcareous clay shale.

In a typical profile, the surface layer is very dark grayish-brown silty clay loam about 3 inches thick. The subsoil extends to a depth of about 20 inches. It is yellowish-brown clay in the upper part and light olive-brown clay in the lower part. The underlying material is grayish-brown and olive-gray silty clay. Calcareous shale is at a depth of about 38 inches.

The Colbert soils are neutral and have moderate natural fertility. Because the subsoil is plastic clay, permeability is slow and root growth is restricted. During normally dry periods in the growing season, droughtiness restricts plant growth.

The natural vegetation includes oak, buckeye, ash, black cherry, hickory, winged elm, tulip-poplar, black walnut, and butternut.

Typical profile of a Colbert silty clay loam (about 0.9 mile east of the Wayne County line on the north side of State Route 92, on a slope of 14 percent) :

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) heavy silty clay loam; moderate to strong, very fine, granular structure; loose; angular fragments make up 1 percent of the volume; neutral; abrupt, wavy boundary.

B2t—3 to 11 inches, clay with yellowish-brown (10YR 5/4) ped interiors and brown (10YR 4/3) exteriors; strong, medium and coarse, subangular blocky structure; firm, very sticky, very plastic; distinct, broken clay films on peds; angular fragments make up 1 percent of the volume; neutral; abrupt, irregular boundary.

B3t—11 to 20 inches, light olive-brown (2.5Y 5/4 to 5/6) clay; many, fine, distinct variegations of yellowish brown (10YR 5/6) ; weak, fine and medium, subangular blocky structure; firm, very sticky, very plastic; faint, patchy clay films on peds; angular fragments make up 1 percent of the volume; neutral; gradual, wavy boundary.

C1—20 to 32 niches, grayish-brown (2.5Y 5/2) to light yellowish-brown (2.5Y 6/4) silty clay; many, fine, distinct variegations of yellowish brown (10YR 5/6) ; massive; firm, very sticky, very plastic; angular fragments make up 5 percent of the volume; neutral; gradual, wavy boundary.

C2—32 to 38 inches, olive-gray (5Y 5/2) silty clay; many, fine, distinct variegations of yellowish brown (10YR 5/6) ; massive; firm; 50 percent of volume is shale fragments ½ inch to 4 inches across; neutral; clear, smooth boundary.

R—38 inches +, weakly calcareous, gray, clayey shale.

Depth to bedrock ranges from 2½ to 3½ feet.

Colbert soils are near the Muse, Shelocta, and Tate soils, which have a redder subsoil that is lower in content of clay and which are deeper to bedrock.

Colbert silty clay loam, 6 to 20 percent slopes (CoD).—This soil has the profile described as typical for the Colbert series.

Small areas of Rock land and of Talbott, Tate, Shelocta, and Muse soils were included with this soil in mapping. Also included were small areas of a soil that developed in maroon-colored material from the underlying shale and that is similar to this soil but is much redder, and also a few moderately steep and steep areas on hillsides.

This soil is not well suited to row crops, but where slopes are less than 8 percent, it can be cultivated occasionally. Growth of crops generally is poor. Runoff is rapid, and the hazard of erosion is very high. (Capability unit VIe–5; woodland suitability group 4)

Cotaco Series

The Cotaco series consists of deep, moderately well-drained to somewhat poorly drained soils. These are nearly level to gently sloping soils on alluvial fans and foot slopes throughout the survey area, especially along Marsh Creek, Jellico Creek, Clear Fork, and their tributaries. They formed in gravelly, acid sediment that washed from soils derived from sandstone and shale.

In a typical profile, the surface layer is friable, dark yellowish-brown silt loam about 8 inches thick. The subsoil extends to a depth of more than 42 inches. It is dark yellowish-brown and yellowish-brown silt loam in the upper part and mottled, yellowish-brown silty clay loam in the lower part.

The Cotaco soils are strongly acid or very strongly acid and have moderate natural fertility. Permeability is moderate to moderately rapid, but seepage keeps these soils wet for long periods in areas that are not artificially drained. These soils have high available moisture capacity. Where artificial drainage and management are good, these soils produce good growth of crops that tolerate slight wetness. Gravel in the plow layer hinders tillage in some places.

The natural vegetation commonly consists of oak, hickory, elm, beech, dogwood, and maple. Most of the acreage of Cotaco soils is pastured or cultivated.

Typical profile of Cotaco silt loam (1 mile north of Upper Marsh Creek School just off State Route 759, on a slope of 3 percent):

Ap—0 to 8 inches, dark yellowish-brown (10YR 4/4) silt loam; weak to moderate, medium, granular structure; friable; 8 percent of the volume is coarse fragments ¼ inch to 3 inches across; strongly acid; clear, wavy boundary.

B1—8 to 15 inches, dark yellowish-brown (10YR 4/4) to yellowish-brown (10YR 5/4) heavy silt loam; weak, fine, subangular blocky structure; friable; 7 percent of the volume is coarse fragments ¼ inch to 7 inches across; very strongly acid; clear, wavy boundary.

B21t—15 to 19 inches, yellowish-brown (10YR 5/4) heavy silt loam; few, fine, faint mottles of pale brown (10YR 6/3); weak, fine, subangular blocky structure; friable; faint, patchy clay films in pores; 20 percent of volume is fragments ¼ inch to 3 inches across; very strongly acid; clear, wavy boundary.

B22t—19 to 26 inches, yellowish-brown (10YR 5/4) light silty clay loam; common, medium, distinct mottles of light gray (10YR 7/2) and strong brown (7.5YR 5/8); weak, fine, subangular blocky structure; friable; faint, patchy clay films in pores; 25 percent of the volume is coarse fragments ¼ inch to 3 inches across; very strongly acid; gradual, wavy boundary.

B3—26 to 42 inches +, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct mottles of light gray (10YR 6/1) and strong brown (7.5YR 5/8); weak, fine, subangular blocky structure; friable; 40 percent of the volume is coarse fragments 1 inch to 5 inches in diameter; very strongly acid.

Depth to bedrock ranges from about 4 to 15 feet, but generally it is about 6 feet. Depth to mottling ranges from 14 to 26 inches.

The Cotaco soils are near the well drained Tate, Muse, and Elk; the moderately well drained Philo; the somewhat poorly drained Stendal; and the poorly drained Robertsville and Atkins soils. The Cotaco soils are finer textured than Stendal soils.

Cotaco silt loam (0 to 4 percent slopes) (Ct).—This soil occupies small alluvial fans, low stream terraces, and foot slopes.

Included with this soil in mapping were small areas of Atkins and Philo soils on alluvial fans. Also included on low-lying stream terraces and toeslopes were small areas of Muse and Allegheny soils.

Where drainage is adequate, this soil is suited to intensive use for cultivated crops that tolerate slight wetness. It is well suited to pasture. (Capability unit IIw-4; woodland suitability group 2)

Dekalb Series

The Dekalb series consists of moderately deep to deep, somewhat excessively drained soils. These soils are sloping to steep and occupy backbonelike ridgetops throughout the survey area. They formed in residuum that weathered from sandstone.

In a typical profile, the surface layer is friable sandy loam about 7 inches thick. It is dark grayish brown in the upper part and yellowish brown in the lower part. The subsoil extends to a depth of about 25 inches. It consists of about 10 inches of yellowish-brown, friable sandy loam and about 8 inches of yellowish-brown to strong-brown, friable sandy loam. Sandstone bedrock is at a depth of about 25 inches.

The Dekalb soils are very strongly acid and have low natural fertility and organic-matter content. Available moisture capacity is low to moderate, and permeability is moderately rapid. Consequently, plant growth is restricted during short dry periods. These soils are easily tilled throughout a wide range of moisture content, but aggregation in the plow layer is weak. Crops on these soils respond fairly well to additions of lime and fertilizer.

Southern yellow pine, blackjack oak, post oak, southern red oak, chestnut oak, and scarlet oak are the common trees that grow on these soils.

Typical profile of a Dekalb sandy loam (1 mile southwest of Stearns in the Cooper Branch watershed, on a slope of 30 percent):

O1—2⅛ inches to ⅛ inch, loose leaf litter, largely oak and pine leaves.

O2—⅛ inch to 0, partly decomposed leaves and twigs.

A1—0 to 1½ inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; loose to friable; less than 1 percent of the volume is coarse fragments; very strongly acid; abrupt, smooth boundary.

A2—1½ to 7 inches, yellowish-brown (10YR 5/4) sandy loam; single grain; loose to friable; about 4 percent of the volume is coarse fragments; very strongly acid; clear, wavy boundary.

B1—7 to 17 inches, yellowish-brown (10YR 5/8) sandy loam; single grain; loose to friable; 5 percent of the volume is coarse fragments; very strongly acid; clear, wavy boundary.

B2—17 to 25 inches, yellowish-brown (10YR 5/8) to strong-brown (7.5YR 5/8) sandy loam; single grain; friable; 3 percent of the volume is coarse fragments; very strongly acid; gradual, wavy boundary.

R—25 inches +, soft sandstone.

Depth to bedrock ranges from 24 to 36 inches.

The Dekalb soils are near the Wellston, Muse, Clymer, and Tate soils. Dekalb soils have a less distinct B horizon than any of these nearby soils.

Dekalb fine sandy loam, 6 to 12 percent slopes (DeC).—This soil occupies smooth or slightly convex, narrow ridgetops. Its profile is deeper than the profile described as typical for the Dekalb series, and the surface layer is mainly fine sandy loam.

Small areas of Clymer soils were included with this soil in mapping. Other included soils were the Ramsey on narrow ridgetops and the Muse on the higher elevations and narrow saddles.

Under good management, pasture plants grow well on this soil. Because the hazard of erosion is very high in cultivated areas, this soil is suited to only an occasional row crop. Growth of cultivated crops generally is poor. (Capability unit IVe-1; woodland suitability group 12)

Dekalb and Ramsey sandy loams, 12 to 20 percent slopes (DrD).—This undifferentiated group of soils occupies narrow ridgetops and the upper part of side slopes throughout the survey area. The soils in this group formed in residuum that weathered from acid sandstone.

Generally, about 60 to 70 percent of this group is the moderately deep, somewhat excessively drained Dekalb soil; about 20 to 30 percent is the shallow, excessively drained Ramsey soil; and the remaining 10 percent is included soils. Some areas are made up of only Dekalb soil, some areas of only Ramsey soil, and some areas of both soils. A profile typical for the Dekalb and Ramsey soils is described under the respective series. Included in mapped areas of this group are small areas of Clymer and Muse soils and outcrops of sandstone.

Except that the Ramsey soil has a thinner root zone and is more droughty, the Dekalb and Ramsey soils have similar qualities. Also, added lime and fertilizer are effective for a shorter period on the Ramsey soil.

Under good management, pasture and hay crops grow fairly well on the soils of this group. These soils are not suited to cultivated crops, because of the hazard of erosion and poor growth of crops. (Capability unit VIe–8; woodland suitability group 12)

Dekalb and Tate sandy loams, 20 to 30 percent slopes (DtE).—This undifferentiated group of soils occurs throughout the survey area and occupies the upper part of side slopes that are smooth and slightly convex. Generally, about 70 to 90 percent of the group is Dekalb soil, about 10 to 30 percent is Tate soil, and a small percentage is included soils. The Tate soil does not occur in all areas mapped.

The soils in this group formed in residuum that weathered from acid sandstone. The profile of the Dekalb soil in this group is similar to the one described as typical for the Dekalb series. The profile of the Tate soil in this group is similar to the one described as typical for the Tate series but is coarser textured throughout and contains fewer coarse fragments. Also, the solum of this Tate soil is not so thick as the solum in the profile described for the Tate series. Included with this group in mapping were small areas of Ramsey soils and a few small, stony, and rocky areas.

Because the soils in this group are steep and near dangerously high cliffs, they are not suited to cultivated crops. Also, the hazard of erosion is high, and the Dekalb soil is droughty. Growth of pasture and hay plants is limited on the Dekalb soil, but these plants grow fairly well on the Tate soil. Both soils are well suited as woodland or as wildlife habitat. Permanent plant cover is needed to help reduce runoff and control erosion. (Capability unit VIe–1; woodland suitability group 10)

Dekalb and Tate sandy loams, 30 to 50 percent slopes (DtF).—The soils in this undifferentiated group, and the percentages of each, are similar to those in the undifferentiated Dekalb and Tate sandy loams, 20 to 30 percent slopes. These soils are steeper, however, and contain more coarse fragments. Also, stones, boulders, and rock outcrops are more common. Small patches of Ramsey soils are included in some mapped areas.

Because of droughtiness, steep slopes, a very high hazard of erosion, and nearby dangerous cliffs, the soils in this group are not suited to cultivated crops, and their use for pasture is somewhat limited. They are better suited as woodland or wildlife habitat. (Capability unit VIIe–1; woodland suitability group 10)

Elk Series

The Elk series consists of deep, well-drained, nearly level, acid soils. These soils occupy low stream terraces and are occasionally flooded. They formed in deep silty sediment that washed from soils derived from shale and siltstone, principally along Marsh and Jellico Creeks.

In a typical profile, the surface layer is friable, dark yellowish-brown silt loam about 8 inches thick. The subsoil extends to a depth of about 39 inches. It consists of about 7 inches of dark yellowish-brown silt loam, about 7 inches of strong-brown silty clay loam, about 7 inches of dark yellowish-brown silty clay loam, and about 10 inches of yellowish-brown silty clay loam. The underlying material is mottled, light yellowish-brown silty clay loam.

The Elk soils have a thick root zone. They are strongly acid and have high natural fertility and available moisture capacity. Permeability of the subsoil is moderate. The plow layer is easily tilled throughout a wide range of moisture content.

The natural vegetation is made up of oaks that commonly grow on bottom lands, river birch, sweetgum, sycamore, and red maple.

Typical profile of Elk silt loam (about 1 mile west of State Route 1470 on State Route 592, on the flood plain of Marsh Creek):

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

B1—8 to 15 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, fine, subangular blocky structure; friable; strongly acid; clear, smooth boundary.

B21t—15 to 22 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; faint, patchy clay films on peds; friable; strongly acid; clear, smooth boundary.

B22t—22 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; distinct, broken clay films on peds; friable; strongly acid; clear, smooth boundary.

B3t—29 to 39 inches, yellowish-brown (10YR 5/6) light silty clay loam; many, medium, distinct mottles of reddish yellow (7.5YR 6/8) and light gray (10YR 7/2); moderate, coarse, subangular blocky structure; friable; distinct, patchy clay films in pores; strongly acid; clear, wavy boundary.

C—39 to 48 inches +, light yellowish-brown (2.5Y 6/4) silty clay loam; many, medium, distinct mottles of light brownish gray (2.5Y 6/2) and brownish yellow (10YR 6/8); massive; firm; strongly acid.

Coarse fragments ¼ to 1 inch across make up from 0 to 2 percent of the volume throughout the profile. Depth to bedrock ranges from 6 to 20 feet.

The Elk soils are near the moderately coarse textured Tate, the somewhat poorly drained Tyler, and the poorly drained Atkins and Robertsville soils.

Elk silt loam (0 to 2 percent slopes) (Ek).—This soil is nearly level and is on low stream terraces adjacent to streams.

Small areas of Tate, Tyler, and Atkins soils were included with this soil in mapping. Also included was a small acreage of gently sloping and sloping, lighter colored, higher lying soils.

Some areas of this soil are flooded infrequently late in winter or early in spring. In general, this soil has only slight limitations to use. Under good management, it is well suited to intensive use for cultivated crops. (Capability unit I–3; woodland suitability group 2)

Gilpin Series

The Gilpin series consists of moderately deep, well-drained soils that mainly are on very steep side slopes on the Jellico Mountains and the hills along Marsh

Creek. These soils formed in residuum that weathered from interbedded shale and siltstone.

In a typical profile, the surface layer is very friable, dark-brown silt loam about 5 inches thick. The subsoil extends to a depth of about 21 inches. It consists of about 5 inches of friable, yellowish-brown silt loam and about 11 inches of friable, yellowish-brown silty clay loam. Bedrock is at a depth of about 21 inches.

The Gilpin soils are very strongly acid and have moderate natural fertility. Permeability is moderate. Because these soils are steep or very steep and the hazard of erosion is very high, they should be disturbed only in emergencies. In many places the steep side slopes are broken by ledges of sandstone.

The native vegetation consists of mixed oak, hickory, and red maple.

The Gilpin soils are mapped only with the Muse and with Muse and Shelocta soils in the McCreary-Whitley Area.

Typical profile of a Gilpin silt loam (about 50 yards north of a saddle on the way to Shelly Knob Lookout Tower, on a slope of 5 percent):

O1—1¼ inches to ¼ inch, leaves and twigs of hardwoods.
O2—¼ inch to 0, partly decomposed hardwood litter.
A1—0 to 1½ inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; 2 percent of the volume is shale fragments; very strongly acid; abrupt, smooth boundary.
A12—1½ to 5 inches, dark-brown (10YR 4/3) silt loam; moderate, medium and fine, granular structure; very friable; 2 percent of the volume is shale fragments; very strongly acid; clear, smooth boundary.
B1—5 to 10 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine and very fine, subangular blocky structure; friable; 5 percent of the volume is shale fragments; very strongly acid; clear, wavy boundary.
B2t—10 to 16 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 10 percent of the volume is shale fragments; very strongly acid; gradual, wavy boundary.
B3t—16 to 21 inches, yellowish-brown (10YR 5/8) silty clay loam; few, fine, faint variegations of light yellowish brown (10YR 6/4); weak, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 15 percent of the volume is shale fragments; very strongly acid; abrupt, smooth boundary.
R—21 inches +, siltstone and interbedded shale of the Breathitt geologic formation.

Depth to hard shale or siltstone ranges from 20 to 28 inches. Throughout the profile the volume of shale fragments ¼ inch to 2 inches across ranges from 2 to 30 percent. The B1 horizon ranges from yellowish brown (10YR 5/8) to brownish yellow (10YR 6/6) in color. The argillic horizon ranges from 10 to 16 inches in thickness and averages 12 inches.

The Gilpin soils are near the Muse, Shelocta, and Wellston soils. Gilpin soils have less clay in the subsoil than the Muse soils. They are not so deep as the Shelocta and Wellston soils.

Huntington Series

The Huntington series consists of deep, well-drained, nearly level soils. These soils occupy narrow flood plains along the Little South Fork Cumberland River and its tributaries. They formed in nonacid sediments that washed from soils derived from limestone and calcareous shale.

In a typical profile, the surface layer is friable, dark-brown silt loam about 18 inches thick. The subsoil extends to a depth of about 40 inches. It consists of about 12 inches of friable, dark-brown silt loam and about 10 inches of friable, dark-brown loam. The underlying material is dark-brown sandy loam.

The Huntington soils have a thick, moderately permeable root zone. Their available moisture capacity and natural fertility are high. The organic-matter content is adequate for maintaining good tilth, and the plow layer is easily worked without clodding or crusting. Most areas are flooded during winter, but damage to crops from flooding during the growing season is infrequent.

Nearly all the acreage of Huntington soils has been cleared and is used for corn, hay, or pasture.

Typical profile of Huntington silt loam (along Lonesome Creek, 100 yards east of the Wayne County line):

Ap—0 to 10 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; very friable; neutral; gradual, wavy boundary.
A1—10 to 18 inches, dark-brown (10YR 3/3) silt loam; moderate, medium, granular structure; friable; neutral; gradual, irregular boundary.
B2—18 to 30 inches, dark-brown (10YR 3/3) silt loam; moderate, coarse, granular structure; friable; neutral; gradual, irregular boundary.
B3—30 to 40 inches, dark-brown (10YR 3/3) loam; weak, medium and coarse, granular structure; friable; neutral; clear, wavy boundary.
C—40 to 58 inches +, dark-brown (10YR 3/3) sandy loam; massive; friable; neutral.

Depth to bedrock ranges from 4 to 10 feet. The color of the horizons below the surface ranges from dark brown (10YR 3/3) to dark yellowish brown (10YR 4/4).

The Huntington soils are less acid and are darker colored than the Pope soils that occupy similar positions. Huntington soils are better drained and are not so acid as the moderately well drained Philo and somewhat poorly drained Stendal soils.

Huntington silt loam (0 to 4 percent slopes) (Hu).—This soil occupies areas along streams and in depressions around sinkholes. Some small areas of this soil consist of deep alluvium deposited behind check dams that have been built across narrow valleys.

Included with this soil in mapping were small areas of Tate soils and of a moderately well drained soil that is similar to this soil in texture and origin.

This Huntington soil is suited to intensive use for all row crops commonly grown in the survey area. (Capability unit I-1; woodland suitability group 2)

Made Land

Made land (Ma) consists of areas where the soil material has undergone drastic changes because of excavation, filling, or other disturbance. This land occurs in small areas throughout the survey area, mainly near recently constructed highways and railroads. Because original soil features have been destroyed, the soils can no longer be identified by series or by single soils. Detailed studies are needed at each site to determine how this land can be used. Generally, it should be kept in permanent plants to help control erosion. (Capability unit not assigned; woodland suitability group 14)

Monongahela Series

The Monongahela series consists of deep, moderately well drained soils that are moderately steep on the lower one-third of rounded side slopes in the northern part of the survey area. These soils formed in colluvium moved downslope from soils derived from sandstone and shale.

In a typical profile, the surface layer is very friable, dark-brown silt loam about 4 inches thick. Above the fragipan the subsoil is brownish-yellow silt loam in the upper part and yellowish-brown silty clay loam in the lower part. The fragipan is at a depth of about 23 inches and is firm, brittle loam and clay loam about 26 inches thick. Weathered shale is at a depth of about 49 inches.

The Monongahela soils are strongly acid or very strongly acid and have moderate natural fertility. Available moisture capacity is moderate. In the layers above the fragipan, permeability is moderate, but it is slow in the fragipan and causes a seasonal high water table. Growth of roots is strongly restricted in the fragipan.

Most of the acreage of Monongahela soils is cleared and used for hay, pasture, or cultivated crops.

In the McCreary-Whitley Area, Monongahela soils are mapped only in a complex with Trappist soils.

Typical profile of a Monongahela silt loam (about 50 yards east of State Route 1277 on a limestone gravel road toward Galilean Children's Home):

Ap—0 to 4 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; very friable; 2 percent of the volume is coarse fragments ¼ to 1 inch across; neutral because of limestone dust blown from the road; abrupt, smooth boundary.

B1—4 to 9 inches, brownish-yellow (10YR 6/6) silt loam; weak, very fine and fine, subangular blocky structure; friable; 2 percent of the volume is coarse fragments ¼ inch to 3 inches across; strongly acid; clear, wavy boundary.

B21t—9 to 14 inches, yellowish-brown (10YR 5/6) light silty clay loam; weak, fine, subangular blocky structure; friable; faint, patchy films on peds; 5 percent of the volume is coarse fragments ½ inch to 3 inches across; very strongly acid; clear, wavy boundary.

B22t—14 to 23 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 8 percent of the volume is coarse fragments ½ inch to 3 inches across; very strongly acid; abrupt, wavy boundary.

IIBx1—23 to 33 inches, brownish-yellow (10YR 6/6) loam; common, medium, faint mottles of light gray (10YR 7/2) and yellowish brown (10YR 5/4); weak, coarse, angular blocky structure that breaks to weak, medium, subangular blocky; firm, brittle; faint, patchy clay films in pores; 15 percent of the volume is coarse fragments ¼ inch to 8 inches across; very strongly acid; gradual, wavy boundary.

IIBx2—33 to 49 inches, strong-brown (7.5YR 5/8) clay loam; common, medium, distinct mottles of yellowish brown (10YR 5/8) and light gray (10YR 7/2); weak, coarse, angular blocky structure that breaks to weak, medium, subangular blocky; firm, brittle; faint, patchy clay films in pores; 15 percent of the volume is coarse fragments ¼ inch to 2 inches across; very strongly acid; gradual, wavy boundary.

IIIC—49 to 59 inches +, variegated strong-brown (7.5YR 5/8), yellow (10YR 7/6), and yellowish-red (5YR 4/6 to 5/8), firm, weathered shale; very strongly acid.

Depth to the fragipan ranges from 20 to 30 inches but generally is about 23 inches. Normally, the fragipan is about 15 inches thick but ranges from 20 to 30 inches in thickness. Depth to the weathered shale ranges from 45 to 60 inches.

The Monongahela soils are coarser textured and less well drained than the nearby Muse, Wellston, and Trappist soils. Monongahela soils are slightly better drained than Cotaco soils, which do not have a fragipan.

Muse Series

The Muse series consists of deep, well-drained soils. These soils occupy convex ridgetops, benches, foot slopes, colluvial fans, and convex to smooth side slopes throughout the uplands of the survey area. They formed in residuum that weathered from interbedded acid shale and thin sandstone or in colluvium moved down from soils derived from shale.

In a typical profile, the surface layer consists of about 2 inches of friable, brown silt loam over about 6 inches of friable, yellowish-brown silty clay loam. The subsoil extends to a depth of about 46 inches. It is yellowish-brown and strong-brown silty clay loam in the upper part and yellowish-red silty clay in the lower part. The underlying material is mottled, yellowish-red silty clay.

The Muse soils have a thick root zone. They are very strongly acid and have moderate natural fertility. Available moisture capacity is high, and permeability is moderately slow.

The present forest species consists mainly of mixed oak and hickory, but pine is encroaching on abandoned fields. Most of the less sloping areas of these soils are cultivated or pastured.

Typical profile of a Muse silt loam (across from the coal mine in the valley of Ryans Creek, on a slope of 16 percent facing south):

A1—0 to 2 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; 1 percent of the volume is shale fragments less than ¼ inch across; very strongly acid; abrupt, wavy boundary.

A2—2 to 8 inches, yellowish-brown (10YR 5/6) light silty clay loam; weak, fine, subangular blocky structure that breaks to weak, fine, granular; friable; 1 percent of the volume is shale fragments less than ¼ inch across; very strongly acid; clear, wavy boundary.

B1—8 to 13 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, fine and medium, subangular blocky structure; friable; 3 percent of the volume is shale fragments ¼ inch to 1½ inches across; very strongly acid; clear, wavy boundary.

B21t—13 to 20 inches, strong-brown (7.5YR 5/8) heavy silty clay loam; weak, fine, subangular blocky structure; friable; faint, patchy clay films in pores; 5 percent of the volume is shale fragments ⅛ to 1 inch across; very strongly acid; gradual, wavy boundary.

B22t—20 to 30 inches, yellowish-red (5YR 5/6) silty clay; moderate, fine, subangular blocky structure; friable; faint, patchy clay films in pores; 15 percent of the volume is shale fragments ¼ to 1 inch across; very strongly acid; clear, smooth boundary.

B3t—30 to 46 inches, yellowish-red (5YR 5/8) silty clay; common, fine, faint variegations of yellowish red (5YR 4/6) and light reddish brown (5YR 6/4); weak, very fine, subangular blocky structure; friable; faint, patchy clay films in pores; 20 percent of the volume is shale fragments ⅛ to ½ inch across; very strongly acid; gradual, irregular boundary.

C—46 to 70 inches +, yellowish-red (5YR 4/6) silty clay; common, fine, faint mottles of pinkish gray (7.5YR 7/2) and reddish yellow (7.5YR 7/6); massive; firm; 20 percent of the volume is shale fragments ⅛ inch to 2 inches across; very strongly acid.

Thickness of the solum ranges from 40 to 50 inches. The volume of coarse fragments in the A horizon ranges from 0 to 30 percent. In the B horizon the volume ranges from 2 to 35 percent. The A horizon is slightly darker colored on slopes facing north than on slopes facing south. In texture, the B horizon ranges from heavy silty clay loam to silty clay or clay. The color of the B2 horizon generally is strong brown

(7.5YR 5/6) or yellowish red (5YR 5/8), but in places it is yellowish brown (10YR 5/6).

The Muse soils have a finer textured subsoil than the nearby Dekalb, Clymer, Wellston, Tate, and Shelocta soils.

Muse silt loam, 6 to 12 percent slopes (MeC).—This soil occupies convex ridgetops. Except for a slightly thicker surface layer and fewer coarse fragments, the profile of this soil is similar to the profile described as typical for the Muse series.

Small areas of Wellston, Clymer, and Dekalb soils were included with this soil in mapping. Also included were some eroded areas and some areas that are nearly level.

This soil can be tilled throughout a wide range of moisture content. The organic-matter content is medium. All crops commonly grown in the survey area are suited, but the hazard of erosion is high in cultivated areas. (Capability unit IIIe-2; woodland suitability group 6)

Muse silt loam, 12 to 20 percent slopes (MeD).—This soil is in the uplands. It has the profile described as typical for the Muse series.

Small areas of Wellston, Dekalb, and Tate soils were included with this soil in mapping. Also included were some eroded areas and some areas that are only moderately sloping.

This soil is suited to most crops commonly grown in the survey area. Because the hazard of erosion is very high in cultivated areas, this soil is suited to only an occasional row crop. It is well suited to pasture and hay. The organic-matter content of the plow layer is medium, and this soil can be tilled throughout a wide range of moisture content. (Capability unit IVe-3; woodland suitability group 6)

Muse silty clay loam, 6 to 12 percent slopes, severely eroded (MlC3).—This soil occupies ridgetops, foot slopes, and colluvial fans. Because this soil is severely eroded, the surface layer is lighter colored and finer textured than that in the profile described as typical for the Muse series; otherwise, the profiles are similar. Shallow gullies occur in some places.

Included with this soil in mapping were some areas that are only moderately eroded or slightly eroded.

Past erosion of this soil has resulted in low organic-matter content, slight droughtiness, and poor workability; consequently, this soil is suited to only an occasional row crop. Permanent vegetation, such as hay and pasture, is a better use. (Capability unit IVe-11; woodland suitability group 6)

Muse silty clay loam, 12 to 20 percent slopes, severely eroded (MlD3).—This soil occupies benches and foot slopes. The profile is similar to that of Muse silty clay loam, 6 to 12 percent slopes, severely eroded. Shallow gullies occur in places.

Included with this soil in mapping were some areas that are less than severely eroded.

Past erosion has resulted in low organic-matter content, droughtiness, and poor workability of this soil, and the hazard of further erosion is very high. Consequently, this soil is not suited to cultivated crops. It is suited to only permanent vegetation. Suitable uses are as pasture, woodland, or wildlife habitat. (Capability unit VIe-2; woodland suitability group 6)

Muse and Gilpin silt loams, 50 to 65 percent slopes (MmG).—The soils in this undifferentiated group occupy smooth to slightly convex landscapes in the southern part of the survey area. Generally, they have slopes facing north and are adjacent to flood plains. Some areas contain only Muse soil; other areas, only Gilpin soil; and still others, both soils. The Muse soil is dominant in the group.

The profile of the Muse soil in this mapping unit is similar to the profile described for the series but has more coarse fragments in the lower part. Also the surface layer and subsoil of this Muse soil are not so thick as those layers in the typical profile. The surface layer and subsoil of Gilpin soil in this group are thicker than those layers described as typical for the Gilpin series. Flagstones and smaller fragments that average about 10 inches across cover about 2 percent of the surface of soils in this group. Also narrow sandstone and siltstone ledges are exposed in some places.

The soils in this group have moderate natural fertility. Because of very steep slopes and the hazard of erosion, these soils are not suited to cultivated crops or hay. They are better used as woodland or wildlife habitat. (Capability unit VIIe-1; woodland suitability group 7)

Muse-Shelocta stony silt loams, 20 to 40 percent slopes (MnE).—This complex occupies the lower part of slopes of the Jellico Mountains. Muse soil makes up from 60 to 70 percent of the complex; the rest is mainly Shelocta soil, but small areas of other soils are included. The landscape is benched and commonly has small ridges that protrude from the side slopes. The soils on benches and small ridges generally have slopes of less than 30 percent; those on side slopes generally have slopes of 35 to 40 percent and, in places, rock outcrops and discontinuous cliffs.

Except for stones and boulders on the surface, the profile of the Muse soil in this complex is similar to the profile described as typical for the Muse series. The Shelocta soil has stones on the surface, a slightly darker colored surface layer, and a finer textured subsoil. Otherwise, the profile is similar to the profile described as typical for the Shelocta series. About 15 percent of the surface of this complex is covered with stones and boulders that average about 16 inches across. The boulders generally are 2 to 3 feet across, but some are as much as 10 feet. The slopes facing south generally have more rock outcrops and a higher percentage of stones on the surface. Included in mapped areas of this complex are small areas of Trappist, Tate, and Weikert soils and of very steep eroded soils.

Steep slopes and many stones and boulders on the surface severely limit the use of the soils in this complex. These soils are not suited to cultivated crops and are extremely difficult to manage for pasture. More practical uses are as woodland or wildlife habitat. (Capability unit VIIs-1; woodland suitability group 8)

Muse-Shelocta-Gilpin stony silt loams, 40 to 60 percent slopes (MoF).—This complex occupies the upper part of slopes of the Jellico Mountains. The landscape is benched and has some rock outcrops. The Muse soil makes up about 50 to 60 percent of this complex, mainly on slopes facing south; Shelocta soil makes up 10 to 30 percent, mainly on north-facing slopes and in drainageways; and Gilpin and included soils make up the remaining 10 to

20 percent. All of these soils are so intermingled that separating them on a soil map is not practical.

The surface layer and subsoil of the Muse soil in this complex are thicker than those layers in the profile described as typical for the series; otherwise, the profiles are similar. The profiles of the Shelocta and Gilpin soils are similar to the profiles described as typical for the respective series. About 10 percent of the surface of this complex is covered with stones and boulders that range from 4 to 30 inches across. Included in mapped areas of this complex are small areas of Trappist, Tate, and Renox soils.

Because of stoniness and steepness, the soils in this complex are not suited to cultivated crops or hay, and their use for grazing is limited. Better uses are as woodland or wildlife habitat. (Capability unit VIIs-1; woodland suitability group 8)

Muse-Trappist silt loams, 20 to 30 percent slopes (MpE).—This complex is on benched, smooth landscapes, mainly in the eastern part of the survey area. About 60 to 70 percent of the complex is Muse soil and about 30 to 40 percent is Trappist and included soils. All of these soils are so intermingled that separating them on a soil map is not practical. The profiles of these soils are similar to the profiles described as typical for the respective series.

Some small areas of Shelocta soils; of deep, dark-colored soils on north-facing slopes; of shallow soils on narrow ridgetops; and of steep soils on side slopes were included with this complex in mapping.

Because of the hazard of erosion and steepness, the soils in this complex are not suited to cultivated crops. Under good management, pasture and hay crops grow well. (Capability unit VIe-1; woodland suitability group 6)

Muse-Trappist silt loams, 30 to 50 percent slopes (MpF).—This complex is on benched, smooth landscapes, mainly in the eastern part of the survey area. About 50 to 60 percent of the acreage is Muse soil, and about 40 to 50 percent is Trappist and included soils. All of these soils are so closely intermingled that separating them on a soil map is not practical. The profiles of these soils are similar to the profiles described as typical for the respective series.

Some small areas of Shelocta soils; of deep, dark-colored soils on the lower part of north-facing slopes; of shallow soils on narrow ridgetops; and of very steep soils on side slopes were included with this complex in mapping.

Because of the hazard of erosion and steepness, the soils in this complex are not suited to cultivated crops. They are suited to limited grazing but are better suited as woodland or wildlife habitat. (Capability unit VIIe-1; woodland suitability group 7)

Muse-Trappist silty clay loams, 20 to 30 percent slopes, severely eroded (MtE3).—This complex is on smooth to convex landscapes. About 50 to 60 percent of the acreage is Muse soil, and about 40 to 50 percent is Trappist and included soils. All of these soils are so closely intermingled that separating them on a soil map is not practical. The plow layer of both the Muse and Trappist soils in this complex is lighter colored and finer textured than the plow layer in the profile described as typical for the respective series. Also these soils have more fragments of shale on the surface than less eroded Muse and Trappist soils, and some areas have shallow gullies.

Included with this complex in mapping were some areas that are only slightly or moderately eroded; shallow soils on narrow ridgetops and slope breaks that generally contain many coarse fragments; and deep, dark-colored soils on benches and the lower part of north-facing slopes.

Because of steepness, past erosion, and the hazard of additional erosion, the soils in this complex are not suited to cultivated crops. Under good management, they are suited to pasture. (Capability unit VIe-2; woodland suitability group 6)

Philo Series

The Philo series consists of deep, nearly level, moderately well drained soils. These soils occupy bottom lands along streams and are flooded at least once annually. They formed in sediment that washed from weathered, acid sandstone and shale.

In a typical profile, the surface layer is dark-brown fine sandy loam about 16 inches thick. The subsoil is yellowish-brown fine sandy loam about 12 inches thick. The substratum is light brownish-gray, mottled sandy loam.

Philo soils are very strongly acid and have moderately high natural fertility. Available moisture capacity is high, and permeability is medium to moderately rapid. These soils have a thick root zone and are easily tilled. Unless these soils are drained artificially, they remain saturated below a depth of 18 to 30 inches during wet periods. They are flooded once or more during winter or early in spring, but flooding rarely occurs during the growing season.

The natural vegeation is hardwoods that grow well on bottom lands, river birch, sycamore, and sweetgum.

Typical profile of Philo fine sandy loam (0.15 mile up the West Fork of Big Lick Branch toward Tom Heath Ridge):

A1—0 to 16 inches, dark-brown (10YR 4/3) fine sandy loam; weak, medium, granular structure; loose; very strongly acid; gradual, smooth boundary.

B2—16 to 28 inches, yellowish-brown (10YR 5/4) fine sandy loam; many, coarse, distinct mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8); weak, fine, granular structure; friable; very strongly acid; gradual, smooth boundary.

Cg—28 to 50 inches +, light brownish-gray (10YR 6/2) sandy loam; many, medium, distinct mottles of light olive brown (2.5Y 5/4) and dark grayish brown (10YR 4/2); single grain; loose; very strongly acid.

In places material that ranges from fine to coarse occurs in lenses throughout the profile. Coarse fragments make up from 0 to 20 percent of the volume and are ¼ inch to 2 inches across. Texture of the surface layer ranges from fine sandy loam to silt loam. Depth to mottling ranges from 16 to 30 inches.

The Philo soils are near the well-drained Pope, the somewhat poorly drained Stendal, and the poorly drained Atkins soils. Philo soils have less clay in their subsoil than the moderately well drained to somewhat poorly drained Cotaco soils.

Philo fine sandy loam (0 to 2 percent slopes) (Pf).—This moderately well drained soil is on flood plains along streams. The profile of this soil is the one described as typical for the Philo series.

Small areas of Atkins, Stendal, Cotaco, and Pope soils were included with this soil in mapping.

Although this soil is slightly wet, it is easily drained with tile and can be used intensively for all cultivated crops commonly grown in the survey area. It is also well suited to most pasture and hay crops commonly grown. (Capability unit I–1; woodland suitability group 2)

Philo silt loam (0 to 2 percent slopes) (Ph).—This moderately well drained soil is on flood plains. Except for texture of the surface layer and upper 10 to 20 inches of the subsoil, the profile of this soil is similar to the profile described as typical for the Philo series.

Small areas of the well-drained Pope and the somewhat poorly drained Stendal and Cotaco soils were included with this soil in mapping.

This soil can be used intensively for all cultivated crops commonly grown in the survey area and is excellent for pasture. The slight wetness is easily overcome by tile drainage. (Capability unit I–1; woodland suitability group 2)

Pope Series

The Pope series consists of deep, well-drained, gently sloping to strongly sloping soils. These soils are on flood plains and streambanks and are flooded annually. They formed in acid sediment that washed from weathered sandstone and shale.

In a typical profile, the surface layer is dark grayish-brown and dark-brown silt loam about 8 inches thick. The next layer is yellowish-brown fine sandy loam that is underlain by dark yellowish-brown or yellowish-brown sandy loam to a depth of more than 63 inches.

The Pope soils are strongly acid and have moderately high natural fertility. Permeability is moderate to moderately rapid, and the available moisture capacity is high. These soils have a thick root zone and can be tilled throughout a wide range of moisture content without clodding or crusting. Most of the acreage is cleared and farmed. Although these soils are flooded annually, flooding rarely occurs during the growing season.

The natural vegetation is red maple, river birch, elm, sycamore, sweetgum, and tulip-poplar.

Typical profile of a Pope silt loam (on the southeast side of Marsh Creek, 0.5 mile south of State Route 92 on State Route 592):

Ap1—0 to 2½ inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

Ap2—2½ to 8 inches, dark-brown (10YR 4/3) silt loam; weak, very fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

C1—8 to 12 inches, yellowish-brown (10YR 5/6) fine sandy loam; single grain; loose; very strongly acid; gradual, wavy boundary.

C2—12 to 63 inches +, dark yellowish-brown (10YR 4/4) to yellowish-brown (10YR 5/6) sandy loam; single grain; loose; very strongly acid.

The surface layer ranges from silt loam to fine sandy loam in texture. In some profiles the lower horizons are gravelly.

The Pope soils are near the moderately well drained Philo, the somewhat poorly drained Stendal, and the poorly drained Atkins soils. The nearby Tate soils are on foot slopes, and the Elk soils are on stream terraces.

Pope fine sandy loam, 4 to 20 percent slopes (PoD).—This soil occupies banks of the larger streams. Except for having a fine sandy loam surface layer, and in some places along the Cumberland River, common fragments of coal throughout its depth, the profile of this soil is similar to the profile described as typical for the Pope series.

Small areas of Tate and of Elk soils were included with this soil in mapping.

Steepness, a hazard of sloughing, and the annual deposition on this soil of material that washed from coal mines are the main limitations to use. This soil generally occurs in long, narrow strips that, except for trees, are not easily used in a different way than the adjoining nearly level flood plain. (Capability unit I–1: woodland suitability group 2)

Pope soils, 0 to 4 percent slopes (PsA).—This undifferentiated group of soils generally occupies the higher parts of flood plains. Texture of the surface layer ranges from fine sandy loam to silt loam. The silt loam soil in this mapping unit has the profile described as typical for the Pope series.

Small areas of Elk, of Philo, and of Tate soils were included with this unit in mapping. Also included were small areas that have slopes of slightly more than 4 percent.

Under good management, these soils are suited to intensive use for cultivated crops. They are also well suited to pasture and hay crops. (Capability unit I–1; woodland suitability group 2)

Ramsey Series

The Ramsey series consists of shallow to moderately deep, somewhat excessively drained soils. These soils occupy narrow ridgetops near sandstone cliffs throughout the survey area. They formed in residuum that weathered from sandstone. Slopes range from 12 to 20 percent.

In a typical profile, the surface layer is very dark grayish-brown and yellowish-brown sandy loam about 5 inches thick. The subsoil is brownish-yellow loamy sand that contains some coarse fragments and that is about 7 inches thick. The substratum is yellowish-brown loamy sand. Soft sandstone is at a depth of about 18 inches.

The Ramsey soils are very strongly acid. Available moisture holding capacity is low, and permeability is moderately rapid to rapid. These soils have a thin root zone.

The natural vegetation consists mainly of Virginia pine, pitch pine, and evergreen shrubs.

In the McCreary-Whitley Area, the Ramsey soils are mapped only in an undifferentiated group with Dekalb soils.

Typical profile of a Ramsey sandy loam (about one-half mile south of Revelo, on U.S. Highway No. 27, on a slope of 19 percent):

O1—1 to ¼ inch, pine needles, oak leaves, and dead herbs.

O2—¼ inch to 0, partly decomposed pine needles and oak leaves.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, very fine, granular structure; very friable; 1 percent of the volume is coarse fragments ¼ to ½ inch across; very strongly acid; abrupt, wavy boundary.

A2—2 to 5 inches, yellowish-brown (10YR 5/4) sandy loam; weak, fine, granular structure; very friable; 3 percent of the volume is coarse fragments ¼ to ½ inch across; very strongly acid; clear, wavy boundary.
B—5 to 12 inches, brownish-yellow (10YR 6/6) loamy sand; single grain; loose; 3 percent of the volume is coarse fragments ½ inch to 2 inches across; very strongly acid; clear, wavy boundary.
C—12 to 18 inches, yellowish-brown (10YR 5/6) loamy sand; single grain; loose; 5 percent of the volume is coarse fragments ½ inch to 3 inches across; very strongly acid; clear, wavy boundary.
R—18 inches +, reddish-yellow (7.5YR 6/6) soft sandstone.

The depth to bedrock ranges from 10 to 24 inches. In some profiles the texture of the B horizon is sandy loam.

Ramsey soils are near the Dekalb, Clymer, and Tate soils. Ramsey soils are not so deep as those soils and contain more sand and less clay.

Renox Series

The Renox series consists of deep, well-drained, steep to very steep soils. These soils occupy the upper part of north-facing coves in the Jellico Mountains. They formed in colluvium that has moved downslope from weathered acid and calcareous shale and sandstone.

In a typical profile, the surface layer is dark-brown silt loam about 15 inches thick. The subsoil extends to a depth of more than 42 inches. The major part is dark-brown silty clay loam. Below a depth of 42 inches about 40 to 60 percent of the volume is fragments of shale and sandstone.

The Renox soils are nonacid and have high natural fertility. Available moisture holding capacity is high, and permeability is moderate. The root zone is thick, but coarse fragments in the surface layer hinder tillage.

The natural vegetation consists of buckeye, tulip-poplar, ash, and mixed oaks.

Typical profile of a Renox channery silt loam (about one-half mile east of Shelly Knob Lookout Tower, on a slope of 43 percent):

O1—2 inches to ½ inch, leaves and twigs of tulip-poplar and oak.
O2—½ inch to 0, partly decomposed leaves and twigs.
Ap—0 to 7 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; very friable; 15 percent of the volume is shale and sandstone fragments 1 inch to 3 inches across; neutral; abrupt, wavy boundary.
A3—7 to 15 inches, dark-brown (7.5YR 3/2 to 4/2) silt loam; strong, fine and medium, granular structure; very friable; 20 percent of the volume is shale and sandstone fragments ¼ inch to 3 inches across; neutral; clear, wavy boundary.
B1—15 to 21 inches, dark-brown (10YR 3/2 to 4/3) heavy silt loam; moderate, fine, granular structure; friable; 30 percent of the volume is shale and sandstone fragments ¼ inch to 3 inches across; neutral; gradual, irregular boundary.
B2t—21 to 42 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 35 percent of the volume is sandstone and shale fragments mainly ¼ inch to 3 inches across, but some are as much as 10 inches across; neutral; gradual, irregular boundary.
B3—42 inches +, brown (7.5YR 4/4) silty clay loam; weak, fine, subangular blocky structure; 40 to 60 percent of the volume is shale and sandstone fragments; neutral.

The reaction ranges from medium acid to mildly alkaline. The volume of coarse fragments in the A horizon ranges from 1 to 25 percent.

The Renox soils are near the Gilpin, Muse, Tate, and Shelocta soils, which are lighter colored and more acid.

Renox channery silt loam, 40 to 60 percent slopes (RcF).—This soil is in coves in the uplands. The profile of this soil is the one described as typical for the Renox series.

Included with this soil in mapping were small areas of Tate and Shelocta soils. Also included were small areas of a dark-colored, strongly acid soil that has a profile similar to the profile of Renox soils.

Because of steepness of slopes and the hazard of erosion, this soil is not suited to cultivated crops. Use of machinery is limited. Where this soil is in grass, it provides limited grazing, but woodland and wildlife habitat are better uses. (Capability unit VIIe-1; woodland suitability group 9)

Robertsville Series

The Robertsville series consists of nearly level, poorly drained soils on stream terraces that generally form part of a flood plain. These soils formed in sediment that washed from acid soils of the uplands.

In a typical profile, the surface layer is light brownish-gray to pale-brown silt loam about 8 inches thick. The subsoil extends to a depth of more than 42 inches. The major part of the subsoil is a light brownish-gray clay loam and loam fragipan.

The Robertsville soils are strongly acid, low in organic-matter content, and moderately low in natural fertility. Available moisture capacity is low to moderate, and permeability is slow. The root zone is thin, and a high water table in spring keeps these soils saturated until after the normal planting dates for most row crops. Most of the acreage is pastured.

The natural vegetation is river birch, sycamore, red maple, sweetgum, and oaks that grow well on bottom lands.

Typical profile of Robertsville silt loam (100 yards southwest of the intersection of State Routes 92 and 1470):

Ap—0 to 8 inches, light brownish-gray (2.5Y 6/2) to pale-brown (10YR 6/3) silt loam; common, fine, distinct mottles of strong brown (7.5YR 5/6); weak, fine, granular structure; friable; strongly acid; abrupt, smooth boundary.
B2tg—8 to 11 inches, light brownish-gray (2.5Y 6/2) silty clay loam; common, fine, distinct mottles of strong brown (7.5YR 5/6); moderate, fine, subangular blocky structure; friable; faint, patchy clay films on peds; very strongly acid; gradual, wavy boundary.
Bx1g—11 to 22 inches, light brownish-gray (2.5Y 6/2) clay loam; many, medium, distinct mottles of strong brown (7.5YR 5/8); moderate, coarse, prismatic structure; firm, brittle; complete, distinct clay films on peds; few fine concretions of manganese; very strongly acid; gradual, wavy boundary.
Bx2g—22 to 42 inches +, light brownish-gray (2.5Y 6/2) loam; many, medium, distinct mottles of strong brown (7.5YR 5/8); moderate, coarse, prismatic structure; firm, brittle; complete, prominent clay films on peds; many medium concretions of manganese; very strongly acid.

Texture of the surface layer ranges from silt loam to loam, and that of the subsoil from silty clay loam to loam. Concretions of manganese occur throughout the profile. Depth to the top of the fragipan ranges from 10 to 22 inches, and depth to bedrock ranges from 6 to 20 feet.

Robertsville soils are near the moderately well drained Captina, the well drained Elk, and the somewhat poorly drained Tyler soils. The nearby Atkins soils are poorly drained, but they do not have a fragipan in the lower horizons.

Robertsville silt loam (0 to 2 percent slopes) (Re).—This soil occupies stream terraces adjacent to large flood plains. The profile of this soil is the profile described as typical for the Robertsville series.

Small areas of Captina, Elk, Tyler, and Atkins soils were included with this soil in mapping. Also included were a few areas of soils along old streambanks that have slopes of slightly more than 2 percent.

A shallow fragipan that is slowly permeable and restricts root growth and a high water table that keeps the root zone wet for long periods are the main limitations to use. Windthrow of trees and root rot are common hazards. Growth of row crops generally is poor because of wetness during the early part of the growing season and droughtiness during the later part. Growth of pasture and hay plants is fair to good. (Capability unit IVw-1; woodland suitability group 1)

Rock Land-Talbott Complex

Rock Land-Talbott complex (Rt) consists of areas where outcrops of limestone cover 25 percent or more of the surface of the Talbott soil. Rock land generally makes up 50 to 70 percent of the acreage in this complex, and the rest is Talbott soil. This complex occurs along the South Fork Cumberland River and Little South Fork drainageways. Slopes commonly range from 5 to 30 percent, but in places adjacent to streams they are 60 percent or more. Except for a thinner surface layer and more rockiness, the profile of the Talbott soil in this complex is similar to the profile described on page 23 for the Talbott series.

Included in mapped areas of this complex are areas of dark-brown to olive, clayey soils derived largely from limestone. These included soils are neutral or slightly acid and range from 1 inch to 40 inches in depth, depending on the depth of the crevices or holes in or between the rock outcrops. Also included in deep draws are small areas of yellowish or brownish soils derived from medium-textured acid colluvium.

Because of rock outcrops, steepness, and past erosion, this complex is not suited to cultivated crops. It provides limited grazing but is better suited as woodland or wildlife habitat. (Capability unit VIIs-2; woodland suitability group 14)

Rock Outcrop

Rock outcrop (Ru) is above and adjacent to steep cliffs or at the end of narrow ridges. About 90 percent or more of the acreage in this mapping unit is outcrops of sandstone. These outcrops have a smooth, convex surface in some places and a fractured, jagged surface in other places. This unit occurs through all of the survey area except the extreme eastern part.

Included with this unit in mapping were small stony areas and small areas of Ramsey soils.

This mapping unit is not suitable for farming but has much scenic value. (Capability unit VIIIs-1; woodland suitability group 14)

Shelocta Series

The Shelocta series consists of deep, well-drained, steep to very steep soils. These soils occupy side slopes in the Jellico Mountains and along the South Fork Cumberland River and its main tributaries. They formed in acid colluvium that has been moved downslope from adjacent areas.

In a typical profile, the surface layer is dark-brown and yellowish-brown silt loam about 7 inches thick. The subsoil extends to a depth of 47 inches. The major part of the subsoil is strong-brown and yellowish-brown silty clay loam. The substratum is reddish-brown silty clay.

The Shelocta soils are strongly acid and have moderate natural fertility. The available moisture capacity is high, and permeability is moderate. These soils have a thick root zone. Most of the acreage is in hardwood forest.

In the McCreary-Whitley Area, Shelocta soils are mapped only in complexes or groups with the Muse, Gilpin, and Tate soils.

Typical profile of a Shelocta stony silt loam (one-half mile north of the Crabtree home near Rock Creek, on a slope of 18 percent):

O1—2 inches to ½ inch, leaves and twigs of hardwoods.

O2—½ inch to 0, partly decomposed leaves and twigs.

A1—0 to 2 inches, dark-brown (10YR 4/3) silt loam; weak, medium and coarse, granular structure; friable; 15 percent of the volume is coarse fragments 2 to 12 inches across; common fine and few medium and coarse roots; very strongly acid; abrupt, wavy boundary.

A2—2 to 7 inches, yellowish-brown (10YR 5/6) silt loam; weak, medium, platy structure to weak, fine, subangular blocky; friable; 10 percent of the volume is coarse fragments 2 to 12 inches across; few fine, medium, and coarse roots; strongly acid; clear, wavy boundary.

B1–7 to 13 inches, strong-brown (7.5YR 5/6) silt loam; weak, fine, subangular blocky structure; 5 percent of the volume is coarse fragments 2 to 12 inches across; few fine, medium, and coarse roots; strongly acid; clear, wavy boundary.

B2t—13 to 29 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, fine, subangular blocky structure; friable; few fine, medium, and coarse roots; distinct broken clay films on peds; 10 percent of the volume is coarse fragments 2 to 12 inches across; strongly acid; gradual, wavy boundary.

B3—29 to 47 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, fine, subangular blocky structure; friable; few fine, medium, and coarse roots; 50 percent of the volume is coarse fragments 2 to 12 inches across; strongly acid; gradual, irregular boundary.

IIC—47 to 50 inches, reddish-brown (2.5YR 4/4) silty clay; massive; firm; few fine, medium, and coarse roots; strongly acid.

On slopes facing north, the color in the upper part of the B horizon generally is brown (7.5YR 4/4) to a depth of about 18 inches; on south-facing slopes the color ranges from strong brown (7.5YR 5/6) to dark yellowish brown (10YR 4/4). Depth to bedrock ranges from 3 to 10 feet.

The Shelocta soils are near the Muse, Trappist, Tate, Gilpin, and Renox soils. Shelocta soils have less clay in their subsoil than the Muse and Trappist soils and less sand than the Tate soils. They are deeper than Gilpin soils and are not so dark colored throughout their profile as the Renox soils.

Stendal Series

The Stendal series consists of deep, nearly level, somewhat poorly drained soils on flood plains. These soils formed in sediment that washed from soils derived from sandstone and shale.

In a typical profile, the surface layer is dark-brown and dark yellowish-brown sandy loam about 12 inches thick. This layer is underlain by light-gray, mottled sandy loam.

The Stendal soils are very strongly acid and have moderate natural fertility. Generally, these soils are flooded at least once late in winter or early in spring and, in some years, during the growing season. Available moisture capacity is high, and permeability is moderate to moderately rapid. Unless these soils are artificially drained, a high water table keeps them saturated during winter and spring.

The natural vegetation is sycamore, sweetgum, river birch, and hardwoods that grow well on bottom lands.

Typical profile of Stendal sandy loam (on Dry Fork, 1 mile downstream from Funston Road and 4 miles north of North Mill Creek School):

A11—0 to 2 inches, dark-brown (10YR 3/3) sandy loam, weak, medium, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

A12—2 to 12 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure; very friable; very strongly acid; clear, smooth boundary.

Cg—12 to 26 inches +, light-gray (10YR 7/2) sandy loam; many, fine, distinct mottles of yellowish brown (10YR 5/6); single grain; loose; very strongly acid.

Coarse fragments throughout the profile make up from 0 to 40 percent of the volume. These fragments range from ¼ inch to 3 inches across. In some cultivated areas, the Ap horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4) in color and from sandy loam to silt loam in texture.

The Stendal soils are near the well drained Pope, the moderately well drained Philo, and the poorly drained Atkins soils.

Stendal sandy loam (0 to 2 percent slopes) (Sd).—This soil is on flood plains along streams. The profile of this soil is the one described as typical for the Stendal series.

Included with this soil in mapping were small areas of Atkins, Philo, and Pope soils. Also included were small spots near the channel of streams that are kept permanently wet.

The high water table in undrained areas and occasional flooding are the main limitations to use. Where this soil is drained with tile, it is suited to continuous row crops. Without drainage, this soil is well suited to forage plants that tolerate wetness. (Capability unit IIw-4; woodland suitability group 1)

Strip Mines

Strip mines (St) consists of areas where the material above a coal seam has been removed to allow open pit mining. This mapping unit occurs throughout the survey area, generally in very steep areas.

Strip mines generally consists of a high vertical wall on one side, a spoil bank on the other side, and a pond of water between. The high wall is the vertical face on the upper side of the mining pit above the coal seam. Sloughing from this high wall is common. The spoil bank consists of soil material, shale, waste coal, and sandstone removed to expose the coal seam. This mixture is spilled downhill or deposited downslope from the pit as steep mounds. These spoil banks tend to slump badly when saturated with water. In some places this slumping releases the water in the pond between the spoil bank and the high wall. The water in strip mines is extremely acid, and when it is released it kills most plants where it flows and all fish that normally live in the streams it flows into. Also the bottom of the streams and nearby rocks are coated yellowish brown. Spoil banks have a high surface temperature, tend to be droughty, and are highly erodible.

A continuous cover crop, a good mulch of litter, and trees that have a deeply penetrating root system help significantly to stabilize these areas. Because the soil characteristics are variable, as well as other features affecting use, investigation at each site is needed to determine suitability for a specific use. (Capability unit and woodland suitability group not assigned.)

Talbott Series

The Talbott series consists of moderately deep to deep, well-drained, rolling to hilly soils. These soils occupy convex side slopes, ridgetops, and benches in the western part of the survey area along the Little South Fork Cumberland River and its tributaries. They formed in residuum derived from limestone.

In a typical profile, the surface layer is mainly light yellowish-brown silt loam about 4 inches thick. The subsoil extends to a depth of 33 inches. The major part of the subsoil is yellowish-red silty clay and clay. Limestone bedrock is at a depth of about 33 inches.

The Talbott soils are strongly acid and have moderately high natural fertility. Permeability is moderately slow, and available moisture capacity is moderate to low. The root zone is moderately thick. Rock outcrops and the hazard of erosion are the main limitations to use.

Most of the acreage of Talbott soils is in pasture or has a sparse stand of redcedar, oak, hickory, buckeye, and elm.

Typical profile of a Talbott silt loam (on the north side of Jones Hollow Road, 2.5 miles northwest of State Route 92, on a slope of 14 percent):

O1—1½ inches to ½ inch, litter of hardwood leaves.

O2—½ inch to 0, dark grayish-brown (10YR 4/2 silt loam;

A1—0 to ½ inch, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; 1 to 2 percent of the volume is gravel; strongly acid; abrupt, wavy boundary.

A2—½ inch to 4 inches, light yellowish-brown (10YR 6/4) silt loam; weak, medium, granular structure; friable; 1 to 2 percent of the volume is gravel; strongly acid; clear, wavy boundary.

B1—4 to 7 inches, strong-brown (7.5YR 5/6) silty clay loam; weak, fine, subangular blocky structure; firm; strongly acid; clear, wavy boundary.

B2t—7 to 18 inches, yellowish-red (5YR 5/6) silty clay; moderate, medium and fine, angular blocky structure; very firm, very sticky, very plastic; faint broken clay films on peds; medium acid; clear, wavy boundary.

B3t—18 to 33 inches, yellowish-red (5YR 5/6) clay; many, coarse, distinct variegations of yellowish brown (10YR 5/8) and very pale brown (10YR 7/4); massive to weak, coarse, angular blocky structure; extremely firm, very sticky, very plastic; distinct broken clay films on peds and in pores; medium acid; abrupt. irregular boundary.

R—33 inches, limestone bedrock.

Reaction ranges from strongly acid to medium acid in the upper horizons and in the subsoil. In tilled areas the surface layer has an Ap horizon that ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4) in color. Depth to bedrock commonly is about 30 inches but ranges from 25 to 40 inches.

Talbott soils are redder in the subsoil than the nearby Colbert soils.

Talbott rocky silt loam, 6 to 12 percent slopes (TaC).—This soil occupies rolling, karst landscapes where rock outcrops make up 3 to 8 percent of the surface. Except for disturbed areas that have a brown Ap horizon, the profile of this soil is similar to the profile described as typical for the Talbott series.

Included with this soil in mapping were small areas of Huntington soils in depressions around sinkholes. Also included were small areas of very dark colored, fine-textured, very plastic soils; of severely eroded soils; of nonrocky soils; and of soils consisting of 15 to 50 percent limestone outcrops.

Because of many rock outcrops, this soil is not well suited to cultivated crops. It is better suited as pasture or as woodland or wildlife habitat. (Capability unit VIs–1; woodland suitability group 4)

Talbott rocky silt loam, 12 to 20 percent slopes (TaD).—This soil occupies convex side slopes, karst ridgetops, and benches. Rock outcrops make up 3 to 8 percent of the surface.

Included with this soil in mapping were small areas of Huntington soils in depressions. Also included were small areas of severely eroded soils; of very dark colored, very plastic soils; and areas that are more than 8 percent rock outcrops.

Because of rockiness and the hazard of erosion, this soil is not suited to cultivated crops. It is better suited as pasture or as woodland or wildlife habitat. (Capability unit VIs–1; woodland suitability group 4)

Talbott very rocky silty clay, 12 to 20 percent slopes, severely eroded (TbD3).—This soil is on convex side slopes, karst ridgetops, and benches. Rock outcrops make up 10 to 25 percent of the surface. Except for a silty clay surface layer and less depth to bedrock, the profile of this soil is similar to the profile described as typical for the Talbott series.

Included with this soil in mapping were small areas of uneroded soils, of gullied soils, and of Huntington soils in depressions.

Most of the original surface layer of this Talbott soil has been washed away. Because of past erosion, rockiness, poor workability, droughtiness, and the hazard of further erosion, this soil is not suited to cultivated crops, hay, or pasture. It is better suited as woodland or wildlife habitat. (Capability unit VIIs–2; woodland suitability group 4)

Tate Series

The Tate series consists of deep, well-drained, mainly moderately steep or steep soils on side slopes that have a sandstone cliff at or near the upper part. These soils are gently sloping and strongly sloping in a small acreage on stream terraces. Tate soils are the most extensive soils in the county. They formed in colluvium that moved downslope from soils derived from acid sandstone and shale.

In a typical profile, the surface layer is friable, brown and yellowish-brown loam about 8 inches thick. The subsoil extends to a depth of more than 48 inches and is underlain by shale. The subsoil consists of about 6 inches of yellowish-brown loam underlain by yellowish-brown and strong-brown clay loam.

The Tate soils are very strongly acid and have moderate natural fertility. Permeability is moderate to moderately rapid. The root zone is deep, and available moisture capacity is high. Except in stony areas, tillage is easy. These soils can be worked throughout a wide range of moisture content without clodding or crusting.

Most of the steep areas are forested. Tulip-poplar and other hardwoods grow on slopes facing north, and mixed oak and hickory grow on slopes facing south. Most of the acreage on stream terraces is used for crops and pasture.

Typical profile of a Tate loam (in the vicinity of Noe's Dock, one-third mile northwest of proclamation line on State Route 1277, on a slope of 34 percent):

A1—0 to 3 inches, brown (10YR 4/3) loam; weak, medium, granular structure; friable; 2 percent of the volume is fragments ½ inch to 2 inches across; very strongly acid; clear, smooth boundary.

A2—3 to 8 inches, yellowish-brown (10YR 5/4) loam; weak, fine, granular structure; friable; 3 percent of the volume is fragments ½ to 1 inch across; very strongly acid; clear, wavy boundary.

B1—8 to 14 inches, yellowish-brown (10YR 5/6) heavy loam; weak, fine and medium, subangular blocky structure; friable; 2 percent of the volume is fragments ½ to 1 inch across; very strongly acid; clear, wavy boundary.

B21t—14 to 21 inches, yellowish-brown (10YR 5/6) light clay loam; moderate, fine, subangular blocky structure; friable; faint, patchy clay films on peds; 2 percent of the volume is fragments ½ to 1 inch across; very strongly acid; clear, wavy boundary.

B22t—21 to 34 inches, strong-brown (7.5YR 5/6) light clay loam; moderate, fine and medium, subangular blocky structure; friable; faint, complete clay films on peds and in pores; 3 percent of the volume is fragments ½ to 1 inch across; very strongly acid; gradual, wavy boundary.

B3t—34 to 48 inches +, strong-brown (7.5YR 5/6) clay loam; weak, fine, subangular blocky structure; friable to firm; faint complete clay films on peds; 10 percent of the volume is fragments ½ inch to 2 inches across; very strongly acid.

Stones and boulders cover from 0 to 15 percent of the surface of these soils. Coarse fragments throughout the profile range from ½ inch to 12 inches across and make up 2 to 30 percent of the volume. The A2 horizon ranges from dark grayish brown (2.5Y 4/2) on north-facing slopes to light yellowish brown (10YR 6/4) on south-facing slopes. Texture of the A horizon ranges from loam to sandy loam. The A horizon ranges from 2 to 16 inches in thickness. The thickness of the B horizon varies according to the total thickness of the colluvium in which these soils formed. This colluvium ranges from 3 to 10 feet in thickness.

The Tate soils occur near the Clymer, Shelocta, Dekalb, and Muse soils. Tate soils are deeper than Clymer soils and contain more sand throughout than Shelocta soils. Tate soils contain more clay than Dekalb soils but less than Muse soils.

Tate fine sandy loam, 0 to 6 percent slopes (TeB).—This soil occupies second bottoms. Some areas are so high above normal flood stage that they are infrequently flooded. In most places the surface layer is darker colored, is slightly coarser textured, and has weaker structure than that in the profile described as typical for the Tate series. Also, this soil is fairly free of coarse fragments to a depth of 40 inches, but below this depth pebbles and cobblestones are common.

Included with this soil in mapping were small areas of Pope and Elk soils and, in places, small areas that have slopes of more than 6 percent.

Natural fertility is moderate, and infiltration and permeability are moderately rapid.

This soil is well suited to hay and pasture. Growth of most crops is good if management is good. Where this soil is cultivated, the hazard of erosion is slight to moderate. (Capability unit IIe-9; woodland suitability group 2)

Tate loam, 6 to 12 percent slopes (TlC).—This soil occupies foot slopes and high stream terraces. Except for fewer coarse fragments throughout, the profile of this soil is similar to the one described as typical for the Tate series.

Included with this soil in mapping were small areas of Cotaco soils. Also included were small areas in which 3 to 8 percent of the surface is covered by stones 10 to 18 inches across.

This soil is well suited to pasture plants. Although the hazard of erosion is high, tilled crops commonly grown in the Area are suitable if management is good. (Capability unit IIIe-1; woodland suitability group 2)

Tate loam, 12 to 20 percent slopes (TlD).—This soil has a concave surface. The soil developed in colluvium, generally around the head of drains and at the base of steep slopes.

Included with this soil in mapping were small areas where as much as 20 percent of the surface is covered by stones from 5 to 15 inches across. Also included were small areas of a dark-colored soil on slopes generally facing north. Other inclusions are small eroded areas and small areas of Muse soils that have convex slopes.

This soil is well suited to pasture and hay. It is suited to only an occasional row crop, because the hazard of erosion is very high in cultivated areas. Most crops grow well, however, if management is good. (Capability unit IVe-1; woodland suitability group 11)

Tate loam, 20 to 30 percent slopes (TlE).—This soil occupies concave and smooth side slopes. Its surface layer and subsoil combined are slightly thicker and contain more coarse fragments than those layers in the profile described as typical for the Tate series.

Included with this soil in mapping were small areas of Muse soils and a dark-colored soil on slopes facing north. Also included were small areas where 10 to 25 percent of the surface is covered by stones.

Because of steepness and the hazard of erosion, this soil is not suited to cultivated crops. It is well suited to pasture and most hay crops. (Capability unit VIe-1; woodland suitability group 11)

Tate loam, 30 to 50 percent slopes (TlF).—This soil occupies slightly concave side slopes. Its profile is the one described as typical for the Tate series.

Included with this soil in mapping were small areas in which sandstone crops out and small areas that have stones on the surface. In most places the stones are less than 15 inches across. Also included were small areas of Dekalb and Muse soils and of a dark-colored soil.

Steep slopes and rapid runoff limit the use of this soil, but it can be used as woodland, for wildlife, or for limited grazing. (Capability unit VIIe-1; woodland suitability group 11)

Tate stony sandy loam, 12 to 20 percent slopes (TmD).—This soil occurs around the head of drains and at the base of steep slopes in areas where outcrops of sandstone are prominent. The profile of this soil is sandier than the one described as typical for the Tate series and contains from 3 to 15 percent more coarse fragments. These fragments range from 2 to 10 inches across. Stones 10 to 20 inches across cover from 3 to 10 percent of the surface.

Included with this soil in mapping were small areas of bouldery Tate soils and of Dekalb, Cotaco, and a dark-colored soil.

Because of stoniness, this soil is not suitable for cultivation. It can be used for pasture, though the stones hinder the use of machinery. It is well suited as woodland and as a source of food and cover for wildlife. (Capability unit VIs-3; woodland suitability group 13)

Tate stony sandy loam, 20 to 30 percent slopes (TmE).—This soil occupies concave side slopes, generally at the foot of cliffs. The profile of this soil is sandier than the profile described as typical for the Tate series, and the solum is slightly thicker. Also, fragments ranging from 1/4 inch to 12 inches across are 3 to 25 percent more plentiful. Stones and boulders 10 to 30 inches across cover from 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of bouldery Tate soils and of Muse and a dark-colored soil on slopes generally facing north.

Stones and steep slopes restrict the use of this soil to pasture, woodland, or wildlife. (Capability unit VIs-3; woodland suitability group 13)

Tate stony sandy loam, 30 to 50 percent slopes (TmF).—This soil occupies concave side slopes, generally at the foot of cliffs. The profile of this soil is sandier than the one described as typical for the Tate series and contains from 3 to 20 percent more coarse fragments. These fragments range from 4 to 12 inches across. Stones and boulders 10 to 36 inches across cover from 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of bouldery Tate soils and of Muse and a dark-colored soil.

Stones and steep slopes severely limit the use of this soil. It is suitable for limited grazing but is more suitable as woodland and for providing wildlife food and cover. (Capability unit VIIs-1; woodland suitability group 13)

Tate-Trappist stony complex, 25 to 45 percent slopes (TnF).—This complex is on benched or irregular landscapes. Generally, about 60 percent of the complex is Tate soil, about 30 percent is Trappist soil, and the remaining 10 percent is included soils. All of these soils are so intermingled that separating them on a soil map is not practical.

The Tate soil developed in colluvium on concave or smooth slopes at the head of drainageways, on benches, or on the lower part of side slopes. In contrast, the Trappist soil developed on strongly convex landforms that project a short distance out from the side slopes. The Trappist soil is 5 to 7 percent steeper than the Tate soil.

The Tate and Trappist soils are unlike in appearance. The profile of the Tate soil in this complex is similar to the profile described as typical for the series but has a higher content of coarse fragments and is underlain by weathered clay shale at a depth of 3 to 4 feet. The profile of the Trappist soil is slightly thicker above shale than the profile described as typical for the series and contains fewer coarse fragments in the subsoil. Also, the Trappist soil is capped with moderately coarse textured colluvium about 5 inches thick. In this complex, however, stones cover from 3 to 15 percent of the surface. Included in mapped areas of this complex are small areas of Cotaco soils or a dark-colored soil. Rock outcrops are common on abrupt slope breaks.

Stoniness and steepness severely restrict the use of soils in this complex. These soils are suitable for limited grazing but are more suitable as woodland and for providing wildlife food and cover. (Capability unit VIIs-1; woodland suitability group 13)

Tate, Shelocta, and Muse stony soils, 12 to 35 percent slopes (ToE).—This undifferentiated group of soils occupies benched landforms that have an overall concave appearance. It occurs mainly along South Fork, Little South Fork, and Rock Creek and in small areas along Lake Cumberland near the mouth of Beaver Creek.

The soils in this group developed in acid colluvium that weathered from siltstone, sandstone, and shale. This colluvium ranges from 3 to 5 feet in thickness and overlies red, greenish gray, and gray, calcareous clay shale and some limestone. Typically, stones cover from 10 to 30 percent of the surface.

Some areas are made up of only Tate soil, some areas of only Shelocta soil, some areas of only Muse soil, and some areas of all three of these soils. The profile of the Tate soil in this group has coarser texture and contains more coarse fragments than the profile described as typical for the Tate series. The profile of the Shelocta soil is similar to the one described as typical for the Shelocta series. Except for more coarse fragments in the surface layer, the profile of the Muse soil is similar to the one described as typical for the Muse series.

Included in mapped areas of these soils in some places are small areas of Colbert, Talbott, or dark-colored soils.

The large amount of stones on the surface severely restricts the use of the soils in this group. These soils can be used as woodland and for producing wildlife food and cover. The operation of farm machinery is extremely difficult. Because of the underlying shale, these soils are likely to slump in some places if they are used for engineering. (Capability unit VIIs-1; woodland suitability group 5)

Tate-Very stony land complex (Tc).—This complex occurs mainly along the Cumberland River and the South Fork Cumberland River. It is at the foot of massive sandstone cliffs and along drainageways that have steep to very steep, concave side slopes. Slopes range from 20 to 65 percent and are from 50 to 200 feet long. This complex consists of about equal parts of Tate soil and very stony areas. The very stony areas have about 40 to 90 percent of their surface covered by sandstone boulders, some rock outcrops, and stones. The stones and boulders generally range from 1 to 8 feet across, but some are 30 feet or more.

Except that it is coarser textured and contains more angular stones and boulders, the profile of the Tate soil in this complex resembles the profile described as typical for the Tate series. The soils in this complex are less erodible than soils on comparable slopes, because of rapid infiltration and the large amount of stones and boulders on the surface.

Because the conventional wheeled and crawler type vehicles cannot be operated on this complex, and because the steep, stony and bouldery slopes and cliffs make access difficult, this complex is not suited to cultivated crops. It has limited use as pasture but is more suitable as woodland and for providing wildlife food and cover. (Capability unit VIIs-2; woodland suitability group 14)

Tilsit Series

The Tilsit series consists of deep, moderately well drained, gently sloping soils. These soils occupy the less sloping parts of the rolling uplands throughout the survey area. They formed partly in residuum derived from siltstone, sandstone and clayey shale and partly in thin loess.

In a typical profile, the surface layer is mainly light yellowish-brown silt loam about 9 inches thick. Below this layer is a layer of light olive-brown to yellowish-brown silt loam about 7 inches thick that is underlain by a thin layer of silt loam that is in many characteristics similar to the surface layer. This thin layer is underlain by a fragipan of yellowish-brown silty clay loam. Below the fragipan are successive layers of silty clay loam and silty clay that continue to bedrock at a depth of about 64 inches.

The Tilsit soils are very strongly acid and have moderate natural fertility. Available moisture capacity is moderate. A fragipan is at a depth of about 19 inches and restricts root growth. Slow permeability of the fragipan keeps the root zone saturated with water during rainy periods. This wetness delays planting in some years and causes alfalfa and other deep-rooted perennial plants to be short lived. These soils can be tilled throughout a wide range of moisture content without clodding or crusting.

The natural vegetation includes mixed upland oak, hickory, blackgum, and red maple.

Typical profile of a Tilsit silt loam (about one-half mile west of Goodin Ridge Road on Forest Service Road 51, on a slope of 1 percent), *Laboratory No. S63KY-74-7:*

O1—1 inch to 0, partly decomposed litter from hardwoods.

Ap1—0 to 1 inch, grayish-brown (10YR 5/2) to dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

Ap2—1 inch to 9 inches, light yellowish-brown (10YR 6/4 to 2.5Y 6/4) silt loam; weak, fine, granular structure; very friable; very strongly acid; gradual, wavy boundary.

B—9 to 16 inches, light olive-brown (2.5Y 5/6) to yellowish-brown (10YR 5/6) silt loam; weak, medium, subangular blocky structure; friable; very strongly acid; clear, smooth boundary.

A'2—16 to 19 inches, light olive-brown (2.5Y 5/4) to light yellowish-brown (2.5Y 6/4) silt loam; moderate, medium, granular structure; friable; very strongly acid; clear, wavy boundary.

B'x—19 to 28 inches, yellowish-brown (10YR 5/6) silty clay loam; light-gray, yellowish-red, and light yellowish-brown mottles; polygons, separated by vertical tongues of dark-gray (10YR 4/1) clay, that break to moderate, medium and coarse, angular blocky structure; some light yellowish-brown silt coats on peds; very firm, brittle, compact; common clay films; less than 10 percent of the volume is shale fragments; a thin stone line is parallel to the surface at a depth of 28 inches; very strongly acid; gradual, irregular boundary.

IIB21t—28 to 32 inches, variegated brown (7.5YR 4/4), yellowish-brown (10YR 5/6), and yellowish-red (5YR 4/6) silty clay loam; strong, fine, angular blocky structure; vertical tongues of dark-gray clay extend from above; very firm, sticky and plastic; many clay films; less than 10 percent of the volume is shale fragments; few grains of coarse sand; very strongly acid; gradual, wavy boundary.

IIB22t—32 to 38 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, distinct variegations of strong brown and yellowish red; moderate to strong, medium, angular blocky structure; vertical streaks of dark-gray clay extend from above; very firm, sticky and plastic; many clay films; less than 10 percent of the volume is shale fragments; common grains of coarse sand; very strongly acid; gradual, wavy boundary.

IIB3t—38 to 44 inches, variegated yellowish-brown, yellowish-red, and dark-brown silty clay; moderate, fine and medium, angular blocky structure; vertical streaks of dark-gray clay extend from above; very firm, sticky and plastic; common clay films; less than 10 percent of the volume is shale fragments; common grains of sand; very strongly acid; gradual, wavy boundary.

IIC—44 to 64 inches, brownish-yellow (10YR 6/6) silty clay loam; weak, medium, angular blocky structure; vertical flows of dark-gray clay in cracks; very firm, sticky and plastic; 10 percent of volume is shale fragments; common grains of sand; very strongly acid; clear, smooth boundary.

R—64 inches +, gray sandstone.

Depth to the B'x horizon (top of the fragipan) ranges from 18 to 28 inches but commonly is 24 inches. Depth to bedrock ranges from 40 to 65 inches.

Tilsit soils occur with the Wellston soils, which are better drained and do not have a fragipan. The Tilsit soils are not so well drained as the Clymer, Dekalb, and Tate soils and are finer textured. They have less clay throughout than the Muse soils, which do not have a fragipan.

Tilsit silt loam, 2 to 6 percent slopes (TpB).—This soil occupies wide ridgetops and benches that are smooth to slightly concave.

Included with this soil in mapping were small areas of Wellston soils and of a somewhat poorly drained soil.

This soil is suited to most crops commonly grown in the survey area, but not to alfalfa. In cultivated areas the hazard of erosion is moderate. This soil is well suited to pasture and hay crops. (Capability unit IIe-7; woodland suitability group 3)

Trappist Series

The Trappist series consists of moderately deep, well-drained, strongly sloping to steep soils. These soils occupy rounded ridgetops and side slopes in the northern part of the survey area and in the Jellico Mountains. They formed in residuum from clay shale.

In a typical profile, the surface layer is mainly yellowish-brown silt loam about 4 inches thick. The subsoil extends to a depth of about 22 inches and abruptly overlies soft shale. The major part of the subsoil is strong-brown silty clay.

The Trappist soils are very strongly acid and have moderately low natural fertility. Permeability is moderately slow, and available moisture capacity is moderate to low. The root zone is moderately thick.

The natural vegetation generally consists of Virginia pine, scarlet oak, chestnut oak, post oak, blackjack oak, and southern red oak.

Typical profile of a Trappist silt loam (one-eighth mile south of State Route 92 on Bon Jellico Mountain about 4 miles southwest of Williamsburg, on a slope of 18 percent):

O1—¾ to ¼ inch, oak leaves and twigs.

O2—¼ inch to 0, partly decomposed oak leaves and twigs.

A1—0 to 1 inch, dark-brown (10YR 4/3) silt loam; weak, very fine, granular structure; friable; 2 percent of the volume is shale fragments ¼ inch across; many very fine roots; very strongly acid; abrupt, smooth boundary.

A2—1 inch to 4 inches, yellowish-brown (10YR 5/6) silt loam; weak, fine, granular structure; friable; 2 percent of the volume is shale fragments ¼ inch across; few fine and medium roots; very strongly acid; clear, smooth boundary.

B1t—4 to 8 inches, brownish-yellow (10YR 6/6) silty clay loam; weak, fine and medium, subangular blocky structure; friable; faint patchy clay films on peds; 3 percent of the volume is shale fragments ¼ inch to 1 inch across; common fine and medium roots; very strongly acid; clear, wavy boundary.

B2t—8 to 17 inches, strong-brown (7.5YR 5/8) silty clay; moderate, fine and medium, subangular blocky structure; firm; distinct broken clay films on the peds; 10 percent of the volume is shale fragments ¼ to 1 inch across; few fine and coarse roots; very strongly acid; gradual, irregular boundary.

B3—17 to 22 inches, strong-brown (7.5YR 5/6) silty clay; weak, fine, subangular blocky structure; firm; 40 percent of the volume is shale fragments ¼ inch to 2 inches across; few fine roots; very strongly acid; clear, irregular boundary.

R—22 inches +, olive-gray, soft, clayey shale.

Depth to the clayey shale ranges from 20 to 30 inches.

Trappist soils occur with the Weikert, Muse, and Monongahela soils. Trappist soils are deeper and have more clay than the Weikert soils. They are not so deep as the Muse soils. Unlike the Monongahela soils, Trappist soils do not have a fragipan.

Trappist silty clay loam, 6 to 12 percent slopes, severely eroded (TrC3).—This soil occupies convex ridgetops. Except for a silty clay loam surface layer and slightly lighter color, the profile of this soil is similar to the profile described as typical for the Trappist series. Most of the original surface layer has been washed away.

Small areas of strongly sloping and moderately steep soils; of shallow gullies; of Muse silt loam; and of less eroded soils were included with this soil in mapping.

Because of poor workability, doughtiness, and low organic-matter content resulting from past erosion and the hazard of further erosion, this soil is poorly suited to cultivated crops. It can be used for pasture and hay or as woodland or wildlife habitat. (Capability unit IVe-11; woodland suitability group 6)

Trappist silty clay loam, 12 to 20 percent slopes, severely eroded (TrD3).—This strongly sloping soil occupies slightly convex slopes. It has a silty clay loam surface layer and is slightly less deep to shale bedrock but is otherwise similar to the soil described as typical for the Trappist series. Most of the original surface layer has been washed away.

Small areas of moderately steep soils; of shallow gullies; of Muse silt loam; and of less eroded soils were included with this soil in mapping.

Because of poor workability, low organic-matter content, and droughtiness resulting from past erosion, this soil is not suited to cultivated crops. It is better suited to pasture and hay or as woodland or wildlife habitat. (Capability unit VIe-2; woodland suitability group 6)

Trappist-Monongahela silt loams, 12 to 20 percent slopes (TsD).—The soils of this complex occur in a fairly regular pattern on benches and convex side slopes, mainly in Whitley County. About 60 to 70 percent of the acreage is Trappist soil, and about 30 to 40 percent is Monongahela and included soils. A profile typical of Trappist and Monongahela soils is described under the respective series.

Small areas of Wellston and Muse soils and of some moderately eroded soils were included with this complex in mapping.

Because the hazard of erosion is very high when these soils are cultivated, they are suited to only occasional row crops. They are well suited to pasture and to most hay crops. The Monongahela soil in this complex has a slowly permeable fragipan that restricts root growth and keeps the root zone waterlogged during rainy periods. (Capability unit IVe-3; woodland suitability group 6)

Trappist-Weikert silt loams, 12 to 20 percent slopes, severely eroded (TwD3).—The soils of this complex occur on ridgetops in the southeastern part of the survey area. About 50 to 60 percent of the acreage is Trappist soil; about 20 to 30 percent, Weikert soil; and the remaining 20 percent, included soils. The Trappist soil occupies the wider, rounded parts of ridgetops; the Weikert soil occupies side slopes and, in many places, the crest of ridges. Except that most of their original surface layer has been washed away and they are therefore less deep to bedrock, these soils are similar to the soils described as typical for the respective series.

Included with this complex in mapping were small areas of Dekalb and Gilpin soils, areas of steeper soils, and areas of stony soils.

Because of past erosion and the hazard of further erosion, the soils of this complex are not suited to cultivated crops. The Trappist soil is fairly well suited to pasture plants, but the Weikert soil is poorly suited because of shallowness to bedrock and droughtiness. A better use for the Weikert soil is as woodland or wildlife habitat. (Capability unit VIe-2; woodland suitability group 6)

Tyler Series

The Tyler series consists of deep, nearly level, somewhat poorly drained soils. These soils occupy smooth, low-lying second bottoms and high stream terraces along the Cumberland River, Clear Fork, Marsh Creek, and Jellico Creek. They formed in acid sediment that washed from soils derived from sandstone and shale.

In a typical profile, the surface layer is dark grayish-brown silt loam about 6 inches thick. Below this layer is a layer of strongly mottled silty clay loam about 6 inches thick that is underlain by a thin layer of light brownish-gray silt loam that is similar to the surface layer in many characteristics. This thin layer is underlain by a fragipan of strongly mottled silty clay loam. At a depth of about 32 inches is a substratum of mottled silt loam.

The Tyler soils are very strongly acid and have moderately low natural fertility. The available moisture capacity is moderate to low. The fragipan is firm and restricts root penetration. Because this pan is slowly permeable, the layer above the pan remains saturated for long periods after heavy rains. The content of organic matter is low. If the surface layer is worked when slightly wet, it tends to clod and crust.

The natural vegetation consists largely of oaks that grow well on bottom lands, river birch, sweetgum, sycamore, and red maple. Most of the acreage is cleared, however, and is used for cultivated crops and pasture.

Typical profile of Tyler silt loam (about one-half mile south of Lower Marsh Creek Church):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

B—6 to 12 inches, mottled yellowish-brown (10YR 5/4), pale-brown (10YR 6/3), strong-brown (7.5YR 5/6), and light brownish-gray (10YR 6/2) silty clay loam; weak to moderate, fine, angular blocky structure; friable; many concretions of manganese; very strongly acid; clear, wavy boundary.

A'2—12 to 15 inches, light brownish-gray (10YR 6/2) silt loam; weak, fine, angular blocky structure; friable to firm; slightly brittle; many black concretions; very strongly acid; gradual, wavy boundary.

B'x—15 to 32 inches, mottled light brownish-gray (10YR 6/2), light yellowish-brown (10YR 6/4), and strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, angular blocky structure; firm, compact, brittle; discontinuous clay films on micro peds and on polygon structural faces; common black concretions; very strongly acid; gradual, wavy boundary.

C—32 to 42 inches +, mottled strong-brown (7.5YR 5/6) and light brownish-gray (10YR 6/2) silt loam; weak, medium, subangular blocky structure; friable; very strongly acid.

Texture of the surface layer generally is silt loam, but it ranges to loam. Depth to the fragipan ranges from 10 to 20 inches.

The Tyler soils occur with the moderately well drained Captina, the well drained Elk and Tate, the poorly drained Robertsville, and the somewhat poorly drained Cotaco soils. Unlike the Cotaco soils, Tyler soils have a fragipan at a depth of about 15 inches.

Tyler silt loam (0 to 2 percent slopes) (Ty).—This soil has the profile described as typical for the Tyler series.

Small areas of Robertsville, Elk, and Cotaco soils were included with this soil in mapping. Also included were permanently wet areas in small depressions.

Because of a water table that stays high for long periods, this soil is suited mainly to shallow-rooted plants and plants that tolerate wetness. Windthrow of trees and root rot are common hazards on this soil. Drainage through open ditches helps to reduce waterlogging of the root zone, but wetness severely limits the use of this soil for cultivated crops. Growth of adapted pasture plants on this soil is good to excellent if management is good. (Capability unit IIIw-1; woodland suitability group 1)

Weikert Series

The Weikert series consists of shallow, strongly sloping, excessively drained soils on ridgetops in the Jellico Mountains. These soils formed in residuum from shale and siltstone.

In a typical profile, the surface layer is mainly yellowish-brown silt loam about 5 inches thick. The subsoil is brownish-yellow silt loam about 7 inches thick over a brownish-yellow silt loam substratum. Hard shale bedrock is at a depth of about 18 inches.

The Weikert soils are very strongly acid and have low natural fertility. Available moisture capacity is low, and infiltration and permeability are moderate. The root zone is thin.

The natural vegetation consists of mixed oaks and hickory.

In the McCreary-Whitley Area, Weikert soils are mapped only in a complex with Trappist soils.

Typical profile of Weikert silt loam (about 1.3 miles from Wolf Knob Tower near a heliport, on a slope of 14 percent):

O1—1¼ inches to ¼ inch, oak leaves and twigs.

O2—¼ inch to 0, partly decomposed oak leaves and twigs.

A1—0 to 1½ inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine, granular structure; soft; less than 3 percent of the volume is shale fragments ¼ inch across; very strongly acid; abrupt, smooth boundary.

A2—1½ to 5 inches, yellowish-brown (10YR 5/4) silt loam; weak, very fine, subangular blocky structure; soft; 3 percent of the volume is shale fragments ½ to 1 inch across; very strongly acid; clear, irregular boundary.

B2—5 to 12 inches, brownish-yellow (10YR 6/8) silt loam; weak, very fine, subangular blocky structure; friable; 40 percent of the volume is shale fragments ½ inch to 4 inches across; very strongly acid; gradual, irregular boundary.

C—12 to 18 inches, brownish-yellow (10YR 6/8) silt loam; massive; friable when moist, hard when dry; 70 percent of the volume is loosely bedded shale fragments 2 inches across; diffuse, broken boundary.

R—18 inches, light brownish-gray (2.5Y 6/2) hard shale.

Eroded Weikert soils have a brown (10YR 5/3) to yellowish-brown (10YR 5/4) surface layer. Depth to bedrock ranges from 12 to 20 inches.

The Weikert soils occur with the Trappist, Gilpin, Shelocta, and Muse soils. They are not so deep as these nearby soils. The Weikert soils have less clay in their subsoil than the Trappist and Muse soils.

Wellston Series

The Wellston series consists of well-drained, gently sloping to sloping soils on broad ridgetops throughout the survey area. These soils formed partly in residuum from acid shale and sandstone and partly in thin loess.

In a typical profile, the surface layer is dark-brown and yellowish-brown silt loam about 7 inches thick. The subsoil extends to a depth of about 34 inches and abruptly overlies fine-grained sandstone. The major part of the subsoil is yellowish-brown silt loam and silty clay loam.

The Wellston soils are very strongly acid and have moderate natural fertility. Permeability is moderate, and available moisture capacity is high. The Wellston soils have a thick root zone. They are easily tilled and can be worked throughout a wide range of moisture content without clodding or crusting.

The natural vegetation includes mixed upland oaks, hickory, red maple, and yellow pine.

Typical profile of a Wellston silt loam (about 3 miles east of State Route 896 on State Route 1609, on a slope of 6 percent):

O1—2¼ inches to ¼ inch, oak twigs and leaves.

O2—¼ inch to 0. partly weathered oak twigs and leaves.

A1—0 to 3 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable; less than 1 percent of the volume is coarse fragments; very strongly acid; abrupt, smooth boundary.

A2—3 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; friable; less than 1 percent of the volume is coarse fragments; very strongly acid; clear, wavy boundary.

B1—7 to 13 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; less than 1 percent of the volume is coarse fragments; very strongly acid; clear, wavy boundary.

B21t—13 to 20 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, medium, subangular blocky structure; friable; patchy clay films on peds; less than 1 percent of the volume is coarse fragments; very strongly acid; clear, wavy boundary.

B22t—20 to 30 inches, yellowish-brown (10YR 5/8) light silty clay loam; moderate, medium, subangular blocky structure; friable; faint patchy clay films on peds and in pores; less than 1 percent of the volume is coarse fragments; very strongly acid; clear, wavy boundary.

B3t—30 to 34 inches, yellowish-brown (10YR 5/8) light clay loam; weak, medium, subangular blocky structure; friable; few patchy clay films; less than 2 percent of the volume is coarse fragments; very strongly acid; abrupt, wavy boundary.

R—34 inches +, fine-grained sandstone.

Thickness of the solum generally is about 34 inches, but it ranges from 32 to 60 inches. Coarse fragments, generally less than 2 inches across, occur throughout the profile and in most places make up less than 5 percent of the volume. The color of some pedons in the B2 horizon is strong brown (7.5YR 5/6).

The Wellston soils are near the Clymer, Muse, Tilsit, Dekalb, and Tate soils. Wellston soils are finer textured than the Clymer, Dekalb, and Tate soils. They have less clay in the subsoil than the Muse soils. Unlike the moderately well drained Tilsit soils, Wellston soils do not have a fragipan.

Wellston silt loam, 6 to 12 percent slopes (WeC).—This soil occupies wide, smooth, convex ridgetops.

Included with this soil in mapping were small areas of Muse, Tilsit, and Clymer soils. Also included were some areas that are nearly level and some that are strongly sloping.

This soil is suited to all crops commonly grown in the survey area. In cultivated areas the hazard of erosion is high. This soil is well suited to pasture and hay crops. (Capability unit IIIe-2; woodland suitability group 3)

Wellston and Tilsit silt loams, 2 to 6 percent slopes (WtB).—This undifferentiated group of soils generally occurs on the less sloping, wide ridgetops and benches that are smooth and slightly convex. These soils do not occur together in a regular pattern. The Wellston soil generally makes up more than 60 percent of the mapping unit, and the rest is Tilsit and included soils. In a few areas the Tilsit soil is absent. Each of these soils has a profile similar to the profile described as typical for the respective series.

Included with this unit in mapping are small areas of Muse and Clymer soils. Also included are areas that have slopes of slightly more than 6 percent.

The Wellston soil in this mapping unit is slightly better drained, is more permeable, and has a thicker root zone than the Tilsit soil. The Tilsit soil has a fragipan at a depth of 10 to 20 inches. The choice of plants is wider for the Wellston soil. Both soils are well suited to pasture and hay crops, but in cultivated areas the hazard of erosion is moderate. (Capability unit IIe-9; woodland suitability group 3)

Use and Management of the Soils

This section is designed to help the landowner understand how soils behave and how they can be used. In it are discussed the use and management of soils for crops and pasture, for woodland, for wildlife, for engineering works, for community and recreation, and for water supply. Specific management is not suggested in this section for each soil. Suggestions for the use of each soil are given in the section "Descriptions of the Soils."

Use of Soils for Crops and Pasture [1]

This subsection has three main parts. The first part explains the capability grouping of soils. In the second part, the soils are placed in capability units, and the use and management of these are discussed. In the third part, estimated yields of the principal crops are given for each soil under two levels of management.

Capability Groups of Soils

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on the limitations of the soils, the risk of damage when they are used for the ordinary field crops or sown pastures, and the way they respond to treatment. The classification does not apply to most horticultural crops, or to rice and other crops that have special requirements for production. The soils are classified according to the degree and kind of permanent limitations, but without consideration of the major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible major reclamation.

In the capability system, all soils are grouped at three levels, the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groupings, are designated by Roman numerals I through VIII. The larger the numerals, the greater the limitations and the narrower the choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

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

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in the McCreary-Whitley Area.)

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

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to grazing, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated 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* shows 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 only in some parts of the United States, but not in the McCreary-Whitley Area, shows 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 limitations. Class V can contain, at the most, only subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are 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 designated by adding an Arabic numeral to the subclass symbol, for example, IIe-7 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The Arabic numeral specifically identifies the capability unit within each subclass. The capability classification of soils in the McCreary-Whitley Area is part of a statewide system, and all of the capability units in the system do not occur in the Area. Consequently, capability unit numbers are not consecutive.

[1] By Herman P. McDonald, soil scientist, and Walter J. Guernsey, conservation agronomist, Soil Conservation Service.

Management of soils by capability units

On the following pages the capability units, or groups of soils that have similar management requirements, are described; some limitations are given; and suitable management is briefly described. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all soils in a given series appear in the unit. To find the names of all the soils in a given capability unit refer to the "Guide to Mapping Units" at the back of the survey. The grouping of soils shown in this guide are subject to change as new methods are discovered or new information becomes available.

In each unit of capability classes IIe, IIIe and IVe, an example is given showing a cropping system suitable for soils that have a slope of specified length and steepness. This system will keep soil losses from erosion within permissible limits, as determined by research and field experience. Contour farming is the conservation practice most widely used. Terraces generally are not used where slopes are more than 8 percent.

Where slopes are longer than those shown in the example but are of the same steepness, row crops can be grown more often if the soil is terraced or contour stripcropped as well as contour farmed. Where slopes are shorter or steeper or where less effective conservation practices are used, fewer years of row crops and more years of sod-forming crops are needed for efficient control of erosion.

CAPABILITY UNIT I-1

This unit consists of deep, well drained and moderately well drained, acid and nonacid soils of the Huntington, Philo, and Pope series. In most places these soils occur on bottom lands and are nearly level to gently sloping. Flash floods occur occasionally during the growing season. Small areas of Pope soils are on streambanks and have slopes of as much as 20 percent. Erosion is a hazard only in the steeper areas of the Pope soils. The Philo soils are slightly wet. Small areas of the other soils in this unit are subject to slight damage by scouring during some high floods.

The soils of this unit are well suited to row crops and to the hay and pasture plants commonly grown in the Area. They are especially well suited to tobacco and corn, but small grains seeded in fall are subject to damage by flooding. Except on the sloping and strongly sloping soils, each of these crops can be grown continuously under a high level of management. All pasture and hay plants grow well under a medium level of management.

Pope soils on streambanks should be kept in permanent vegetation. The slightly wet Philo soils can be artificially drained.

CAPABILITY UNIT I-3

Only Elk silt loam is in this capability unit. This is one of the better soils for farming in the survey area. It is a deep, nearly level, well-drained soil on low stream terraces. This soil is not susceptible to erosion and has few limitations to use. The natural fertility and available moisture capacity are high. The plow layer of this soil is friable and easily tilled. It is strongly acid, but crops respond well to added lime and fertilizer.

The soil in this capability unit is well suited to all row crops commonly grown in the Area. It is especially well suited to tobacco, corn, and small grains. Each of these crops can be grown continuously under a high level of management. All pasture and hay plants grow well under a medium level of management.

CAPABILITY UNIT IIe-7

This capability unit consists of gently sloping, moderately well drained soils of the Captina and Tilsit series. These soils are not extensive in the survey area. They are on uplands and stream terraces. A fragipan in the subsoil restricts penetration by roots and water. Slight wetness is likely early in spring. These soils are strongly acid, but the acidity can be corrected easily by adding lime. The root zone is moderately thick, and the available moisture capacity is moderate. The hazard of erosion is moderate in cultivated areas.

The soils in this unit are suited to all row crops and most pasture and hay plants commonly grown in the Area. Corn, tobacco, and small grains grow fairly well. Some of the suitable pasture and hay plants are Kentucky 31 fescue, orchardgrass, ladino clover, red clover, Kentucky bluegrass, timothy, sericea lespedeza, and Korean lespedeza. Because the root zone is saturated during wet periods, alfalfa and some other perennial plants are short lived.

Where these soils are cultivated, various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on the Captina soil where the slope is 4 percent and 100 feet long, a cropping system consisting of corn and meadow can be used if (1) the field is contour farmed, (2) the first crop of corn is used for silage and the field is planted to a winter cover crop, (3) the second crop of corn is harvested for grain and the residue is left on the soil, and (4) a high level of mangement is used.

If these soils are used for pasture, management that provides a good plant cover is needed.

CAPABILITY UNIT IIe-9

This unit consists of mostly gently sloping soils of the Clymer, Tate, Tilsit, and Wellston series. Tilsit soils are moderately well drained, and the rest are well drained. The Clymer and Tate soils have a moderately sandy subsoil, and the Wellston soil has a silt loam to silty clay loam subsoil. Also, the Clymer soil in this unit is slightly droughty.

The soils of this unit have moderate to moderately low natural fertility. They are very strongly acid, but crops respond well to added lime and fertilizer. The root zone is moderately thick to thick. The Tilsit soil is moderately deep to a fragipan. These soils are easily tilled and easily kept in good tilth. The hazard of erosion is moderate in cultivated areas.

The soils of this unit are suited to most crops common in the Area. They are especially well suited to corn, tobacco, and small grains. Some of the suitable pasture and hay plants are Kentucky bluegrass, smooth bromegrass, Kentucky 31 fescue, orchardgrass, timothy, alfalfa,

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red clover, ladino clover, white clover, and Korean lespedeza. Alfalfa tends to die in 2 or 3 years on the Tilsit soils.

Where these soils are cultivated, various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on a Wellston silt loam where the slope is 5 percent and 100 feet long, a cropping system of corn, corn, and meadow can be used if (1) the field is contour farmed, (2) all crop residue is left on the soil, and (3) a high level of management is used.

If these soils are used for pasture, management that provides good plant cover is needed.

CAPABILITY UNIT IIw-4

This unit consists of deep, somewhat poorly drained to moderately well drained, nearly level soils of the Cotaco and Stendal series. These soils are on flood plains or foot slopes. A high water table during rainy periods is the main limitation to the growth of crops. The Stendal soil is subject to occasional flooding during the growing season. The soils in this unit are very strongly acid and have moderate natural fertility, but crops on them respond well to added lime and fertilizer. They can be tilled within a wide range of moisture content. In some areas the content of gravel in the surface layer is a moderate hindrance to tillage.

The soils in this unit are suited to most crops and pasture and hay plants grown in the Area. If these soils are artificially drained and are managed at a high level, tobacco and corn grow moderately well and can be grown year after year. Small grains seeded in fall generally are damaged by flooding. Plants that tolerate wetness are well suited. These plants include Kentucky 31 fescue, redtop, red clover, alsike clover, ladino clover, Korean lespedeza, Kobe lespedeza, and reed canarygrass. Alfalfa and orchardgrass generally die out after 2 or 3 years.

CAPABILITY UNIT IIIe-1

This unit consists of deep to moderately deep, sloping, well-drained soils of the Allegheny, Clymer, and Tate series. Except for the Clymer, these soils have high available moisture capacity and moderate natural fertility. The Clymer soil is slightly droughty and is less fertile. The acreage of soils in this unit is fairly small, but it is important to farming in the Area. Except for some places that are gravelly, these soils are easy to till. They are strongly acid or very strongly acid, and crops on them respond well to added lime and fertilizer. The hazard of erosion is high in cultivated areas.

The soils in this unit are suited to all crops and pasture and hay plants grown in the Area. They are well suited to corn, tobacco, and small grains. Suitable pasture and hay plants are Kentucky 31 fescue, smooth bromegrass, Kentucky bluegrass, orchardgrass, timothy, alfalfa, red clover, ladino clover, white clover, and Korean lespedeza.

Various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on the Clymer soil where the slope is 8 percent and 100 feet long, a cropping system of corn, corn, and meadow can be used if (1) the field is contour farmed, (2) the first crop of corn is used for silage and the field is planted to a winter cover crop, (3) the second crop of corn is harvested for grain and the residue is left on the soil, and (4) a high level of management is used.

If these soils are used for pasture, management that provides a good plant cover is needed.

CAPABILITY UNIT IIIe-2

This unit consists of deep, sloping, well-drained soils of the Muse and Wellston series. These soils are fairly extensive throughout the survey area. They have moderate natural fertility, but crops grow slightly better on the Wellston soil than on the Muse soil. These soils are strongly acid or very strongly acid, and crops respond well to added lime and fertilizer. Good tilth is fairly easy to maintain. The hazard of erosion is high in cultivated areas.

The soils of this unit are suited to all crops and pasture and hay plants common in the Area. They are well suited to tobacco, corn, and small grains. Some suitable pasture and hay plants are Kentucky bluegrass, orchardgrass, Kentucky 31 fescue, timothy, alfalfa, red clover, ladino clover, white clover, and Korean lespedeza.

Various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on the Wellston soil where the slope is 8 percent and 100 feet long, a cropping system consisting of corn, corn, meadow, and meadow can be used if (1) the field is contour farmed, (2) the first crop of corn is used for silage, and (3) a high level of management is used.

If these soils are used for pasture, management that provides good plant cover is needed.

CAPABILITY UNIT IIIw-1

Only Tyler silt loam is in this capability unit. It is nearly level, is somewhat poorly drained, and has a fragipan at a depth of 10 to 20 inches. This soil occurs mostly on stream terraces. It is very strongly acid, has moderately low natural fertility, and has moderate available moisture capacity. Runoff is slow, and water tends to stand in depressions after rains. Tile drains generally do not function well in this soil, because of slow permeability of the fragipan.

This soil is poorly suited to most row crops grown in the Area. A seasonal high water table and shallowness to the fragipan restrict the choice of plants. Drained areas are moderately well suited to corn and small grains, and corn can be grown continuously under a high level of management. Tobacco grows only moderately well, even where this soil has been drained. Kentucky 31 fescue, redtop, red clover, alsike clover, ladino clover, Korean lespedeza, Kobe lespedeza, reed canarygrass, and other plants that withstand slight to moderate wetness grow well on this soil.

CAPABILITY UNIT IIIw-5

Only Atkins silt loam is in this capability unit. It is a deep, nearly level, poorly drained soil on flood plains. This soil is susceptible to both ponding and flooding and stays wet most of the time. Permeability is moderate, and erosion is not a hazard. This soil is very strongly acid, but in drained areas crops respond fairly well to added lime and fertilizer.

This soil is poorly suited to most row crops grown in the Area. Under a high level of management, drained areas are moderately well suited to corn, but growth of tobacco is poor to moderately good. Small grains seeded in fall generally are damaged by flooding. Suitable pasture plants are orchardgrass, red clover, timothy, Korean lespedeza, Kobe lespedeza, Kentucky 31 fescue, redtop, reed canarygrass, alsike clover, and ladino clover. If a high level of management is used, this soil can be cultivated continuously without damage to soil structure or tilth.

CAPABILITY UNIT IVe-1

This unit consists of sloping to strongly sloping, well-drained or somewhat excessively drained soils of the Dekalb and Tate series. They are on foot slopes and uplands. The Tate soil is deep and has high available moisture capacity; the Dekalb soil is moderately deep to deep and has low to moderate available moisture capacity. The soils in this unit are very strongly acid, and crops on them grow better if lime and fertilizer are added. In some places strong or steep slopes hinder tillage. The hazard of erosion is very high in cultivated areas.

The soils in this unit are suited to most crops and pasture plants grown in the Area. Tobacco, corn, and small grains grow moderately well under a high level of management. Well-suited pasture plants are Kentucky bluegrass, smooth bromegrass, alfalfa, ladino clover, Kentucky 31 fescue, orchardgrass, red clover, and sericea lespedeza.

Where these soils are cultivated, various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on the Tate soil where the slope is 12 percent and 75 feet long, a cropping sequence of corn, corn, meadow, meadow can be used if the soil is contour farmed and a high level of management is used.

If these soils are used for pasture, management that provides a good ground cover is needed.

CAPABILITY UNIT IVe-3

This unit consists of strongly sloping, moderately deep to deep soils of the Muse, Trappist, and Monongahela series. The Monbnghela soil has a fragipan at a depth of about 25 inches that restricts root growth and keeps part of the root zone saturated during wet periods. All of these soils have a silty or clayey subsoil and moderate to high available moisture capacity. They are very strongly acid, but crops respond well to added lime and fertilizer. The hazard of erosion in cultivated areas is very high.

The soils in this unit are fairly well suited or well suited to most crops commonly grown in the survey area, though alfalfa generally dies after 2 or 3 years on Monongahela soil. They are moderately well suited to tobacco, corn, and small grains under a high level of management. Suitable pasture and hay plants are Kentucky bluegrass, smooth bromegrass, alfalfa, ladino clover, Kentucky 31 fescue, orchardgrass, red clover, and sericea lespedeza.

Various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on the Trappist soil where the slope is 12 percent and 75 feet long, a cropping system consisting of corn and 4 years of meadow can be used if (1) the field is contour farmed, (2) all residue from the corn crop is left on the soil, and (3) a high level of management is used.

If these soils are used for pasture, management that provides good plant cover is needed.

CAPABILITY UNIT IVe-11

This unit consists of sloping, severely eroded silty clay loam soils of the Muse and Trappist series. These soils are not extensive in the survey area. They are slightly or moderately droughty and have moderate to moderately low natural fertility. Tillage is somewhat difficult. These soils are very strongly acid, and crops respond only fairly well to added lime and fertilizer. The hazard of erosion in cultivated areas is very high.

The soils of this unit are suited to most row crops and pasture plants grown in the survey area. Tobacco, corn, and small grains grow moderately well under a high level of management. Kentucky 31 fescue, sericea lespedeza, and Korean lespedeza grow well on these soils, but Kentucky bluegrass, orchardgrass, timothy, and red clover grow only fairly well.

Various combinations of cropping systems and conservation practices can be used to slow runoff and control erosion. For example, on the Trappist soil where the slope is 8 percent and 75 feet long, a cropping system consisting of corn and 3 years of meadow can be used if (1) the field is contour farmed and (2) a high level of management is used.

If these soils are used for pasture, management is needed that provides good plant cover.

CAPABILITY UNIT IVw-1

Only Robertsville silt loam is in the unit. This soil is not extensive in the survey area. It is nearly level, is poorly drained, and has a fragipan at a depth of 10 to 22 inches. This soil occurs next to large flood plains, and some areas are flooded occasionally. The chief limitations to use are a thin root zone, slow permeability, and a seasonal high water table. The slowly permeable fragipan greatly hinders drainage by tile lines, and suitable outlets for the lines are scarce. In drained areas crops respond well to added fertilizer and lime. Erosion is not a hazard on this soil.

This soil is poorly suited to most row crops grown in the survey area. Growth of corn is poor to moderate under a high level of management. Tobacco and small grains generally are not grown on this soil. Suitable pasture and meadow plants include Kentucky 31 fescue, reed canarygrass, redtop, alsike clover, ladino clover, Korean lespedeza, and Kobe lespedeza.

Under a high level of management, this soil can be cultivated. A suitable cropping system is corn for 2 years and a sod-forming crop for 2 years. The sod-forming crop helps to maintain soil structure and tilth.

CAPABILITY UNIT VIe-1

This unit consists of moderately steep, deep to moderately deep, well-drained soils of the Dekalb, Muse, Tate, and Trappist series. These soils are on foot slopes, side slopes, and ridgetops of the uplands. They are widely scattered throughout the Area, though the total acreage is fairly small. These soils are strongly acid. The available moisture capacity is moderate to high, and natural fertility, in most places, is moderate.

The soils in this unit are not suited to cultivation. The risk of erosion is high, and the moderately steep slopes hinder the use of farm machinery. Pasture is a good use. Kentucky 31 fescue, sericea lespedeza, and Korean lespedeza grow well, but Kentucky bluegrass, orchardgrass, timothy, red clover, and alfalfa grow only fairly well.

The most important concern of management of these eroded soils is providing a good plant cover. The pasture mixture selected should be one that provides satisfactory grazing and ground cover and that requires the least frequent renovation. Pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIe-2

This unit consists of strongly sloping to moderately steep, severely eroded soils of the Muse, Trappist, and Weikert series. These soils are on foot slopes, benches, side slopes, and ridgetops of the uplands. The Muse and Trappist soils have a silty clay loam plow layer and a moderately thick to thick root zone. The Weikert soil has a silt loam plow layer, many coarse fragments, and is shallow or very shallow to bedrock. All the soils in this unit are strongly acid and slightly to moderately droughty, but the Weikert soil is more droughty than the other soils.

Because the risk of erosion is high, the soils in this unit are not suited to row crops. The Muse and Trappist soils are suited to hay and pasture plants. Kentucky 31 fescue and sericea lespedeza grow well, but Kentucky bluegrass, orchardgrass, timothy, red clover, sweetclover, and Korean lespedeza grow only fairly well. The Weikert soil is poorly suited to pasture, because establishing and maintaining good plant cover is difficult. It is better suited as woodland.

The most important concern of management on these severely eroded soils is providing good plant cover. The pasture mixture selected should be one that provides satisfactory grazing and ground cover and that requires the least frequent renovation. Pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIe-5

Only Colbert silty clay loam, 6 to 20 percent slopes, is in this capability unit. It is on benches and ridgetops. This soil has a clay, nonacid subsoil that overlies weakly calcareous clay shale. Permeability is slow, and a very plastic clay layer at a depth of 2 feet or less restricts root growth. Natural fertility is moderate, but droughtiness reduces plant growth during short dry periods.

Because of droughtiness, rapid runoff, and a high risk of erosion, this soil is not suited to cultivated crops. Where slopes are not more than 8 percent, it can be cultivated occasionally, but growth of crops generally is poor. This soil is suited to pasture and hay. Kentucky bluegrass, orchardgrass, timothy, red clover, sweetclover, and Korean lespedeza grow well, but stands are not long lived. Kentucky 31 fescue and sericea lespedeza grow better than the other crops.

The most important concern of management on this soil is providing a good plant cover. The pasture or hay mixture should be one that provides satisfactory grazing and ground cover and that requires the least frequent renovation. Pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIe-8

This unit consists of strongly sloping, shallow to moderately deep soils of the Clymer, Dekalb, and Ramsey series. These soils are on uplands. They are widely scattered throughout the survey area, though the total acreage is small. These soils have low to moderate available moisture capacity and generally are droughty. They are very strongly acid.

Because of a high risk of erosion, the soils of this unit are not suited to row crops. Pasture or hay is a good use. Kentucky 31 fescue and sericea lespedeza grow well on these soils, and Kentucky bluegrass, orchardgrass, timothy, red clover, and Korean lespedeza grow fairly well. All of these plants grow better on the Clymer soil than on the other soils in this unit.

The most important concern in managing these moderately steep soils is providing adequate plant cover. The pasture mixture selected should be one that provides satisfactory grazing and ground cover and that requires the least frequent renovation. Pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIs-1

This unit consists of sloping to strongly sloping, rocky soils of the Talbott series. These soils occur in karst areas and on convex side slopes. The total acreage is small. These soils have a moderately thick root zone. Available moisture capacity is moderate, and permeability is moderately slow. In places rock crops out and hinders the use of farm machinery.

Because these soils are rocky and erodible, they are not suited to row crops. They are suited to pasture, but loose stones on and in the surface layer and rock outcrops interfere with tillage and the preparation of a seedbed for hay crops. Kentucky bluegrass, orchardgrass, timothy, red clover, sweetclover, and Korean lespedeza grow fairly well, but stands are not vigorous, plants are short lived, and renovation is needed frequently. Kentucky 31 fescue and sericea lespedeza grow better than the other plants and provide better plant cover.

The most important concern in managing these rocky, erodible soils is providing a good plant cover. The pasture mixture selected should be one that provides satisfactory grazing and ground cover and that requires the least frequent renovation. Pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants.

Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIs-3

This unit consists of strongly sloping to moderately steep, stony soils of the Tate series. These soils are at the head of drains and on side slopes, generally below cliffs. They are widely scattered throughout the survey area, though the total acreage is fairly small. These soils are strongly acid or very strongly acid and have moderate natural fertility. Permeability is moderate to moderately rapid, and the soils are slightly droughty.

The soils in this unit are not suited to cultivated crops but can be used satisfactorily for pasture. Stones, rock outcrops, and steepness hinder the use of most farm machinery and the preparation of seedbeds. Orchardgrass, red clover, and Korean lespedeza can be grown, but stands are not vigorous, plants are short lived, and renovation is needed frequently. Kentucky 31 fescue and sericea lespedeza grow better than these other plants and provide better ground cover.

Because the hazard of erosion on these soils is high, the most important concern of management is providing a good plant cover. The pasture mixture selected should be one that provides satisfactory grazing and ground cover and that requires the least frequent renovation. Pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIIe-1

This unit consist of steep to very steep, mostly well-drained soils of the Dekalb, Gilpin, Muse, Tate, Trappist, and Renox series. These soils are extensive. They have low to moderately high natural fertility. The Renox soil is nonacid, but the other soils are very strongly acid.

Because of steepness and the very high hazard of erosion, the soils of this unit are not suited to cultivated crops. The Gilpin, Muse, and Renox soils are too steep for use as pasture and should be kept as woodland or wildlife habitat. The Tate soil in this unit is suited to grazing but is better used as woodland or wildlife habitat. When used for grazing, the choice of plants is limited. Kentucky 31 fescue, sericea lespedeza, and Korean lespedeza grow moderately well. Kentucky bluegrass and alfalfa stands are not vigorous, and the plants are short lived.

The most important concern of management is providing good plant cover. Mowing pastures for weed control, spreading fertilizer and lime, and operating other farm machines are difficult, costly, and in places hazardous because of steepness. Where these soils are used for pasture, the pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIIs-1

This unit consists of moderately deep to deep, stony and bouldery soils of the Gilpin, Muse, Shelocta, Tate, and Trappist series. The acreage of this unit is among the most extensive in the survey area. Stones and boulders cover from 10 to 90 percent of the surface. These soils are strongly acid or very strongly acid and have moderate to moderately high natural fertility.

Because of steepness, the hazard of erosion, and stones and boulders on the surface, the soils of this unit are not suited to cultivation. In most places they are too steep and too stony and bouldery for satisfactory use for pasture and are better used as woodland or wildlife habitat. Areas that are less sloping and have fewer stones and boulders are suited to limited grazing. Kentucky 31 fescue and sericea lespedeza can be planted in these areas, but growth is poor, even where management is good. Any other plants grown in these areas will be extremely short lived.

Maintaining good ground cover is the most important concern of management. Where these soils are used for pasture, the pasture should not be grazed continuously. Rest periods are needed after each period of grazing to allow time for renewed growth of the plants. Grazing should be managed to maintain these plants at a minimum height of 3 inches.

CAPABILITY UNIT VIIs-2

This unit consists of Rock land, areas of Very stony land, and soils of the Talbott and Tate series. Some areas consist of 25 percent or more rock outcrops and Talbott soils; other areas consist of Tate soils that have 40 to 90 percent of the surface covered by stones and boulders. The total acreage in this unit is small. The soils are mostly droughty, medium acid, and low in organic-matter content.

Rock outcrops and very stony areas have little or no value for farming. They provide a habitat for some kinds of wildlife, and some stony areas are suited as woodland. The Talbott soils in this unit are suited only as woodland or wildlife habitat, but the Tate soils provide limited grazing. Kentucky 31 fescue and sericea lespedeza are suitable for planting, but growth is poor, even where management is good. Other pasture plants are short lived.

Maintaining ground cover adequate to control erosion is the most important concern of management. Operating farm machinery on this unit is extremely difficult and hazardous. Grazing periods should be short and rest periods long to allow time for renewed growth of plants. These plants should not be grazed below a height of 3 inches.

CAPABILITY UNIT VIIIs-1

Only one mapping unit, Rock outcrop, is in this capability unit. This land type consists of areas in which 90 percent or more of the surface is sandstone outcrops, and the rest is small areas of shallow sandy soil between the outcrops. Rock outcrop has no value for commercial crops. It has value mainly as scenic and recreational sites.

Estimated Yields

In table 2 soils of the McCreary-Whitley Area are listed and the average acre yields of principal crops that can be expected under two levels of management are given. The yields in columns A are expected under a medium level of management; those in columns B are expected under a high level of management. Absence of a yield figure in the table indicates that the crop is not commonly grown, is not well suited to the soil, or cannot be feasibly grown under the level of management specified. Soils not shown in the table are considered too steep, too stony, or too rocky for the crop listed. In addition, miscellaneous land types are not shown because their use is limited to nonagricultural purposes, or their properties are too variable to allow reliable estimates.

The information is based on research and experimental work carried on by the Agricultural Research Service, the University of Kentucky Agricultural Experiment Station, and the Soil Conservation Service. More detailed information can be obtained from the local office of the Soil Conservation Service, the Agricultural Extension Service, and the Agricultural Experiment Station.

A medium level of management is generally considered the minimum fertilization, treatment, and management that will keep the soil from deteriorating and yet produce enough crops for some profit.

A high level of management includes (1) the use of suitable crops and varieties; (2) use of appropriate seeding rates, harvesting methods, inoculation of legumes, and planting dates; (3) control of runoff, erosion, weeds, insect pests, and plant diseases; (4) applying lime and fertilizer according to recommendations of the University of Kentucky Agricultural Experiment Station or according to the results of soil tests; (5) use of drainage if needed; (6) use of an appropriate cropping system and of crop residues; and (7) use of applicable conservation practices, such as contour farming, terracing, stripcropping, and grassed waterways. High-level management of pasture includes fertilizing, liming, mowing, seeding desirable plants, and controlling grazing.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are expected under a medium level of management; those in columns B are expected under a high level of management. Absence of yield indicates crop is not commonly grown, is not well suited to the soil, or cannot be feasibly grown under the level of management specified. Some very steep, stony, or rocky soils and the miscellaneous land types have been omitted]

Soil	Corn		Wheat		Tobacco [1]	Alfalfa and grass		Red clover [2] and grass		Lespedeza (Korean, Kobe)		Pasture (tall fescue-legume)	
	A	B	A	B	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Allegheny gravelly loam, 6 to 12 percent slopes	70	95	25	35	2, 200	2. 2	3. 5	1. 7	2. 8	1. 4	2. 0	130	220
Atkins silt loam	50	80	----	----	----	----	----	----	----	----	2. 0	130	200
Captina silt loam, 2 to 6 percent slopes	60	80	20	30	2, 000	1. 4	2. 5	2. 0	2. 8	1. 5	2. 2	160	230
Clymer fine sandy loam, 2 to 6 percent slopes	65	90	20	30	1, 950	2. 1	3. 0	1. 6	2. 6	1. 5	2. 1	150	220
Clymer fine sandy loam, 6 to 12 percent slopes	55	80	20	30	1, 800	2. 0	3. 0	1. 5	2. 5	1. 3	1. 8	140	200
Clymer and Dekalb fine sandy loams, 12 to 20 percent slopes:													
Clymer part	45	70	20	25	1, 700	2. 0	2. 8	2. 2	2. 3	----	----	120	190
Dekalb part	45	65	15	20	1, 350	1. 6	2. 0	1. 3	1. 8	1. 0	1. 5	95	160
Colbert silty clay loam, 6 to 20 percent slopes	----	----	----	----	----	1. 5	2. 8	1. 4	2. 1	----	1. 4	90	150
Cotaco silt loam	65	95	25	40	1, 750	----	----	2. 0	2. 7	. 9	2. 0	160	240
Dekalb fine sandy loam, 6 to 12 percent slopes	45	65	15	20	1, 350	1. 6	2. 0	1. 3	1. 8	1. 0	1. 5	95	160
Dekalb and Ramsey sandy loams, 12 to 20 percent slopes:													
Dekalb part	----	60	15	20	----	----	2. 0	1. 2	1. 6	----	----	70	130
Ramsey part	----	----	----	----	----	----	----	1. 0	1. 4	----	----	60	100
Dekalb and Tate sandy loams, 20 to 30 percent slopes:													
Dekalb part	----	----	----	----	----	----	----	----	----	----	----	70	125
Tate part	----	----	----	----	----	1. 8	3. 0	1. 9	2. 5	----	----	95	170
Dekalb and Tate sandy loams, 30 to 50 percent slopes:													
Dekalb part	----	----	----	----	----	----	----	----	----	----	----	50	90
Tate part	----	----	----	----	----	----	----	----	----	----	----	80	140
Elk silt loam	80	120	30	50	2, 450	3. 0	4. 5	2. 0	3. 5	2. 0	3. 0	170	245
Huntington silt loam	85	130	35	50	2, 550	2. 5	4. 0	2. 0	3. 2	2. 0	3. 0	170	255
Muse silt loam, 6 to 12 percent slopes	60	85	20	30	1, 900	2. 5	3. 5	1. 9	2. 8	1. 2	2. 0	140	225
Muse silt loam, 12 to 20 percent slopes	50	75	20	25	1, 750	2. 3	3. 2	1. 7	2. 6	----	----	135	220
Muse silty clay loam, 6 to 12 percent slopes, severely eroded	45	65	15	20	1, 650	1. 9	3. 0	1. 5	2. 4	. 9	1. 6	120	190
Muse silty clay loam, 12 to 20 percent slopes, severely eroded	----	----	----	----	----	1. 5	2. 8	1. 2	2. 0	----	----	110	185
Muse-Shelocta stony silt loams, 20 to 40 percent slopes	----	----	----	----	----	----	----	----	----	----	----	80	140
Muse-Trappist silt loams, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----	----	120	190
Muse-Trappist silt loams, 30 to 50 percent slopes	----	----	----	----	----	----	----	----	----	----	----	75	135

See footnotes at end of table.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Tobacco [1]	Alfalfa and grass		Red clover [2] and grass		Lespedeza (Korean, Kobe)		Pasture (tall fescue-legume)	
	A	B	A	B	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Muse-Trappist silty clay loams, 20 to 30 percent slopes, severely eroded												70	130
Philo fine sandy loam	70	100	25	35	1, 950	2. 2	3. 5	2. 0	2. 8	1. 5	2. 2	160	230
Philo silt loam	75	110	25	40	2, 200	2. 5	4. 0	2. 1	3. 0	1. 6	2. 5	170	235
Pope fine sandy loam, 4 to 20 percent slopes	75	110	25	40	2, 200	2. 8	4. 4	2. 1	3. 0	1. 6	2. 5	170	235
Pope soils, 0 to 4 percent slopes	80	125	35	50	2, 450	3. 0	4. 4	2. 2	3. 2	1. 7	2. 8	180	245
Robertsville silt loam	40	60								1. 2	1. 8	100	165
Stendal sandy loam	65	90	15	30	1, 850			1. 6	2. 2	1. 5	2. 2	155	225
Talbott rocky silt loam, 6 to 12 percent slopes							2. 8		2. 4	1. 2	1. 8	90	160
Talbott rocky silt loam, 12 to 20 percent slopes						2. 3	2. 7	1. 9	2. 2			85	155
Talbott very rocky silty clay, 12 to 20 percent slopes, severely eroded												70	110
Tate fine sandy loam, 0 to 6 percent slopes	75	95	25	35	2, 150	3. 2	3. 8	2. 5	3. 4	1. 6	2. 3	135	220
Tate loam, 6 to 12 percent slopes	65	85	20	30	1, 900	2. 3	3. 6	2. 5	3. 2	1. 5	2. 0	125	200
Tate loam, 12 to 20 percent slopes	55	80	20	30	1, 650	2. 1	3. 4	2. 3	2. 9			115	190
Tate loam, 20 to 30 percent slopes						1. 8	3. 0	1. 9	2. 5			95	170
Tate loam, 30 to 50 percent slopes												80	140
Tate stony sandy loam, 12 to 20 percent slopes						1. 8	3. 1	2. 0	2. 6			90	165
Tate stony sandy loam, 20 to 30 percent slopes												80	150
Tate stony sandy loam, 30 to 50 percent slopes												65	130
Tate-Trappist stony complex, 25 to 45 percent slopes												65	130
Tilsit silt loam, 2 to 6 percent slopes	60	75	20	30	2, 000	1. 3	2. 2	1. 8	2. 5	1. 4	2. 1	140	215
Trappist silty clay loam, 6 to 12 percent slopes, severely eroded	40	60	15	20	1, 500	1. 5	2. 5	1. 3	2. 1	. 8	1. 5	95	180
Trappist silty clay loam, 12 to 20 percent slopes, severely eroded												80	160
Trappist-Monongahela silt loams, 12 to 20 percent slopes	45	65	15	20	1, 650	1. 9	2. 6	2. 0	2. 7			85	170
Trappist-Weikert silt loams, 12 to 20 percent slopes, severely eroded:													
Trappist part												80	160
Weikert part												65	125
Tyler silt loam	45	70	15	25	1, 550			1. 2	1. 8	1. 3	2. 0	115	200
Wellston silt loam, 6 to 12 percent slopes	65	95	25	35	2, 200	2. 3	3. 7	2. 0	2. 7	1. 6	2. 4	155	230
Wellston and Tilsit silt loams, 2 to 6 percent slopes:													
Wellston part	75	105	25	35	2, 300	2. 5	4. 0	2. 3	3. 0	1. 9	2. 6	160	235
Tilsit part	60	75	20	30	2, 000	1. 3	2. 2	1. 8	2. 5	1. 4	2. 1	140	215

[1] Tobacco is a highly specialized crop and is grown only under a high level of management.

[2] Because red clover is not cut for hay the first year after seeding, yields are those expected the second year.

[3] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the pasture. An acre of pasture that provides 80 days of grazing for three cows has a carrying capacity of 240 cow-acre-days.

Engineering Uses of Soils

This subsection gives brief descriptions of the systems of engineering soil classification, estimates of engineering properties of soils, ratings of suitability for soils used in construction material, and specific soil characteristics that affect the use of soils in engineering structures and practices.

Soil properties frequently influence design, construction, and maintenance of engineering structures. The properties most important are permeability to water, shear strength, compaction characteristics, shrink-swell characteristics, soil drainage, grain size, plasticity, and reaction. Depth to bedrock, depth to water table, and topography are also important.

With the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works that involve heavy loads or where the excavations are deeper than the depth of layers here reported. Even in these situations, however, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

The information in this survey can be used to—

1. Aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils that will help in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables; and in planning detailed investigations at the selected locations.
4. Locate probable sources of road fill and topsoil.
5. Correlate performance of engineering structures with soil mapping units, and thus develop information that will be useful in planning, designing, and maintaining structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and construction equipment.
7. Supplement the 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.

Much of the information in this subsection is in tables 3, 4, and 5. Table 3 gives estimates of the properties of soils significant to engineering; table 4 gives engineering interpretations of the soils; and table 5 gives engineering test data.

Some of the terms used by soil scientists may not be familiar to the engineer, and some terms may have special meaning in soil science. Several of these terms are defined in the Glossary at the back of this survey.

Engineering classification systems

Two systems of classifying soil materials are in general use by engineers. These classifications have special meaning for engineering purposes.

Many highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (AASHO) (*1*).[2] In this system, soil materials are classified in seven main groups on the basis of field performance. The groups range from A-1 (gravelly soils having high bearing capacity) to A-7 (clayey soils having low strength when wet).

Some engineers prefer the Unified system of soil classification that was established by the Corps of Engineers, U.S. Army (*26*). This system is based on the texture and plasticity of soils and their performance as material in engineering construction. Of the 15 classes in this system, 8 are for coarse-grained material, 6 for fine-grained material, and 1 for highly organic material.

Engineering properties of soils

In table 3 are estimates of some soil properties significant to engineering. These properties are based on the study, by horizons, of a typical soil profile. A typical profile for each soil series is described in the section "Descriptions of the Soils." The estimates listed in table 3 are based on information gained from field experience, characteristics described for a typical profile, and available test data for similar soils.

Depth to a seasonal high water table, as shown in table 3, is difficult to determine accurately. During wet periods, the soils on ridgetops that have slowly per-

[2] Italic numbers in parentheses refer to Literature Cited, p. 81.

TABLE 3.—*Estimated properties of*

[Made land (Ma), Strip mines (St), and Rock outcrop (Ru)

Soil series and map symbol	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture
	Feet	*Feet*	*Inches*	
Allegheny (AgC)	4+	5-10	0-22	Gravelly loam
			22-32	Gravelly clay loam
			32-45	Gravelly clay loam
Atkins (At)	0	6-8+	0-20	Silt loam
			20-28	Loam
			28-42	Sandy clay loam
Captina (CaB)	1½-2	3½-6	0-24	Silt loam
			24-42	Silty clay loam (fragipan)
			42	Hard sandstone.
Clymer (ClB, ClC, CmD) (For properties of Dekalb soil in mapping unit CmD, refer to the Dekalb series.)	4+	2-4	0-11	Sandy loam
			11-31	Heavy loam
			31-37	Sandy clay loam
			37	Soft sandstone.

meable horizons may have a water table perched above these layers, though the permanent water table normally is much below these layers.

Table 3 gives the estimated U.S. Department of Agriculture textural classification of soils (*21*). Textural classes are based on the percentages of sand, silt, and clay. The important layers are also classified according to the AASHO (*1*) and Unified (*26*) systems.

The column that shows permeability gives the estimated rate, in inches per hour, that water moves through a soil as it occurs in place.

Available water capacity, in inches per inch of soil depth, refers to the approximate amount of capillary water in the soil when it is wet to field capacity. When the soil is at the wilting point of common crops, this amount of water will wet the soil material to a depth of 1 inch without deeper penetration.

The reaction, or pH, given in table 3 is that which would be expected for soil in its natural or untreated state. The pH has been raised in cultivated fields that have been limed.

The rating for shrink-swell potential indicates the volume change to be expected when the moisture content changes. The terms used to rate this potential, *low*, *moderate*, and *high*, are determined by the amount and kind of clay in each layer. In general, soils classified CH have high shrink-swell potential, and clean sand and gravel or soils that have small amounts of plastic material have low shrink-swell potential.

Engineering interpretations of soils

In table 4 the soils are rated for susceptibility to frost action and for suitability as a source of topsoil and road fill. Also shown in the table are features affecting highway location, farm ponds, agricultural drainage, irrigation, terraces and diversions, and grassed waterways. These interpretations are based on the information given in table 3, on field experience, and on observed performance of the soils.

Susceptibility to frost action depends on the texture of the soil, the depth to the water table during the freezing period, and the length of time that the temperature is below freezing. The ratings are *high*, *moderate*, and *low*. Soils that contain much silt and very fine sand are rated high in susceptibility to frost action; coarser textured soils are less susceptible. Exposed areas are particularly affected by frost heaving and readily eroded.

The ratings of soils as a source of topsoil are *good*, *fair*, and *poor*, and apply mainly to the surface layer. These ratings are based on soil characteristics that affect the use of soils for covering road shoulders, cut slopes, lawns, and other disturbed areas. This covering of topsoil helps to promote rapid growth of plants.

The suitability of soils for road fill is rated *good*, *fair*, and *poor* in table 4. These ratings are based on plasticity, content of water, compaction characteristics, erodibility, and the amount of rock to the normal depth of excavation. Generally, sandy or coarse-textured soils are rated good, and the finer textured soils are rated fair or poor. Very highly plastic clay is unsuitable.

For features that adversely affect highway location, the entire soil profile is evaluated. The factors considered are the presence and thickness of organic matter, depth to bedrock, amount of stones and boulders, ground-water conditions, flood hazard, topography, and soil properties.

soils in the McCreary-Whitley Area

are so variable that their properties were not estimated]

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					Inches per hour	*Inches per inch of soil*	*pH value*	
GM, ML	A-4	65–85	60–80	35–65	2. 0 -6. 3	0. 08–0. 12	5. 1–5. 5	Low.
GC, SC	A-2, A-4, A-6	60–80	55–75	30–45	2. 0 -6. 3	0. 11–0. 14	5. 1–5. 5	Low.
GM, GP, ML	A-2, A-4	30–70	25–65	10–60	2. 0 -6. 3	0. 11–0. 12	5. 1–5. 5	Low.
ML	A-4	95–100	85–100	75–90	0. 63–2. 0	0. 18–0. 23	4. 5–5. 0	Moderate.
SM, ML	A-4	95–100	80–100	45–75	0. 63–2. 0	0. 16–0. 20	4. 5–5. 0	Low.
SM, ML, CL	A-4, A-6	85–100	80–100	45–75	0. 63–2. 0	0. 14–0. 18	4. 5–5. 0	Low to moderate.
ML, CL	A-4, A-6	95–100	90–100	80–95	0. 63–2. 0	0. 18–0. 23	5. 1–5. 5	Low.
CL	A-6	90–100	85–100	75–95	<0. 2	0. 16–0. 18	4. 5–5. 0	Moderate to low.
SM, ML	A-2, A-4	85–95	80–90	25–55	2. 0 -6. 3	0. 12–0. 14	4. 5–5. 0	Low.
ML, CL, SM	A-4, A-6	80–90	65–75	40–75	0. 63–2. 0	0. 14–0. 18	4. 5–5. 0	Low.
SC, CL	A-2, A-4, A-6	65–95	60–85	20–55	0. 63–2. 0	0. 10–0. 12	4. 5–5. 0	Low.

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TABLE 3.—*Estimated properties of soils*

Soil series and map symbol	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture
	Feet	*Feet*	*Inches*	
Colbert (CoD)	4–6	2½–3½	0–3	Heavy silty clay loam
			3–32	Clay to silty clay
			32–38	Silty clay
Cotaco (Ct)	1–2	4–15	0–8	Silt loam
			8–19	Heavy silt loam
			19–26	Silty clay loam
			26–42	Silty clay loam
Dekalb (DeC, DrD, DtE, DtF) (For properties of Ramsey soil in mapping unit DrD and Tate soils in mapping units DtE and DtF, refer to their respective series.)	4+	2–3	0–25	Sandy loam
			25	Soft sandstone.
Elk (Ek)	4+	6–20	0–15	Silt loam
			15–48	Silty clay loam
Gilpin (Mapped only with Muse soil.)	4+	1½–2½	0–10	Silt loam
			10–21	Silty clay loam
			21	Siltstone and shale.
Huntington (Hu)	4+	4–10	0–40	Silt loam, loam
			40–58	Sandy loam
Monongahela (Mapped only with Trappist soil.)	1½–2	4+	0–9	Silt loam
			9–23	Light silty clay loam
			23–49	Loam, clay loam (fragipan)
Muse (MeC, MeD, MlC3, MlD3, MmG, MnE, MoF, MpE, MpF, MtE3). (For properties of Gilpin soils in mapping units MmG and MoF, of Shelocta soils in mapping units MnE and MoF, of Trappist soils in mapping units MpE, MpF, and MtE3, refer to their respective series.)	4+	4+	0–8	Silt loam, silty clay loam
			8–20	Silty clay loam
			20–70	Silty clay
Philo (Pf, Ph)	1½–2	6+	0–28	Fine sandy loam or silt loam
			28–50	Sandy loam
Pope (PoD, PsA)	4+	6+	0–12	Silt loam or fine sandy loam
			12–63	Sandy loam
Ramsey (Mapped only with Dekalb soils.)	4+	1–2	0–5	Sandy loam
			5–18	Loamy sand
			18	Soft sandstone.
Renox (RcF)	4–10	4–15	0–15	Silt loam
			15–21	Silt loam
			21–42	Silty clay loam
Robertsville (Re)	0	6–20	0–8	Silt loam
			8–11	Silty clay loam
			11–42	Clay loam, loam (fragipan)
Shelocta (Mapped only with Muse soils.)	4+	3–10	0–13	Silt loam
			13–29	Light silty clay loam
			29–47	Light silty clay loam
			47–50	Silty clay
Stendal (Sd)	½–1	6+	0–12	Sandy loam
			12–26	Sandy loam
Talbott (Rt, TaC, TaD, TbD3) (Rock land in mapping unit Rt is too variable for properties to be estimated.)	6+	2–3½	0–4	Silt loam
			4–7	Silty clay loam
			7–18	Silty clay
			18–33	Clay
			33	Limestone bedrock.

in the McCreary-Whitley Area—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					Inches per hour	*Inches per inch of soil*	*pH value*	
CL	A–6, A–7	85–100	80–100	80–100	0. 2 –0. 63	0. 14–0. 18	6. 6–7. 3	Moderate.
CH	A–7	85–100	80–100	70–100	<0. 2	0. 14–0. 18	6. 6–7. 3	High.
GC, CH	A–7, A–6	50–80	45–80	40–75	<0. 2	0. 15–0. 18	6. 6–7. 3	High.
ML	A–4	85–100	80–100	65–95	0. 63–2. 0	0. 18–0. 23	5. 1–5. 5	Low.
ML, CL	A–4, A–6	80–95	75–95	60–90	0. 63–2. 0	0. 18–0. 23	4. 5–5. 0	Low.
CL, ML	A–6, A–4	70–90	65–90	55–75	0. 2 –0. 63	0. 19–0. 21	4. 5–5. 0	Low.
CL, GC, GM	A–6	60–85	55–80	45–60	2. 0 –6. 3	0. 19–0. 21	4. 5–5. 0	Low.
SM, ML	A–2, A–4	70–95	65–90	25–55	2. 0 –6. 3	0. 10–0. 12	4. 5–5. 0	Low.
ML, CL	A–4, A–6	95–100	95–100	65–80	0. 63–2. 0	0. 14–0. 18	5. 1–5. 5	Low.
CL, ML	A–6, A–4	95–100	90–95	75–90	0. 63–2. 0	0. 14–0. 18	5. 1–5. 5	Moderate to low.
ML	A–4	85–100	80–90	75–85	0. 63–2. 0	0. 18–0. 23	4. 5–5. 0	Low.
CL, ML	A–6, A–4	70–90	75–85	55–70	0. 63–2. 0	0. 16–0. 18	4. 5–5. 0	Moderate to low.
ML	A–4	95–100	90–100	75–100	0. 63–2. 0	0. 18–0. 23	6. 6–7. 3	Low.
SM, SC	A–2, A–4	85–95	75–90	20–45	2. 0 –6. 3	0. 12–0. 14	6. 6–7. 3	Low.
ML, CL	A–4, A–6	90–100	85–95	75–95	0. 63–2. 0	0. 16–0. 18	5. 1–7. 3	Low.
ML, CL	A–4, A–6	90–100	85–95	70–95	0. 2 –0. 63	0. 16–0. 18	4. 5–5. 0	Low.
ML, CL	A–4, A–6	80–95	75–90	50–80	<0. 2	0. 14–0. 18	4. 5–5. 0	Low.
ML, CL	A–4	95–100	85–95	80–95	0. 63–2. 0	0. 18–0. 23	4. 5–5. 0	Low.
CL	A–6	90–100	80–95	80–95	0. 2 –2. 0	0. 19–0. 21	4. 5–5. 0	Moderate.
CH, CL	A–7, A–6	90–100	85–100	80–95	0. 2 –0. 63	0. 15–0. 18	4. 5–5. 0	High.
SM, ML	A–4	80–100	75–95	40–80	0. 63–2. 0	0. 14–0. 19	4. 5–5. 0	Low.
SM	A–2, A–4	80–90	75–90	25–45	0. 63–6. 3	0. 10–0. 12	4. 5–5. 0	Low.
ML, SM	A–4	85–100	80–95	55–80	0. 63–2. 0	0. 18–0. 20	4. 5–5. 0	Low.
SM, GM	A–2, A–4	60–85	55–80	25–45	0. 63–6. 3	0. 10–0. 14	4. 5–5. 0	Low.
SM	A–2, A–4	85–100	80–95	20–45	2. 0 –6. 3+	0. 06–0. 10	4. 5–5. 0	Low.
SM, SM–SP	A–2	85–95	80–95	10–30	6. 3+	0. 04–0. 06	4. 5–5. 0	Low.
ML	A–4	85–95	80–95	75–90	0. 63–2. 0	0. 18–0. 23	6. 6–7. 3	Low.
ML, CL	A–4, A–6	75–90	70–90	65–85	0. 63–2. 0	0. 12–0. 16	6. 1–7. 3	Low.
GC, CL	A–6, A–2	40–85	35–80	30–75	0. 63–2. 0	0. 09–0. 12	6. 1–7. 3	Moderate.
ML	A–4	95–100	95–100	90–100	0. 63–2. 0	0. 18–0. 23	5. 1–5. 5	Low.
CL, ML	A–6	95–100	90–100	75–100	0. 63–2. 0	0. 16–2. 0	4. 5–5. 0	Low.
CL, ML	A–6, A–4	85–100	80–95	55–95	<0. 2	0. 16–0. 18	4. 5–5. 0	Low to moderate.
ML	A–4	90–100	85–100	75–95	0. 63–2. 0	0. 18–0. 23	4. 5–5. 0	Low.
CL	A–6	85–95	80–95	75–95	0. 63–2. 0	0. 19–0. 21	5. 1–5. 5	Low.
CL, GC	A–6	50–80	45–75	35–70	0. 63–2. 0	0. 09–0. 14	5. 1–5. 5	Low.
CL, CH	A–6, A–7	90–100	90–100	85–100	0. 2 –0. 63	0. 15–0. 18	5. 1–5. 5	High.
SM, GM	A–2, A–4	65–100	60–100	25–45	2. 0 –6. 3	0. 10–0. 14	4. 5–5. 0	Low.
SM, GM	A–2, A–4	65–100	60–100	30–45	0. 63–6. 3	0. 10–0. 14	4. 5–5. 0	Low.
ML, CL	A–4	90–100	85–100	70–95	0. 63–2. 0	0. 18–0. 23	5. 1–5. 5	Low.
CL	A–6	90–100	85–100	80–95	0. 2 –0. 63	0. 18–0. 20	5. 6–6. 0	Moderate.
CL, CH	A–7, A–6	90–100	85–100	80–95	0. 2 –0. 63	0. 15–0. 18	5. 6–6. 0	High.
CH	A–7	90–100	85–100	85–100	0. 2 –0. 63	0. 15–0. 18	5. 6–6. 0	High.

TABLE 3.—*Estimated properties of soils*

Soil series and map symbol	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface of typical profile	Classification: USDA texture
	Feet	*Feet*	*Inches*	
Tate (Tc, TeB, TlC, TlD, TlE, TlF, TmD, TmE, TmF, TnF, ToE). (Very stony land in mapping unit Tc is too variable for properties to be estimated; for properties of Trappist soil in mapping unit TnF and of Shelocta and Muse soils in mapping unit ToE, refer to their respective series.)	4+	4–12	0–8	Loam or fine sandy loam
			8–34	Loam or clay loam
			34–48	Clay loam to sandy loam
Tilsit (TpB)	1½–2	3½–5½	0–19	Silt loam
			19–28	Silty clay loam (fragipan)
			28–64	Silty clay, silty clay loam
			64	Sandstone bedrock.
Trappist (TrC3, TrD3, TsD, TwD3) (For properties of Monongahela soil in mapping unit TsD and of Weikert soil in mapping unit TwD3, refer to their respective series.)	4+	1½–2½ to shale.	0–8	Silt loam, silty clay loam
			8–17	Silty clay
			17–22	Silty clay
			22	Soft clayey shale.
Tyler (Ty)	½–1½	4+	0–6	Silt loam
			6–12	Silty clay loam
			12–15	Silt loam (fragipan)
			15–32	Silty clay loam (fragipan)
			32–42	Silt loam
Weikert (Mapped only with Trappist soil.)	5+	1–1½	0–5	Silt loam
			5–18	Silt loam
			18	Hard shale.
Wellston (WeC, WtB) (For properties of Tilsit soil in mapping unit WtB, refer to the Tilsit series.)	4+	3–5	0–20	Silt loam
			20–34	Silty clay loam, clay loam
			34	Sandstone bedrock.

TABLE 4.—*Interpretations of*

[Made land (Ma), Strip mines (St), and Rock outcrop

Soil series and map symbol	Susceptibility to frost action	Suitability as a source of— Topsoil	Suitability as a source of— Road fill	Soil features affecting engineering practices for— Highway location
Allegheny (AgC)	Low	Poor	Good	Features favorable
Atkins (At)	High	Fair	Fair to poor	Subject to flooding; seasonal high water table.
Captina (CaB)	Moderate	Fair	Fair	Seasonal high water table; seepage along top of fragipan.

See footnotes at end of table.

in the McCreary-Whitley Area—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					Inches per hour	*Inches per inch of soil*	*pH value*	
ML, SM	A-4	85-95	80-95	35-80	0. 63-6. 3	0. 14-0. 18	4. 5-5. 0	Low.
ML	A-4	85-100	85-95	55-80	0. 63-2. 0	0. 14-0. 18	4. 5-5. 0	Low.
CL, SM	A-6, A-2	85-90	80-90	20-75	0. 63-6. 3	0. 14-0. 18	4. 5-5. 0	Low.
ML, CL	A-4, A-6	95-100	90-100	75-95	0. 63-2. 0	0. 18-0. 23	4. 5-5. 0	Low.
CL	A-6	85-95	80-95	80-95	<0. 2	0. 19-0. 21	4. 5-5. 0	Low.
CH, CL	A-7, A-6	90-100	85-100	80-95	0. 2 -0. 63	0. 15-0. 18	4. 5-5. 0	Moderate.
ML, CL	A-4, A-6	85-95	80-95	75-95	0. 63-2. 0	0. 19-0. 23	4. 5-5. 0	Low.
CH, CL	A-7, A-6	80-95	75-95	75-95	0. 2 -0. 63	0. 15-0. 17	4. 5-5. 0	Moderate.
CH, CL	A-7, A-6	65-90	60-85	55-80	0. 2 -0. 63	0. 15-0. 17	4. 5-5. 0	Moderate.
ML	A-4	95-100	80-100	65-100	0. 63-2. 0	0. 18-0. 23	4. 5-5. 0	Low.
CL	A-6	85-100	80-100	80-90	0. 63-2. 0	0. 19-0. 21	5. 1-5. 5	Low.
ML, CL	A-4, A-6	80-100	80-100	75-100	0. 2 -0. 63	0. 18-0. 23	5. 1-5. 5	Low.
CL	A-6	85-100	85-100	80-100	<0. 2	0. 19-0. 21	5. 1-5. 5	Moderate to low.
ML, CL	A-4, A-6	85-100	80-100	75-100	0. 2 -2. 0	0. 18-0. 23	5. 1-5. 5	Low.
ML	A-4	30-85	25-75	20-70	0. 63-2. 0	0. 08-0. 12	4. 5-5. 0	Low.
GM	A-2	30-60	25-50	15-35	2. 0 -6. 3	0. 07-0. 11	4. 5-5. 0	Low.
ML, CL	A-4, A-6	95-100	90-100	85-100	0. 63-2. 0	0. 18-0. 23	4. 5-5. 0	Low.
CL	A-6	95-100	90-100	75-90	0. 63-2. 0	0. 16-0. 18	4. 5-5. 0	Moderate to low.

engineering properties of the soils [1]

(Ru) are so variable that interpretations were not made]

Soil features affecting engineering practices for—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions [2]	Grassed waterways
Reservoir area	Embankment				
Pervious substratum	Features favorable	Not needed	Moderately rapid permeability.	Some slopes steeper than 8 percent.	Gravelly.
Seasonal high water table; probability of seepage because of pervious substratum.	Some hazard of piping and instability.	Subject to flooding; seasonal high water table; few outlets.	Subject to flooding	Terraces not needed; subject to flooding.	Seasonal high water table.
Pervious layer in substratum in in places.	Fair stability	Not needed where slopes are more than 2 percent; fragipan at a depth of about 21 inches.	Slow permeability in fragipan.	Seepage along top of fragipan.	Seepage along top of fragipan on side slopes.

TABLE 4.—*Interpretations of*

Soil series and map symbol	Susceptibility to frost action	Suitability as a source of—		Soil features affecting engineering practices for—
		Topsoil	Road fill	Highway location
Clymer (ClB, ClC, CmD). (For interpretations of Dekalb soil in mapping unit CmD, refer to interpretations for the Dekalb series.)	Low	Good to fair	Good	Bedrock at a depth of 2 to 4 feet.
Colbert (CoD)	Moderate	Poor	Poor	Bedrock at a depth of 2½ to 3½ feet; plastic clay; high shrink-swell potential.
Cotaco (Ct)	Moderate to high.	Fair	Fair	Seasonal high water table; seepage.
Dekalb (DeC, DrD, DtE, DtF). (For interpretations of Ramsey soil in mapping unit DrD and Tate soils in mapping units DtE and DtF, refer to interpretations for their respective series.)	Low	Poor to fair	Good	Bedrock at a depth of 2 to 3 feet; steep in places.
Elk (Ek)	Moderate	Good	Fair	Features favorable
Gilpin. (Mapped only with Muse soil.)	Low to moderate.	Fair to good	Fair	Bedrock at a depth of 1½ to 2½ feet; steep slopes.
Huntington (Hu)	Moderate	Good	Fair	Subject to flooding
Monongahela. (Mapped only with Trappist soil.)	Moderate	Fair	Fair	Seasonal high water table; seepage along top of fragipan.
Muse (MeC, MeD, MlC3, MlD3, MmG, MnE, MoF, MpE, MpF, MtE3). (For interpretations of Gilpin soils in mapping units MmG and MoF, of Shelocta soils in mapping units MnE and MoF, of Trappist soils in mapping units MpE, MpF, and MtE3, refer to interpretations for their respective series.)	Moderate	Fair	Poor	Steep in many places; very stony in places; fair to poor stability.
Philo (Pf, Ph)	Moderate to low.	Fair	Fair	Subject to flooding; seasonal high water table.
Pope (PoD, PsA)	Low to moderate.	Good in surface layer.	Good	Subject to flooding
Ramsey. (Mapped only with Dekalb soils.)	Low	Poor	Good; material limited.	Bedrock at a depth of 1 to 2 feet.
Renox (RcF)	Moderate	Good	Fair	Steep slopes
Robertsville (Re)	High	Poor	Fair	Seasonal high water table; subject to flooding in some places.

See footnotes at end of table.

engineering properties of the soils [1]—Continued

Soil features affecting engineering practices for—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions [2]	Grassed waterways
Reservoir area	Embankment				
Substratum and bedrock pervious in places.	Some hazard of piping; fair stability.	Not needed	Features favorable	Some slopes steeper than 8 percent.	Features favorable.
Excess seepage through crevices in bedrock in places.	Soil material limited; poor compaction.	Not needed	Slow permeability	Some slopes steeper than 8 percent.	Bedrock at a depth of 2½ to 3½ feet; plastic clay subsoil.
Excess seepage in places; seasonal high water table.	Some hazard of piping; fair stability.	Seasonal high water table.	Features favorable	Features favorable	Coarse fragments.
Pervious substratum	Soil material is limited in places; hazard of piping; moderately pervious.	Not needed	Rapid permeability; some slopes of 20 to 50 percent.	Slopes steeper than 8 percent in most places.	Bedrock at a depth of 2 to 3 feet; some slopes too steep; low available water capacity.
Pervious substratum	Features favorable	Not needed	Features favorable	Some slopes steeper than 8 percent.	Features favorable.
Steep slopes	Steep slopes; bedrock at a depth of 1½ to 2½ feet.	Not needed	Slopes too steep	Slopes too steep	Slopes too steep.
Subject to flooding; pervious substratum.	Some hazard of piping; fair to poor stability.	Not needed	Features favorable	Terraces not needed	Features favorable.
Features favorable	Features favorable	Not needed	Slopes of 12 to 20 percent; slow permeability in fragipan.	Slopes too steep	Slopes too steep; seepage along top of fragipan.
Steep in many places.	Steep in many places; very stony in places; fair to poor compaction.	Not needed	Steep in many places; moderately slow permeability.	Slopes are steeper than 8 percent in many places.	Steep in many places; very stony in places; clayey subsoil.
Pervious substratum; subject to flooding.	Hazard of piping; fair stability.	Features favorable	Subject to flooding	Terraces not needed	Features favorable.
Pervious substratum; subject to flooding.	Hazard of piping; fair stability.	Not needed	Moderately rapid permeability; subject to flooding.	Terraces not needed	Features favorable.
Pervious substratum.	Hazard of piping; fair stability; moderately pervious.	Not needed	Rapid permeability; slopes are 12 to 20 percent; low fertility.	Slopes are 12 to 20 percent.	Droughty; bedrock at a depth of 1 to 2 feet.
Steep slopes	Features favorable	Not needed	Steep slopes	Steep slopes	Steep slopes.
Subject to flooding in some places; pervious substratum.	Fair compaction; poor to fair stability; hazard of piping.	Slow permeability in fragipan; seasonal high water table.	Slow permeability; seasonal high water table.	Seasonal high water table; slow permeability.	Seasonal high water table; seepage along top of fragipan.

TABLE 4.—*Interpretations of*

Soil series and map symbol	Susceptibility to frost action	Suitability as a source of—		Soil features affecting engineering practices for—
		Topsoil	Road fill	Highway location
Shelocta (Mapped only with Muse soils.)	Low	Poor; stony	Poor; steep and stony.	Steep slopes; very stony
Stendal (Sd)	High	Fair	Poor	Subject to flooding; seasonal high water table.
Talbott (Rt, TaC, TaD, TbD3) (Rock land in mapping unit Rt is too variable for interpretations to be made.)	Moderate	Poor	Poor	Bedrock at a depth of 2 to 3½ feet; rock outcrops.
Tate (Tc, TeB, TlC, TlD, TlE, TlF, TmD, TmE, TmF, TnF, ToE). (Very stony land in mapping unit Tc is too variable for interpretations to be made; for interpretations of Trappist soil in mapping unit TnF and of Shelocta and Muse soils in mapping unit ToE, refer to interpretations for their respective series.)	Low	Fair	Good	Steep slopes in many places; bouldery or very stony in some places.
Tilsit (TpB)	Moderate	Fair	Fair	Seasonal high water table; seepage along top of fragipan.
Trappist (TrC3, TrD3, TsD, TwD3)	Moderate	Fair	Poor	Shale bedrock at a depth of 1½ to 2½ feet; slopes steep in some places.
Tyler (Ty)	High	Fair	Poor	Seasonal high water table; seepage along top of fragipan.
Weikert (Mapped only with Trappist soil.)	Low	Poor	Fair; material limited.	Shale bedrock at a depth of about 18 inches.
Wellston (WeC, WtB) (For interpretations of Tilsit soil in mapping unit WtB, refer to interpretations for the Tilsit series.)	Moderate	Fair	Fair	Features favorable

[1] For engineering interpretations of soils for community development and recreation, see table 6, page 50.

engineering properties of the soils [1]—Continued

Soil features affecting engineering practices for—Continued						
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions [2]	Grassed waterways
Reservoir area	Embankment				
Steep slopes	Steep slopes; very stony.	Not needed	Steep slopes	Slopes too steep	Steep slopes; very stony.
Pervious substratum; subject to flooding; seasonal high water table.	Hazard of piping; poor to fair stability.	Features favorable	Seasonal high water table.	Seasonal high water table; terraces not needed.	Seasonal high water table.
Bedrock at a depth of 2 to 3½ feet; crevices in bedrock.	Poor compaction; rock outcrops.	Not needed	Some slopes are steeper than 8 percent; moderately slow permeability; rock outcrops.	Most slopes are steeper than 8 percent; rock outcrops.	Rock outcrops; clayey subsoil.
Pervious substratum; steep in places.	Hazard of piping; bouldery; very stony and steep in some places.	Not needed	Moderately rapid permeability; steep in some places.	Many slopes are steeper than 8 percent; bouldery or very stony in places.	Steep in many places; bouldery or very stony in places.
Features favorable	Features favorable	Slow permeability in fragipan.	Slow permeability; fragipan at a depth of about 1½ feet.	Features favorable	Seepage on side slopes.
Slopes steep in some some places; shale bedrock at a depth of 1½ to 2½ feet.	Fair stability; medium to high compressibility.	Not needed	Moderately slow permeability; slopes steep in some places.	Many slopes steeper than 8 percent.	Steep in many places; moderate available water capacity; bedrock at a depth of 1½ to 2½ feet.
Pervious substratum; seasonal water table.	Poor to fair stability.	Slow permeability; fragipan at depth of about 18 inches; seasonal high water table.	Slow permeability; seasonal high water table.	Features favorable	Seasonal high water table; droughty; seepage along top of fragipan.
Pervious bedrock at a depth of about 18 inches.	Soil material limited; fair stability.	Not needed	Shallow to bedrock; low fertility and available water capacity.	Slopes too steep for terraces.	Shale bedrock at a depth of 18 inches; low fertility; droughty.
Features favorable	Features favorable	Not needed	Features favorable	Features favorable	Features favorable.

[2] Where slopes are more than 8 percent, terraces are not considered feasible.

TABLE 5.—*Engineering*

[Tests performed by the Kentucky Department of Highways in cooperation with U.S. Department of Commerce, Bureau of

Soil name and location	Parent material	Depth	Moisture density [1]		Mechanical analysis [2]		
					Percentage passing sieve—		
			Maximum dry density	Optimum moisture	1 in.	¾ in.	⅜ in.
		Inches	*Lb. per cu. ft.*	*Percent*			
Clymer fine sandy loam: On Pine Knot flat. *Laboratory No.* S64Ky–74–13	Acid sandstone.	0–6	107	16	--------	100	99
		21–31	109	17	--------	100	99
		31–37	113	15	[5] 98	98	98
Dekalb fine sandy loam: 1 mile S. of Greenwood on U.S. Highway No. 27, along Hughes Fork of Beaver Creek. *Laboratory No.* S64Ky–74–8	Acid sandstone.	6–13	122	11	--------	100	99
		23–30	119	10	--------	100	99
		30–43	121	12	--------	100	96
Shelocta silt loam: N. of State Route 759 and about 2 miles E. of U.S. Highway No. 27. *Laboratory No.* S63Ky–74–5	Colluvium from shale.	18–32	113	16	[6] 97	87	70
		32–41	106	18	[7] 99	98	91
		41–67	109	19	100	97	86
N. of State Route 759 and about 2 miles S. of U.S. Highway No. 27. *Laboratory No.* S63Ky–74–6	Colluvium from siltstone and shale.	10–19	104	18	100	100	95
		34–48	104	21	100	91	86
Tilsit silt loam: On Swain Ridge in Cumberland National Forest, 0.5 mile W. of Goodin Ridge Road and 100 yards north of road across Beaver Creek. *Laboratory No.* S63Ky–74–7	Siltstone and shale.	16–19	113	15	--------	--------	--------
		19–28	97	23	--------	--------	--------
		32–38	92	27	--------	--------	--------
Trappist silt loam: N. of State Route 759 and about 2.2 miles E. of U.S. Highway No. 27. *Laboratory No.* S63Ky–74–3	Shale.	9–21	92	29	--------	--------	--------
		21–35	95	28	--------	--------	--------
		35–60	103	20	100	99	93
Wellston silt loam: 50 yards W. of new U.S. Highway 27, north of Greenwood. *Laboratory No.* S64Ky–74–39	Siltstone.	3–8	111	15	--------	--------	100
		18–28	115	14	[7] 99	99	96
		31–42	109	18	--------	100	99

[1] Based on AASHO Designation T 99–57, Method A (*1*).

[2] Mechanical analyses according to American Association of State Highway Officials Designation T88–57 (*1*). Results by 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 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 naming textural classes for soils.

Affecting farm pond reservoir areas are those features of an undisturbed soil and the underlying bedrock that affect their suitability for holding water. These features are permeability, seepage, depth to water table, depth to bedrock or other unfavorable material that allows seepage, and topography that affects the amount of water that can be stored. Affecting farm pond embankments are those features of disturbed soils that affect their suitability for use in constructing earth fills. Where they have significant thickness for borrow material, both the subsoil and substratum are evaluated. The features evaluated include stability, compaction characteristics, permeability, compressibility, and resistance to piping.

Agricultural drainage is affected by those features that affect the installation and performance of surface and subsurface structures. These features include permeability, texture, structure, depth to any restricting layer, depth to water table, flooding, and availability of satisfactory outlets.

Affecting the suitability of soils for irrigation are such features as the water-holding capacity, intake rate, depth to water table, depth to any restricting layer, and water erosion. Careful investigation of each site is needed to determine feasibility.

Features affecting the stability, layout, and construction of terraces and diversions include length and steepness of slopes, depth to bedrock or other unfavorable material, availability of outlets, seepage, and stability of *test data*

Public Roads (BPR) in accordance with standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [2]—Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued				Percentage smaller than—							
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			ASSHO	Unified [3]
99	99	98	42	39	28	16	10	[4] NP	[4] NP	A-4 (1)	SM
99	99	99	47	44	40	33	28	28	9	A-4 (2)	SC
98	98	98	32	26	23	17	13	NP	NP	A-2-4 (0)	SM
98	98	93	30	27	20	11	6	NP	NP	A-2-4 (0)	SM
98	96	92	35	28	17	10	7	NP	NP	A-2-4 (0)	SM
90	86	81	24	21	18	15	10	NP	NP	A-1-b (0)	SM
60	47	42	36	34	28	16	11	30	6	A-2-4 (0)	SM-SC
80	71	63	58	56	50	27	15	34	9	A-4 (6)	ML-CL
76	65	55	51	50	44	24	13	35	11	A-6 (5)	ML-CL
88	79	71	67	64	54	32	22	32	9	A-4 (6)	ML-CL
81	70	63	60	57	49	32	22	40	14	A-6 (7)	ML-CL
100	100	98	89	83	66	30	21	27	6	A-4(8)	ML-CL
100	98	95	88	86	77	54	50	44	28	A-7-6(11)	ML-CL
100	99	90	61	59	58	57	45	48	16	A-7-5(9)	ML
100	86	83	81	81	78	56	36	63	17	A-7-5(15)	MH
100	93	91	90	90	86	57	42	61	26	A-7-5(18)	MH
82	76	72	72	71	61	34	23	40	13	A-6(8)	ML-CL
99	98	96	82	74	56	22	12	16	2	A-4(8)	ML
93	90	89	74	66	50	24	18	25	8	A-4(8)	CL
98	98	96	80	75	58	38	28	30	10	A-4(8)	CL

[3] Based on the Unified Soil Classification System (*26*). SCS and BPR have agreed to consider that all soils having plasticity indexes within 2 points of the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are SM-SC and ML-CL.
[4] NP = Nonplastic.
[5] 99 percent passes a 1½-inch sieve.
[6] Stones greater than 3 inches across and comprising about 10 percent of the volume were discarded and not included in test data.
[7] 100 percent passes a 1½-inch sieve.

soil material. Terraces are not considered feasible where slopes are more than 8 percent.

The features considered for establishing grassed waterways include shallowness, steepness, stoniness, and erodibility of soils and the difficulty of establishing and maintaining plants.

Engineering test data

Engineering test data for seven different soil types of six soil series are given in table 5. Laboratory tests of samples of the horizons of these soils were made by the Kentucky Department of Highways Research Laboratory. The data probably do not show the maximum variations in the horizons of each soil series, but are representative of that series. Because samples at most sites were obtained to a depth of less than 7 feet, the data may not be suitable for estimating the characteristics of soil material from deep cuts.

The soil classifications in table 5 were made on the basis of data obtained by mechanical analyses and by tests to determine the liquid limit and the plastic limit. Mechanical analyses were made by the combined sieve and hydrometer methods. The percentages of clay obtained by the hydrometer method should not be used in naming textural classes.

Table 5 gives the compaction (moisture-density) data for the soils tested. If the soil material is compacted at successively higher moisture content, assuming that the compactive effort remains the same, the density of the compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed maximum density. Moisture-density data are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about maximum density, when it is at approximately the optimum moisture content.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a fine-grained soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from the plastic to the liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Use of Soils for Recreational and Community Developments

The McCreary-Whitley Area has many natural and historic features that provide potential areas for outdoor recreation. These features include Cumberland Falls, Natural Arch, Yahoo Falls, Great Gulf, and Lake Cumberland. Knowledge of the limitations of soils aids in selecting and planning potential areas for recreational facilities and community developments, including suitable sites for buildings and play areas.

Table 6 shows the estimated ratings of the degree and kind of limitations of each soil in the Area for recreational facilities and community developments. A rating of *slight* indicates that the soil has few limitations and that they are easily overcome. A soil rated *moderate* has limitations that can be overcome but that requires special management practices. A rating of *severe* indicates serious limitations requiring intensive management practices. This rating does not imply that the soil cannot be used for the purpose stated. Where the rating is severe, however, the cost involved in overcoming the limitation may not be justified. The ratings given in the

TABLE 6.—*Limitations of soils for*

[Made land (Ma) and Strip mines (St) are

Mapping unit and symbol	Estimated degree and kind of limitations if limitation is moderate or severe		
	Septic tank filter fields	Impoundments and sewage lagoons	Buildings with basements
Allegheny gravelly loam, 6 to 12 percent slopes (AgC).	Moderate: slope	Severe: slope; moderate permeability in substratum.	Moderate: slope
Atkins silt loam (At)	Severe: high water table; flooding hazard.	Severe: flooding hazard	Severe: flooding hazard; high water table.
Captina silt loam, 2 to 6 percent slopes (CaB)	Severe: slow permeability.	Moderate: slope	Moderate: high water table.
Clymer fine sandy loam, 2 to 6 percent slopes (ClB).	Moderate: bedrock at a depth of 2 to 4 feet.	Moderate: bedrock at depth of 2 to 4 feet; slope; pervious substratum.	Moderate: bedrock at a depth of 2 to 4 feet.
Clymer fine sandy loam, 6 to 12 percent slopes (ClC).	Moderate: bedrock at a depth of 2 to 4 feet; slope.	Severe: pervious substratum; slope.	Moderate: bedrock at a depth of 2 to 4 feet; slope.
Clymer and Dekalb fine sandy loams, 12 to 20 percent slopes (CmD):			
Clymer soil	Severe: bedrock at a depth of 2 to 4 feet; slope.	Severe: slope; pervious substratum.	Moderate: bedrock at a depth of 2 to 4 feet; slope.
Dekalb soil	Severe: bedrock at a depth of 2 to 3 feet.	Severe: slope; pervious substratum.	Moderate: bedrock at a depth of 2 to 3 feet.
Colbert silty clay loam, 6 to 20 percent slopes (CoD).	Severe: bedrock at a depth of 2½ to 3½ feet; slow permeability; slope.	Severe: slope; bedrock at a depth of 2½ to 3½ feet; poor material.	Moderate: bedrock at a depth of 2½ to 3½ feet; slope.

See footnote at end of table.

table do not eliminate the need for investigations at the site, because of the small area needed for many of the uses rated. The section "Engineering Uses of Soils" contains some detailed information needed for engineering design.

The criteria used in determining the degree and kind of limitations to various uses shown in table 6 are discussed in the following paragraphs.

The limitations of soils for use as a filter field for disposal of septic tank effluent are steep slopes, a seasonal high water table, flooding, shallowness to bedrock, stoniness, and slow permeability. A rating of moderate indicates that the soil has borderline limitations and that a careful investigation should be made at the proposed site.

Soil features limiting the development of impoundments and sewage lagoons are steep slopes, flooding, rapid permeability of the subsoil, and shallowness to bedrock. The impoundments discussed here are shallow water developments that can be used for boating, fishing, swimming, and other kinds of recreation. They require a surface area of at least 0.1 acre of water and a depth of 6 feet or more over one-fourth of the area. Specific interpretations of soils for reservoirs and earthen dams that are also applicable to these impoundments are in the section "Engineering Uses of Soils." Sewage lagoons are shallow ponds that are built to dispose of sewage in areas where septic tanks or other sewage systems are not feasible.

Limitations for service buildings and homesites were rated for buildings of three stories or less that have basements. Soil features limiting the use of these sites are a seasonal high water table, flood hazard, steep slopes, depth to and kind of bedrock, and the need for land shaping and other landscaping. If buildings do not have basements, depth to bedrock and seasonal high water table are not so limiting as stated in the table.

The limitations of soils for roads are rated for light and medium traffic. Soil features limiting use of soils for roads are steepness, seasonal high water table, flooding, depth to and kind of rock, and stoniness. Bridle paths, nature trails, and footpaths are less restricted by these features.

Features limiting the use of soils for athletic fields are a clayey or gravelly surface layer, stoniness or rockiness, a high water table, steep slopes, and flooding. Athletic fields include small nearly level areas intensively used for baseball, tennis, football, and other sports.

recreational and community developments

so variable that limitations are not rated]

Estimated degree and kind of limitations if limitation is moderate or severe—Continued				
Roads	Athletic fields	Play and picnic areas	Campsites	
			Tents	Trailers
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Severe: slope.
Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.	Severe: high water table; flooding hazard.
Moderate: high water table.	Severe: slow permeability.	Slight	Severe: slow permeability.	Severe: slow permeability.
Moderate: bedrock at a depth of 2 to 4 feet.	Moderate: slope	Moderate: bedrock at a depth of 2 to 4 feet.	Slight	Moderate: slope.
Moderate: bedrock at a depth of 2 to 4 feet; slope.	Severe: slope	Moderate: slope; bedrock at a depth of 2 to 4 feet.	Moderate: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope; slow permeability.	Severe: slope	Severe: slope; slow permeability.	Severe: slope; slow permeability.

TABLE 6.—*Limitations of soils for recreational*

Mapping unit and symbol	Estimated degree and kind of limitations if limitation is moderate or severe		
	Septic tank filter fields	Impoundments and sewage lagoons	Buildings with basements
Cotaco silt loam (Ct)	Moderate to severe: high water table.	Moderate: pervious substratum.	Moderate to severe: high water table.
Dekalb fine sandy loam, 6 to 12 percent slopes (DeC).	Moderate: bedrock at a depth of 2 to 3 feet; slope.	Severe: slope; pervious substratum.	Moderate: bedrock at a depth of 2 to 3 feet; slope.
Dekalb and Ramsey sandy loams, 12 to 20 percent slopes (DrD).			
Dekalb soil	Severe: bedrock at a depth of 2 to 3 feet; slope.	Severe: slope; pervious substratum.	Moderate: bedrock at a depth of 2 to 3 feet; slope.
Ramsey soil	Severe: bedrock at a depth of 1 to 1½ feet; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope.
Dekalb and Tate sandy loams, 20 to 30 percent slopes (DtE).	Severe: slope	Severe: slope	Severe or moderate: slope.[1]
Dekalb and Tate sandy loams, 30 to 50 percent slopes (DtF).	Severe: slope	Severe: slope	Severe: slope
Elk silt loam (Ek)	Slight	Moderate: pervious substratum.	Slight
Huntington silt loam (Hu)	Severe: flooding hazard	Severe: flooding hazard	Severe: flooding hazard
Muse silt loam, 6 to 12 percent slopes (MeC)	Severe: moderately slow permeability.	Severe: slope	Moderate: slope
Muse silty clay loam, 6 to 12 percent slopes, severely eroded (MlC3).	Severe: moderately slow permeability.	Severe: slope	Moderate: slope
Muse silt loam, 12 to 20 percent slopes (MeD)	Severe: slope; moderately slow permeability.	Severe: slope	Moderate: slope
Muse silty clay loam, 12 to 20 percent slopes, severely eroded (MlD3).	Severe: slope; stoniness in some areas; moderately slow permeability.	Severe: slope	Severe: slope; stoniness in some areas.
Muse and Gilpin silt loams, 50 to 65 percent slopes (MmG).	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Muse-Shelocta stony silt loams, 20 to 40 percent slopes (MnE).	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Muse-Shelocta-Gilpin stony silt loams, 40 to 60 percent slopes (MoF).	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Muse-Trappist silt loams, 20 to 30 percent slopes (MpE).	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Muse-Trappist silt loams, 30 to 50 percent slopes (MpF).	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Muse-Trappist silty clay loams, 20 to 30 percent slopes, severely eroded (MtE3).	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Philo find sandy loam (Pf)	Severe: flooding hazard	Severe: pervious substratum; flooding hazard.	Severe: flooding hazard

See footnote at end of table

and community developments—Continued

Estimated degree and kind of limitations if limitation is moderate or severe—Continued				
Roads	Athletic fields	Play and picnic areas	Campsites	
			Tents	Trailers
Moderate: high water table.	Moderate: high water table.	Slight to moderate: high water table.	Moderate to severe: high water table.	Moderate to severe: high water table.
Moderate: bedrock at a depth of 2 to 3 feet; slope.	Severe: slope	Moderate: slope	Moderate: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: bedrock at a depth of 1 to 1½ feet; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope.	Severe: bedrock at a depth of 1 to 1½ feet; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Slight	Slight	Slight	Slight	Slight.
Severe: flooding hazard	Moderate: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.
Moderate: slope; high shrink-swell potential.	Severe: slope	Moderate: slope; silt loam surface layer.	Moderate: slope; moderately slow permeability.	Severe: slope.
Moderate: slope; high shrink-swell potential.	Severe: slope	Moderate: slope; silty clay loam surface layer.	Moderate: slope; moderately slow permeability.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas..
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope	Severe: slope; stoniness in some areas.
Severe: flooding hazard	Moderate: high water table; flooding hazard.	Moderate: flooding hazard.	Moderate: high water table; flooding hazard.	Moderate: high water table; flooding hazard.

TABLE 6.—*Limitations of soils for recreational*

Mapping unit and symbol	Estimated degree and kind of limitations if limitation is moderate or severe		
	Septic tank filter fields	Impoundments and sewage lagoons	Buildings with basements
Philo silt loam (Ph)	Severe: flooding hazard	Severe: pervious substratum; flooding hazard.	Severe: flooding hazard
Pope fine sandy loam, 4 to 20 percent slopes (PoD).	Severe: slope; flooding hazard.	Severe: slope; pervious substratum; flooding hazard.	Severe: flooding hazard
Pope soils, 0 to 4 percent slopes (PsA)	Severe: flooding hazard	Severe: pervious substratum; flooding hazard.	Severe: flooding hazard
Renox channery silt loam, 40 to 60 percent slopes (RcF).	Severe: slope	Severe: slope	Severe: slope
Robertsville silt loam (Re)	Severe: high water table; slow permeability.	Moderate: fair amount of soil material.	Severe: high water table
Rock land-Talbott complex (Rt):			
Rock land	Severe: rockiness	Severe: rockiness	Severe: rockiness
Talbott soil	Severe: slope; moderately slow permeability; rockiness.	Severe: slope; rockiness	Severe: rockiness
Rock outcrop (Ru)	Severe	Severe	Severe
Stendal sandy loam (Sd)	Severe: flooding hazard; high water table.	Severe: pervious substratum; flooding hazard.	Severe: flooding hazard; high water table.
Talbott rocky silt loam, 6 to 12 percent slopes (TaC).	Severe: bedrock at a depth of 2 to 3½ feet; moderately slow permeability.	Severe: slope	Moderate: slope; rockiness.
Talbott rocky silt loam, 12 to 20 percent slopes (TaD).	Severe: slope; moderately slow permeability.	Severe: slope	Moderate: slope; rockiness.
Talbott very rocky silty clay loam, 12 to 20 percent slopes, severely eroded (TbD3).	Severe: slope; moderately slow permeability; rockiness.	Severe: slope; rockiness	Severe: rockiness
Tate-Very stony land complex (Tc):			
Tate soil	Severe: slope	Severe: slope	Severe: slope; stoniness
Very stony land	Severe: stoniness	Severe: stoniness	Severe: stoniness
Tate fine sandy loam, 0 to 6 percent slopes (TeB).	Slight	Severe: pervious substratum.	Slight
Tate loam, 6 to 12 percent slopes (TlC)	Moderate: slope	Severe: slope	Moderate: slope
Tate loam, 12 to 20 percent slopes (TlD)	Severe: slope	Severe: slope	Moderate: slope
Tate loam, 20 to 30 percent slopes (TlE)	Severe: slope	Severe: slope	Severe: slope
Tate loam, 30 to 50 percent slopes (TlF)	Severe: slope	Severe: slope	Severe: slope
Tate stony sandy loam, 12 to 20 percent slopes (TmD).	Severe: slope; stoniness	Severe: slope	Severe: slope; stoniness
Tate stony sandy loam, 20 to 30 percent slopes (TmE).	Severe: slope; stoniness	Severe: slope	Severe: slope; stoniness
Tate stony sandy loam, 30 to 50 percent slopes (TmF).	Severe: slope; stoniness	Severe: slope	Severe: slope; stoniness

See footnote at end of table.

and community developments—Continued

Estimated degree and kind of limitations if limitation is moderate or severe—Continued				
Roads	Athletic fields	Play and picnic areas	Campsites	
			Tents	Trailers
Severe: flooding hazard	Moderate: high water table; flooding hazard.	Moderate: flooding hazard.	Moderate: high water table; flooding hazard.	Moderate: high water table; flooding hazard.
Severe: flooding hazard	Moderate: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.
Severe: flooding hazard	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: high water table.	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.
Severe: rockiness	Severe: rockiness	Severe: rockiness	Severe: rockiness	Severe: rockiness.
Severe: slope; rockiness	Severe: rockiness	Severe: rockiness	Severe: rockiness	Severe: rockiness.
Severe	Severe	Severe	Severe	Severe.
Severe: flooding hazard.	Severe: high water table.	Moderate: high water table.	Severe: high water table.	Severe: high water table.
Moderate: slope; rockiness.	Severe: slope	Moderate: slope	Moderate: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope; rockiness.	Severe: slope; rockiness; surface texture.	Severe: slope; surface texture.	Severe: slope; surface texture.	Severe: slope; surface texture.
Severe: slope; stoniness	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: stoniness	Severe: stoniness	Severe: stoniness	Severe: stoniness	Severe: stoniness.
Slight	Slight	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope; stoniness	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.
Severe: slope; stoniness	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.
Severe: slope; stoniness	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.

TABLE 6.—*Limitations of soils for recreational*

Mapping unit and symbol	Estimated degree and kind of limitations if limitation is moderate or severe: Septic tank filter fields	Impoundments and sewage lagoons	Buildings with basements
Tate-Trappist stony complex, 25 to 45 percent slopes (TnF):			
Tate soil	Severe: slope; stoniness	Severe: slope	Severe: slope; stoniness
Trappist soil	Severe: depth to rock; slope.	Severe: slope; depth to rock.	Severe: slope; stoniness
Tate, Shelocta, and Muse stony soils, 12 to 35 percent slopes (ToE):			
Tate soil	Severe: slope; stoniness	Severe: slope	Severe: slope; stoniness
Shelocta soil	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Muse soil	Severe: slope; stoniness in some areas.	Severe: slope	Severe: slope; stoniness in some areas.
Tilsit silt loam, 2 to 6 percent slopes (TpB)	Severe: slow permeability.	Moderate: slope	Moderate: high water table.
Trappist silty clay loam, 6 to 12 percent slopes, severely eroded (TrC3).	Severe: bedrock at a depth of 1½ to 2½ feet; slow permeability.	Severe: slope; bedrock at a depth of 1½ to 2½ feet.	Moderate: slope; bedrock at a depth of 1½ to 2½ feet.
Trappist silty clay loam, 12 to 20 percent slopes, severely eroded (TrD3).	Severe: bedrock at a depth of 1½ to 2½ feet; slope.	Severe: slope	Moderate: slope; bedrock at a depth of 1½ to 2½ feet.
Trappist-Monongahela silt loams, 12 to 20 percent slopes (TsD):			
Trappist soil	Severe: bedrock at a depth of 1½ to 2½ feet; slope.	Severe: slope	Moderate: slope; bedrock at a depth of 1½ to 2½ feet.
Monongahela soil	Severe: bedrock at a depth of 4 to 5 feet; slope; slow permeability.	Severe: slope	Moderate: slope; bedrock at a depth of 4 to 5 feet.
Trappist-Weikert silt loams, 12 to 20 percent slopes, severely eroded (TwD3):			
Trappist soil	Severe: slope; bedrock at depth of 1½ to 2 feet.	Severe: slope; bedrock depth of 1½ to 2 feet.	Severe: slope; bedrock at a depth of 1½ to 2 feet.
Weikert soil	Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.
Tyler silt loam (Ty)	Severe: high water table; slow permeability.	Slight	Severe: high water table.
Wellston silt loam, 6 to 12 percent slopes (WeC).	Moderate: slope; bedrock at a depth of 3 to 5 feet.	Severe: slope	Moderate: slope; bedrock at a depth of 3 to 5 feet.
Wellston and Tilsit silt loams, 2 to 6 percent slopes (WtB):			
Wellston soil	Moderate: bedrock at a depth of 3 to 5 feet.	Moderate: slope	Moderate: bedrock at a depth of 3 to 5 feet.
Tilsit soil	Severe: slow permeability.	Moderate: slope	Moderate: high water table.

[1] Limitations to use for buildings with basements are severe for Dekalb soil and moderate for Tate soil.

and community developments—Continued

Estimated degree and kind of limitations if limitation is moderate or severe—Continued				
Roads	Athletic fields	Play and picnic areas	Campsites	
			Tents	Trailers
Severe: slope; stoniness	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.
Severe: slope	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.
Severe: slope; stoniness	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness in some areas.
Severe: slope	Severe: slope; stoniness in some areas.	Severe: slope; stoniness.	Severe: slope; stoniness.	Severe: slope; stoniness in some areas.
Moderate: high water table.	Severe: slow permeability.	Slight	Severe: slow permeability.	Severe: slow permeability.
Moderate: slope; bedrock at a depth of 1½ to 2½ feet.	Severe: slope	Moderate: slope; surface texture.	Moderate: slope; slow permeability; surface texture.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.	Severe: slope; bedrock at a depth of 1 to 1½ feet.
Moderate: high water table.	Severe: high water table; slow permeability.	Moderate: high water table.	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.
Moderate: slope; bedrock at a depth of 3 to 5 feet.	Severe: slope	Moderate: slope	Moderate: slope	Severe: slope.
Moderate: bedrock at a depth of 3 to 5 feet.	Moderate: slope	Slight	Slight	Moderate: slope.
Moderate: high water table.	Severe: slow permeability.	Slight	Severe: slow permeability.	Severe: slow permeability.

Features affecting the use of soils for picnic and play areas are steep slopes, flooding, a high water table, rocks and stones, and texture. Golf fairways and lawns are slightly more affected by soil texture, rockiness, and stoniness than other areas. Steep, rocky, or stony areas are important for their scenic value or as nature trails.

Campsites for tents and trailers are limited by the same soil features, though tents can be located on steeper soils than trailers. Steep slopes, a high water table, flooding, soil texture and permeability, depth to and kind of bedrock, and rock outcrops or stones are the main limiting features. Sites for trailers should be level, accessible, and include a parking area at each site.

Use of Soils as Watersheds [3]

The severity of flooding, duration of streamflow, and the quality of water are becoming more important as the need for water increases. The kind of soil, relief, geology, climate, cover of vegetation, and the interaction of these factors, as affected by land treatment, influence the amount of water that runs off the watershed. An understanding of the relationship between these factors and runoff is needed for good management of watersheds.

Soils transmit and store varying amounts of water. Depth of the soil and pore space largely determine the storage capacity of water for a given soil. Morphology of the soil, the slope, and plant cover influence the rate at which water moves into, through, and over a soil. This rate affects the length of time taken after rains for the water to reach streams and the amount of water that enters the streams. The peak flow from a watershed depends on the intensity and duration of rainfall, the size of the watershed, and the runoff coefficient. This coefficient is based on such characteristics of the watershed as relief, plant cover, surface storage, and infiltration rate.

The following paragraphs describe the effect of different soils on the behavior of water for each of the eight soil associations. These associations are shown on the colored General Soil Map at the back of this survey. Their descriptions are based on observations made under typical soil and plant conditions in each association during the time of field mapping.

Atkins-Pope-Tate association.—The watershed characteristics of this association vary directly with the characteristics of the soils. Along Marsh and Spruce Creeks, the soils are somewhat poorly drained to poorly drained and are saturated with water part of the year. These creeks flow continuously, but following a significant rainfall, they change rapidly from sluggish shallow creeks to swollen spreading torrents. The creeks generally are muddy when swollen, and the sediment often is deposited on adjacent fields. The soils in other parts of this association are well drained and have high storage capacity for water. Creeks and streams in these parts

[3] This subsection was prepared with assistance from ROBERT A. TOBIASKI, watershed management staff officer, Cumberland National Forest, recently changed to the Daniel Boone National Forest.

TABLE 7.—*Suitability of soils for elements*

[Soils rated *good* are well suited or above average; *fair*, suited or average;

Mapping unit and symbol	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Allegheny gravelly loam, 6 to 12 percent slopes (AgC)	Fair	Good	Good
Atkins silt loam (At)	Poor	Fair	Fair
Captina silt loam, 2 to 6 percent slopes (CaB)	Fair	Good	Good
Clymer fine sandy loam, 2 to 6 percent slopes (ClB)	Fair	Good	Good
Clymer fine sandy loam, 6 to 12 percent slopes (ClC)	Fair	Good	Good
Clymer and Dekalb fine sandy loams, 12 to 20 percent slopes (CmD):			
Clymer soil	Poor	Fair	Good
Dekalb soil	Poor	Fair	Fair
Colbert silty clay loam, 6 to 20 percent slopes (CoD)	Poor	Fair	Fair
Cotaco silt loam (Ct)	Fair	Fair	Good
Dekalb fine sandy loam, 6 to 12 percent slopes (DeC)	Fair	Fair	Fair
Dekalb and Ramsey sandy loams, 12 to 20 percent slopes (DrD):			
Dekalb soil	Poor	Fair	Fair
Ramsey soil	Unsuited	Poor	Poor
Dekalb and Tate sandy loams, 20 to 30 percent slopes (DtE):			
Dekalb soil	Unsuited	Poor	Fair
Tate soil	Unsuited	Poor	Fair
Dekalb and Tate sandy loams, 30 to 50 percent slopes (DtF):			
Dekalb soil	Unsuited	Unsuited	Fair
Tate soil	Unsuited	Unsuited	Fair
Elk silt loam (Ek)	Good	Good	Good
Huntington silt loam (Hu)	Fair	Good	Good
Made land (Ma). [2]			
Muse silt loam, 6 to 12 percent slopes (MeC)	Fair	Good	Good

See footnotes at end of table.

have lower and clearer water during peak flow, but the flow is for longer periods.

Muse-Shelocta and Muse-Wellston-Trappist associations.—Soils in these associations have high storage capacity for water. Slopes are steep and very steep, however, and runoff is medium to rapid. Also, their runoff coefficient is the highest of any associations in the McCreary-Whitley Area. Fluctuation of streams after thunderstorms is rapid but of short duration, and the water in the streams is slightly muddy. Many steep drainageways in this association are dry late in summer. Runoff occurs during wet periods, and water in the streams is clear or turbid.

Wellston-Muse-Clymer association.—Soils in this association have moderate to high storage capacity for water. Most streams are clear, have low slope gradient, and have intermittent flow. Flash floods can occur after thunderstorms of moderate duration, and the floodwater is turbid.

Tate-Trappist association.—Soils in this association have high storage capacity for water. Runoff from this association is moderate and is uniformly distributed throughout the year. Streamflow, which changes slowly, is at high peaks only when the soils are saturated or after periods when rainfall is of high intensity. Most streams are clear, and the water is neutral or slightly acid. Below strip mines or deep mines, however, the water in streams becomes very strongly acid or extremely acid.

Clymer-Dekalb association.—The soils in this association have a moderate to low storage capacity for water. Most streams have low slope gradient, and few streams flow the year round. Runoff and flash floods are rare, and only during these floods do the normally clear streams become slightly turbid.

Tate-Clymer-Dekalb association.—The soils in this association have a moderate to high storage capacity for water. Perennial streams are common, and in most of these the flow is uniform throughout the year. Peak flows are of fairly long duration but generally occur only once or twice during the year.

Tate-Shelocta association.—The soils in this association have a moderate to high storage capacity for water. Most streams flow during wet periods, but during the drier periods the water disappears into numerous sinkholes or into underground streams. Surface streams tend to have high peak flows and then rapidly become dry. Except for the larger rivers, continuously flowing streams are scarce in this association. Springs and seeps are common during wet weather.

Use of Soils for Wildlife [4]

This subsection discusses the kinds of wildlife habitat suitable for each soil association shown on the General Soil Map. Also discussed is the suitability of soils for specific elements of wildlife habitats and kinds of wildlife. The soils are rated in table 7 for wildlife habitat elements and kinds of wildlife.

[4] This subsection was prepared with assistance from WILLIAM D. ZEEDYK, wildlife staff officer, Daniel Boone National Forest.

of wildlife habitats and kinds of wildlife

poor, poorly suited or below average; and *unsuited*, use is not feasible]

Wildlife habitat elements—Continued				Kinds of wildlife [1]	
Hardwood woody plants	Evergreen woody plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife
Good	Poor	Unsuited	Unsuited	Good	Good.
Fair	Fair	Poor	Unsuited	Fair	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Poor	Fair	Unsuited	Unsuited	Poor	Poor.
Fair	Fair	Unsuited	Unsuited	Fair	Fair.
Good	Poor	Fair	Fair	Good	Good.
Fair	Fair	Unsuited	Unsuited	Fair	Fair.
Poor	Fair	Unsuited	Unsuited	Poor	Poor.
Fair	Good	Unsuited	Unsuited	Poor	Fair.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.

TABLE 7.—*Suitability of soils for elements of*

Mapping unit and symbol	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Muse silt loam, 12 to 20 percent slopes (MeD)	Poor	Fair to good	Good
Muse silty clay loam, 6 to 12 percent slopes, severely eroded (MlC3)	Poor	Fair to good	Good
Muse silty clay loam, 12 to 20 percent slopes, severely eroded (MlD3).	Unsuited	Fair	Fair
Muse and Gilpin silt loams, 50 to 65 percent slopes (MmG)	Unsuited	Unsuited	Fair
Muse-Shelocta stony silt loams, 20 to 40 percent slopes (MnE)	Unsuited	Poor	Good
Muse-Shelocta-Gilpin stony silt loams, 40 to 60 percent slopes (MoF).	Unsuited	Unsuited	Fair
Muse-Trappist silt loams, 20 to 30 percent slopes (MpE)	Unsuited	Poor	Good
Muse-Trappist silt loams, 30 to 50 percent slopes (MpF)	Unsuited	Unsuited	Fair
Muse-Trappist silty clay loams, 20 to 30 percent slopes, severely eroded (MtE3).	Unsuited	Poor	Fair
Philo fine sandy loam (Pf)	Fair	Good	Good
Philo silt loam (Ph)	Fair	Good	Good
Pope fine sandy loam, 4 to 20 percent slopes (PoD)	Poor	Good	Good
Pope soils, 0 to 4 percent slopes (PsA)	Fair	Good	Good
Renox channery silt loam, 40 to 60 percent slopes (RcF)	Unsuited	Unsuited	Fair
Robertsville silt loam (Re)	Poor	Fair	Fair
Rock land-Talbott complex (Rt):			
Rock land	Unsuited	Unsuited	Poor
Talbott soil	Poor	Fair	Good
Rock outcrop (Ru)	Unsuited	Unsuited	Unsuited
Stendal sandy loam (Sd)	Poor	Fair	Fair
Strip mines (St)	Unsuited	Unsuited	Poor
Talbott rocky silt loam, 6 to 12 percent slopes (TaC)	Poor	Fair	Good
Talbott rocky silt loam, 12 to 20 percent slopes (TaD)	Poor	Fair	Good
Talbott very rocky silty clay, 12 to 20 percent slopes, severely eroded (TbD3).	Unsuited	Poor	Fair
Tate-Very stony land complex (Tc):			
Tate soil	Unsuited	Poor	Fair
Very stony land	Unsuited	Unsuited	Fair
Tate fine sandy loam, 0 to 6 percent slopes (TeB)	Fair	Good	Good
Tate loam, 6 to 12 percent slopes (TlC)	Fair	Good	Good
Tate loam, 12 to 20 percent slopes (TlD)	Poor	Fair	Good
Tate loam, 20 to 30 percent slopes (TlE)	Unsuited	Poor	Fair
Tate loam, 30 to 50 percent slopes (TlF)	Unsuited	Unsuited	Fair
Tate stony sandy loam, 12 to 20 percent slopes (TmD)	Unsuited	Poor	Fair
Tate stony sandy loam, 20 to 30 percent slopes (TmE)	Unsuited	Poor	Fair
Tate stony sandy loam, 30 to 50 percent slopes (TmF)	Unsuited	Unsuited	Fair
Tate-Trappist stony complex, 25 to 45 percent slopes (TnF):			
Tate soil	Unsuited	Unsuited	Fair
Trappist soil	Unsuited	Unsuited	Fair
Tate, Shelocta, and Muse stony soils, 12 to 35 percent slopes (ToE)	Unsuited	Unsuited	Fair
Tilsit silt loam, 2 to 6 percent slopes (TpB)	Fair	Good	Good
Trappist silty clay loam, 6 to 12 percent slopes, severely eroded (TrC3).	Poor	Fair	Fair
Trappist silty clay loam, 12 to 20 percent slopes, severely eroded (TrD3).	Unsuited	Poor	Fair
Trappist-Monongahela silt loams, 12 to 20 percent slopes (TsD):			
Trappist soil	Poor	Fair	Good
Monongahela soil	Poor	Fair	Good
Trappist-Weikert silt loams, 12 to 20 percent slopes, severely eroded (TwD3):			
Trappist soil	Unsuited	Poor	Fair
Weikert soil	Unsuited	Poor	Poor
Tyler silt loam (Ty)	Poor	Poor	Fair
Wellston silt loam, 6 to 12 percent slopes (WeC)	Fair	Good	Good
Wellston and Tilsit silt loams, 2 to 6 percent slopes (WtB):			
Wellston soil	Fair	Good	Good
Tilsit soil	Fair	Good	Good

[1] Wetland wildlife was omitted from this table because there are no large bodies of water in the Area and few species of wetland wildlife.

wildlife habitats and kinds of wildlife—Continued

Wildlife habitat elements—Continued				Kinds of wildlife [1]	
Hardwood woody plants	Evergreen woody plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife
Good	Poor	Unsuited	Unsuited	Fair	Good.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Poor	Poor	Good	Good.
Good	Poor	Poor	Poor	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Fair	Unsuited	Unsuited	Poor	Fair.
Fair	Fair	Fair	Fair	Fair	Fair.
Fair	Fair	Unsuited	Unsuited	Unsuited	Fair.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Unsuited	Unsuited	Unsuited	Unsuited	Unsuited	Unsuited.
Good	Fair	Poor	Unsuited	Fair	Good.
Poor	Good	Unsuited	Unsuited	Unsuited	Poor.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Fair	Unsuited	Unsuited	Poor	Good.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Good	Good.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Poor	Fair.
Good	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Fair	Unsuited	Unsuited	Poor	Fair.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Poor	Poor	Good	Good.
Fair	Fair	Unsuited	Unsuited	Fair	Fair.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Good	Poor	Unsuited	Unsuited	Fair	Good.
Good	Fair	Unsuited	Unsuited	Fair	Good.
Fair	Fair	Unsuited	Unsuited	Poor	Fair.
Fair	Good	Unsuited	Unsuited	Poor	Fair.
Fair	Fair	Fair	Fair	Poor	Fair.
Good	Poor	Poor	Poor	Good	Good.
Good	Poor	Poor	Poor	Good	Good.
Good	Poor	Poor	Poor	Good	Good.

[2] Made land (Ma) has variable properties, and examination is needed at each site.

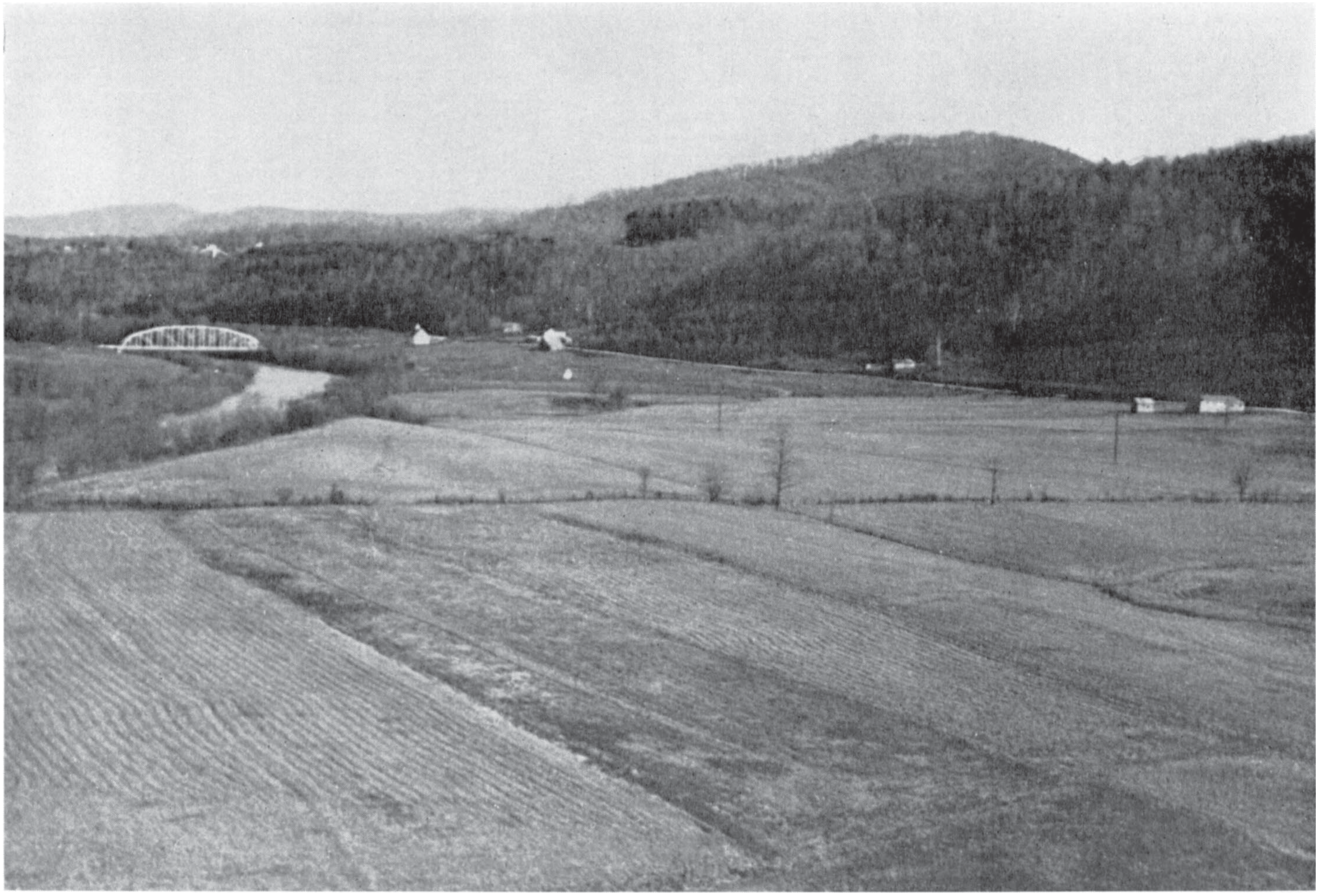

Figure 10.—**View in the Atkins-Pope-Tate soil association. The lack of adequate cover for loafing and escaping from predators makes this association a poor habitat for quail.**

Kinds of wildlife habitats suitable for soil associations

Wildlife is an important natural resource of the McCreary-Whitley Area. White-tailed deer, ruffed grouse, gray squirrel, fox squirrel, cottontail rabbit, bobwhite, and wild turkey are common in many places. In much of the Area, information about soils that is applied to the management of timber and wildlife helps game managers to determine which species of game to encourage in a particular habitat and also to identify specific sites for the development, protection, and enhancement of important habitat elements (*9*). In the following pages, the kinds of wildlife habitat suitable for the soils in each soil association are discussed.

ATKINS-POPE-TATE ASSOCIATION

This association consists of nearly level to gently sloping soils on flood plains and stream terraces. It occurs in small, widely scattered areas, and more than 90 percent of the acreage is used for hay, small grains, corn, and pasture (fig. 10). River birch, sycamore, and silver maple grow in scattered small woodlots, but these trees are cut before they grow large enough to provide much food for wildlife.

Present land use favors a squirrel and rabbit habitat. This association would be an excellent habitat for quail if cover was provided where the birds could escape from hunters and predators and where they could rest and loaf. Areas of cover could be provided, especially between fields and along the edge of woodlots. Allowing trees to mature and reducing grazing would improve the habitat for squirrels in this association.

MUSE-SHELOCTA ASSOCIATION

This is a rugged, mountainous association of dominantly very stony soils covered by a hardwood forest. The trees are mostly white oak, black oak, scarlet oak, red oak, buckeye, tulip-poplar, black cherry, hickory, and blackgum; but a few scattered evergreens, such as hemlock, are along drainageways, and pines grow in some of the drier sites. The common shrubs in this association are mountain-laurel, greenbrier, huckleberry, blueberry, and strawberry bush. These shrubs grow abundantly on south-facing slopes, but they are scarce or absent on north-facing slopes.

Strip mining of coal in this association has caused siltation of many streams and pollution of the water with acid.

The upland oaks that generally grow on the Muse and Shelocta soils provide a large amount of acorns that are eaten by squirrels and wild turkeys. This association is an excellent habitat for squirrels and a fair habitat for wild turkeys. The turkeys generally avoid the brushy south-facing slopes and mainly use the better habitat of slopes facing north. But use of this association by turkeys is limited because there are few of the sod clearings that turkey chicks need and because places for drinking are few and poorly distributed. Where slopes face south, these soils support stands that provide sufficient browse and cover of evergreens, mostly mountain-laurel, for deer and grouse and a good habitat for them.

MUSE-WELLSTON-TRAPPIST ASSOCIATION

This association consists of gently sloping to steep soils. It is made up of areas of cropland, pasture, abandoned fields, hardwood forest, and pine forest. About 60 percent of this association consists of the steeper, forested slopes; the remaining 40 percent is in about equal acreages of cropland, pasture, and abandoned fields. Areas of open water are scarce, and areas in brush are common.

Because its soils are used in many ways, this association provides an excellent habitat for rabbits and quail on farms. The habitat for squirrels could be improved by growing more food-producing trees. A good habitat for grouse and deer is provided in the wooded areas and around abandoned fields that are reverting mainly to southern yellow pine. Watering places can be built easily on the Muse and Wellston soils.

WELLSTON-MUSE-CLYMER ASSOCIATION

This association consists of gently sloping to moderately steep soils on broad, gently rolling to rolling uplands. These soils commonly are used for pasture or for small grains, corn, or hay (fig. 11). Most of the Muse soils in this association have been eroded. Some of these eroded areas are now abandoned fields or have been reforested with young southern pine and mixed hardwoods. Watering places, generally constructed on the Clymer soils, are common in this association.

Present land use of soils in this association is providing a good habitat for rabbits and a fair habitat for quail. The habitat for both quail and rabbits would be excellent if adequate cover was provided to allow escape from hunters and predators and for loafing and resting. If the trees in woodlots on the Wellston and Muse soils were allowed to mature and produce mast, these woodlots would be an excellent habitat for squirrels.

TATE-TRAPPIST ASSOCIATION

This is the most extensive association in the McCreary-Whitley Area. It consists of strongly sloping to steep soils on ridgetops and long, stony side slopes. It has many cliffs that form barriers and hinder the movement of both hunters and deer. A forested area of this association east of the South Fork Cumberland River is crossed by roads and is broken up by many small farms, residential clearings, and coal mines. Most of the association west of the river is forested and has only a few farms or other openings and very poor roads.

The soils of this association are suited to hardwoods, such as oak, hickory, blackgum, and tulip-poplar. These hardwoods produce abundant mast. If these soils are continuously managed for production of hardwood timber, more mast and less browse will be produced. Browse quickly grows out of reach of deer on north-facing slopes of Tate soils and is moderately sparse in most mature stands. Virginia pine and shortleaf pine commonly grow on south-facing slopes of Tate soils, and hemlock grows in most deep drainageways. Continuous production of hardwoods throughout the association provides excellent habitat for squirrels and good to excellent habitat for wild turkeys in the vicinity of the lookout tower on Peters Mountain and on Laurel and Step-up Rock Ridges.

The habitat for deer and grouse in this association is good, but a lack of evergreens for cover, such as mountain-laurel and rhododendron, and poor distribution of grassed openings and watering places, tend to limit the number of these species in some areas. Clearings in sod for turkeys can be easily developed in less sloping areas where a stand of bluegrass and white clover can be established and readily maintained. The watering places needed for deer and turkeys are more easily developed on the Wellston or other minor soils in this association. The habitat for deer and grouse can be improved by favoring hardwoods on areas of minor Dekalb and Clymer soils on ridgetops in this association, and by favoring hemlock or broad-leaved evergreens on the lower part of slopes of the Tate soils.

CLYMER-DEKALB ASSOCIATION

This association consists of an area of broad, gently rolling to moderately steep soils near Pine Knot and Gilreath. Almost 80 percent of the acreage is pastured or cultivated (fig. 12). The habitat for rabbits and quail is fair to good, but it can be improved by providing scattered brushy areas and allowing vegetation along fence rows to grow.

A small part of this association along the northern edge is forested, largely with shortleaf pine. These forested areas support good stands of pine interspersed with a few oaks, hickories, and blackgums. The hardwoods generally are harvested with the pines, however, before they are mature enough to produce the mast needed for squirrels and turkeys. Browse is fairly abundant from shrubs. Except in farmed areas, year-round drinking water for deer and turkeys generally is scarce.

The forested areas of this association provide good habitat for deer and grouse. More vegetation is needed to provide browse and cover for these species except in areas adjacent to cropland. Clumps of uncut hardwoods will provide food for deer and squirrels. An excellent habitat for quail generally can be maintained in areas where pines are grown for timber. Clearings that produce browse for deer are easier to maintain on the Dekalb than on the Clymer soils, but plants grown on the Clymer soils probably are more nutritious. Clearings for sod can be developed easier on the Cotaco and Philo than on other soils in this association. Watering places can be developed on the Clymer soils because they have a satisfactory watershed.

***Figure 11.*—View in the Wellston-Muse-Clymer soil association. Clean cultivation and grazing limit development of wildlife habitat in this association.**

TATE-CLYMER-DEKALB ASSOCIATION

This association is characterized by sloping to steep soils on narrow ridgetops and side slopes surrounded by nearly continuous sandstone cliffs. Fallen stones and boulders from these cliffs are on the lower slopes. The acreage is mostly forested, but there are a few small farms and a few roads.

Stands of Virginia pine, shortleaf pine, and pitch pine, or these stands mixed with a few oaks, hickories, blackgum, or other hardwoods that tolerate dry sites, grow on the Dekalb and Clymer soils and on Tate soils that have south-facing slopes. The hardwoods generally are harvested with the pines, however, before they mature enough to produce the mast needed for squirrels and turkeys. Cove hardwoods, such as tulip-poplar and red oak, grow better on the north-facing slopes of Tate and other soils. Except on the slopes facing north, browse and evergreens for cover are moderately abundant in a thick stand of shrubs on all soils in this association.

The soils in this association provide a good habitat for deer and grouse. The habitat for turkeys and squirrels is only fair because the production of mast generally is limited to Tate soils that have slopes facing north. A good habitat for quail generally can be maintained in areas where intensive management for pine is practiced.

TATE-SHELOCTA ASSOCIATION

This largely forested association occupies the lower slopes and benches along Little South Fork and the South Fork Cumberland River and its main western tributaries. Small farms occur in a few areas, and abandoned fields are common along Little South Fork north of Slavans. Cliffs that are common in adjacent soil asso-

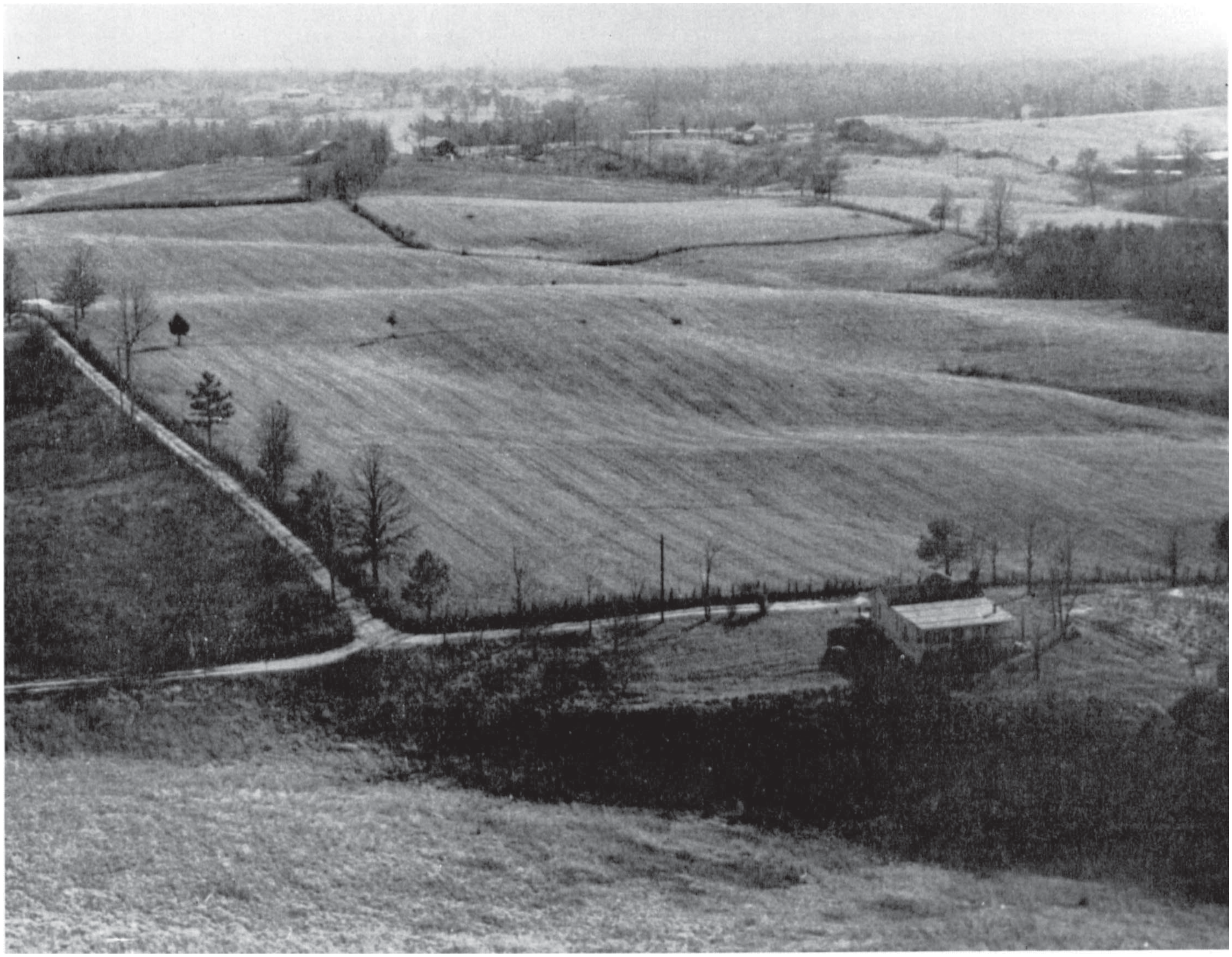

Figure 12.—**View in the Clymer-Dekalb soil association. Much of the acreage is cultivated or pastured.**

ciations hinder access of this association to both hunters and deer. This association probably has the best potential for supporting wildlife of any in the McCreary-Whitley Area. Plants grown on these soils generally are higher in nutritive value than plants grown on other soils. Permanent openings, or clearings in sod, that are needed by turkeys are scarce, especially along the South Fork Cumberland River. Den trees for squirrels and permanent sources of water for deer and turkeys are abundant.

In most places the soils in this association provide a good habitat for turkeys and an excellent habitat for squirrels. Small areas of Huntington and Pope soils on the flood plains of small streams can be cleared and established in sod for deer and turkeys. In a few places, mainly along Little South Fork north of Slavans and at Bell Farm on Rock Creek, the habitat for deer and grouse is fair to good. Browse generally is scarce in the sparse stand of shrubs among the hardwoods. More browse occurs where intermediate cuttings are made, but the plants soon grow too tall to be reached by deer.

Suitability of soils for wildlife habitat elements

Wildlife management can be successful if food, cover, and water are available in suitable places. Wildlife habitats can be created, improved, or maintained by planting or managing existing vegetation on the soils to provide desirable plants. Table 7 rates the estimated suitability of soils for producing the various wildlife habitat elements. The present land use, the relationship of soils to adjoining areas, and the movements of wildlife are not considered in these ratings. In the following paragraphs, the ratings used in table 7 are defined.

A rating of *good* means that habitats generally are easily created, improved, or maintained on the soil; there are few or no soil limitations to habitat management; and satisfactory results can be expected. A rating of *fair* means that habitats can be created, improved, or maintained, but there are moderate soil limitations that affect management. Moderately intensive management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that habitats generally can be created, improved, or maintained, but soil limitations are severe. Management of the habitat is difficult, is expensive, and requires intensive effort. A rating of *unsuited* means that habitats cannot be created, improved, or maintained, or that these practices are not feasible under prevailing soil conditions.

Kinds of wildlife habitat elements

In the following paragraphs, the wildlife habitat elements rated in table 7 are briefly described.

GRAIN AND SEED CROPS. Areas of domestic grains or seed-producing annual herbaceous plants that have been planted to produce food for wildlife. Suitable plants are corn, sorghum, wheat, oats, millet, buckwheat, soybeans, and sunflowers.

GRASSES AND LEGUMES. Areas of domestic perennial grasses and herbaceous legumes that have been planted to provide wildlife food and cover. Suitable plants are fescue, bromegrass, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

WILD HERBACEOUS UPLAND PLANTS. Native or introduced perennial grasses and weeds preferred by wildlife on uplands that provide food and cover and that are established mainly through natural processes. Examples of these plants are beggarweed, wild bean, goldenrod, wild ryegrass, oatgrass, pokeweed, strawberry, and lespedeza. Ratings are based on the estimated number, variety, and vigor of desirable species that are native to each soil.

HARDWOOD WOODY PLANTS. Vigorous sprouts or dependable, naturally occurring food-producing hardwood trees, shrubs, or woody vines that are preferred by wildlife. Examples of these plants are oak, hickory, dogwood, maple, grape, blueberry, brier, greenbrier, cherry, and viburnum.

EVERGREEN WOODY PLANTS. Coniferous trees and slower growing evergreen shrubs that commonly are established through natural processes and that are important to wildlife, mainly as cover but also for food. Examples of these plants are pine, hemlock, redcedar, mountain laurel, and rhododendron.

SHALLOW WATER DEVELOPMENTS. Areas of water in impoundments or excavations that generally do not exceed 5 feet in depth. Structures include shallow dugout ponds, low dikes, and levees.

EXCAVATED PONDS. Dugout water areas or combinations of dugout ponds and low dikes or dams that hold enough water of suitable quality and depth to support fish or other wildlife. These are ponds of one-tenth acre or more that are built on nearly level land and that have an average depth of 6 feet or more over at least one-fourth of the area. A dependable source of unpolluted water of low acidity is needed for producing fish.

TABLE 8.—*Management data for*

Woodland group	Potential productivity		Tree species—
	Forest type	Site index [1]	In existing stands
Group 1: Nearly level, somewhat poorly drained to poorly drained, acid soils on bottom lands and low terraces; shallow root zone above high water table or fragipan; flooded annually.	Sweetgum Cottonwood	90 100	River birch, pin oak, sweetgum, sycamore, cottonwood, and red maple.
Group 2: Nearly level to gently sloping, moderately well drained to well drained soils on bottom lands, low terraces, toe slopes, and colluvial fans; seasonal high water table or occasional flooding in places.	Upland oak Tulip-poplar	80 95	Tulip-poplar, black walnut, red oak, white oak, elm, and river birch.
Group 3: Nearly level to gently sloping, moderately well drained to well drained soils on high terraces and uplands; fragipan in places.	Upland oak Shortleaf pine	72 70	Scarlet oak, black oak, blackgum, shortleaf pine, and Virginia pine.
Group 4: Gently sloping to moderately steep, well-drained, residual soils on uplands; derived from limestone or calcareous shale; some areas are rocky.	Upland oak	74	White oak, post oak, redcedar, winged elm, Virginia pine, black cherry, shagbark hickory, bitternut hickory, and buckeye.
Group 5: Moderately steep to steep, well-drained, acid, stony soils on uplands; developed in colluvium over calcareous substratum.	Upland oak. Tulip-poplar.	[2] 85 [3] 75 [2] 96 [3] 87	White oak, black oak, scarlet oak, red oak, rock elm, buckeye, tulip-poplar, black walnut, basswood, black cherry, shagbark hickory, and bitternut hickory.

See footnotes at end of table.

Kinds of wildlife

The kinds of wildlife as shown in table 7 are described in the following paragraphs. Because there are no large bodies of water in the McCreary-Whitley Area, wetland wildlife is not important and was omitted from table 7. Some species may occur along the larger streams, but their number is small.

OPENLAND WILDLIFE. Included in this category are birds and mammals that normally frequent croplands, pastures, meadows, lawns, and areas that are overgrown with grasses, herbs, and shrubby plants. Examples of these forms are quail, meadowlarks, doves, cottontail rabbits, red foxes, and woodchucks.

WOODLAND WILDLIFE. Included in this category are birds and mammals that normally frequent woodland made up of hardwood trees, shrubs, and vines; coniferous trees and shrubs; or a mixture of these plants. Examples of these forms are ruffed grouse, gray squirrels, fox squirrels, gray foxes, white-tailed deer, raccoons, and wild turkeys.

Use of Soils as Woodland

This section describes the woodland of the McCreary-Whitley Area and explains woodland suitability groupings of the soils. In table 8, each woodland suitability group is described, the potential productivity and suitability of different tree species are listed, and the main limitations and hazards affecting management of the soils for trees are rated. Also, in table 9 the relation of site index to expected yields of second-growth upland oaks at 50 years of age and other data are shown.

The mapping units shown on the soil map are identified in the "Guide to Mapping Units" at the back of this survey. To obtain information about the characteristics of the soils, the kinds of trees that grow on them, and the probable yield, the reader must refer to both table 8 and table 9.

Woodlands in the McCreary-Whitley Area

Approximately 85 percent of the Area is forested. Nearly all of the wooded areas are within the proclamation boundary of the Daniel Boone National Forest. Some of these wooded areas are owned by the Federal Government, and some are privately owned.

The original hardwood forest that covered the McCreary-Whitley Area consisted of many species. The dominant species were oak, tulip-poplar, and hickory. Some hemlock grew on side slopes and on bottom lands of deep valleys. Virginia, shortleaf, and pitch pines were the minor species. These minor species grew near cliffs and on sandy and rocky ridgetops.

After the Area was settled, the original forest first was selectively logged and then was clear cut. Some of this cleared land was farmed, was then abandoned, and finally reverted naturally to forest. Most areas of forest land have been burned over by wildfires or by fires set by farmers to encourage growth of herbaceous plants for grazing livestock.

woodland suitability groups

Tree species—Continued		Hazards and limitations			
Preferred in stands	Suitable for planting	Plant competition	Seedling mortality	Erosion hazard	Equipment limitation
Sweetgum, pin oak, and cottonwood.	Cottonwood, pin oak, and sweetgum.	Severe	Severe	Slight	Moderate to severe.
Tulip-poplar, red oak, black oak, and white oak.	White pine, tulip-poplar, black walnut, shortleaf pine, and red oak.	Severe	Slight	Slight	Slight.
Shortleaf pine, black oak, and scarlet oak.	White pine and shortleaf pine	Moderate	Moderate	Slight	Slight.
White oak, red oak, black oak, and scarlet oak.	Shortleaf pine, Virginia pine, and redcedar.	Severe	Severe	Severe	Severe.
Tulip-poplar, red oak, black oak, white oak, and black walnut.	Tulip-poplar, shortleaf pine, and white pine.	Moderate to severe.	Moderate	Severe	Severe.

TABLE 8.—*Management data for*

Woodland group	Potential productivity		Tree species—
	Forest type	Site index [1]	In existing stands
Group 6: Sloping to moderately steep, mostly well-drained, acid, clayey soils on uplands.	White oak Shortleaf pine Scarlet oak Upland oak	62 68 70 66	Scarlet oak, white oak, blackgum, shortleaf pine, Virginia pine, blackgum, pignut hickory, and mockernut hickory.
Group 7: Steep to very steep, well-drained, acid, loamy or clayey soils on uplands.	Upland oak. Upland oak.	[2] 75 [3] 66	White oak, black oak, chestnut oak, scarlet oak, shortleaf pine, Virginia pine, blackgum, pignut hickory, and mockernut hickory.
Group 8: Stony, loamy, or clayey, acid soils that have long, steep to very steep slopes and are on uplands.	Upland oak.	[2] 75 [3] 64	Scarlet oak, chestnut oak, white oak, shortleaf pine, pitch pine, Virginia pine, red maple, blackgum, and mockernut hickory.
Group 9: Very steep, slightly acid to neutral, stony soils in the upper part of coves facing north.	Tulip-poplar Upland oak	95 83	Buckeye, basswood, tulip-poplar, red oak, beech, and sugar maple.
Group 10: Moderately steep to steep, moderately coarse textured, well-drained or somewhat excessively drained soils on uplands.	Shortleaf pine.	[2] 68 [3] 55	Shortleaf pine, pitch pine, Virginia pine, post oak, chestnut oak, black jack oak, southern red oak, scarlet oak, blackgum, sourwood, and mockernut hickory.
Group 11: Strongly sloping to steep, medium-textured, well-drained soils on uplands; developed in deep colluvium.	Upland oak.	[2] 78 [3] 70	Red oak, [2] white oak, black oak, [2] scarlet oak, blackgum, shortleaf pine, tulip-poplar, and mockernut hickory.
Group 12: Gently sloping to strongly sloping, moderately coarse textured, well-drained to somewhat excessively drained soils on uplands; some areas are shallow.	Virginia pine Shortleaf pine	73 64	Shortleaf pine, Virginia pine, pitch pine, black oak, white oak, post oak, southern red oak, black jack oak, chestnut oak, scarlet oak, and blackgum.
Group 13: Strongly sloping to steep, stony, acid soils, mainly below cliffs in the uplands; mainly moderately coarse textured but small areas are fine textured.	Upland oak.	[2] 75 [3] 65	Red oak, [2] white oak, black oak, chestnut oak, scarlet oak, shortleaf pine, tulip-poplar, [2] blackgum, mockernut hickory, and pignut hickory.
Group 14: Land types and soil complexes that are extremely variable in texture, slope, and other characteristics.	(4)	(4)	(4)

[1] Site index is based on height at 30 years of age for cottonwood (*6*); site index for all other species is based on height at 50 years of age (*3*, *7*, *10*, *16*, *19*). Generally, two of every three trees measured will vary less that 10 percent from the site index.
[2] On the lower one-third of slopes on all aspects and the upper two-thirds of slopes that have aspects of 340 to 125 degrees.

The present vegetation covering the Area reflects past management, but it is a poor indicator of the natural forest community. On the moist sites, the main tree species include beech, northern red oak, black oak, tulip-poplar, cucumbertree, magnolia, white ash, basswood, hemlock, bitternut hickory, pignut hickory, blackgum, dogwood, and paw paw. Rhododendron, hazelnut, hop-hornbeam, and many other shrubs grow on these sites. On the dry sites, the main tree species are scarlet oak, black oak, white oak, post oak, southern red oak, chestnut oak, blackgum, and mockernut hickory; and such shrubs as mountain-laurel, azalea, huckleberry, and blueberry. The number of shortleaf and Virginia pines has increased on these drier sites since the first logging, which occurred during the period between 1880 and 1920 and after farmland had been abandoned.

Hardwoods tend to replace pines under natural conditions in the McCreary-Whitley Area. The rate at which replacement progresses is related to soil characteristics (*8*). Dekalb, Ramsey, and other soils that provide a dry site remain in forest of pine or pine-oak type for a long time. Wellston and other moist soils revert somewhat rapidly to an oak-hickory forest type with a few scattered pines. Tate soils on slopes facing north revert rapidly to hardwoods.

Woodland suitability grouping of soils

Soils of the McCreary-Whitley Area have been placed in 14 suitability groups based on (1) site index, or potential productivity, (2) existing tree species, (3) species preferred in future stands, (4) species suitable for planting, and (5) limitations and hazards to management. 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. Listed and described in table 8 are the 14 woodland suit-

woodland suitability groups—Continued

Tree species—Continued		Hazards and limitations			
Preferred in stands	Suitable for planting	Plant competition	Seedling mortality	Erosion hazard	Equipment limitation
Scarlet oak, white oak, black oak, and shortleaf pine.	Shortleaf pine and Virginia pine.	Moderate to severe.	Moderate	Moderate to severe.	Moderate to severe.
Black oak, red oak,[2] scarlet oak, white oak, shortleaf pine, white ash,[2] and tulip-poplar.[2]	Shortleaf pine and Virginia pine.	Moderate	Moderate	Very severe	Severe.
Red oak, [2] black oak, chestnut oak, white oak, tulip-poplar, [2] and white ash[2].	Shortleaf pine, Virginia pine, white pine, [2] and tulip-poplar.	Moderate	Moderate	Very serve	Severe.
Tulip-poplar, red oak, and black oak.	Tulip-poplar, white pine, and black walnut.	Moderate	Slight	Very severe	Severe.
Shortleaf pine, white oak, scarlet oak, and chestnut oak.	Shortleaf pine and Virginia pine.	Slight	Slight	Severe	Severe.
White oak, [3] red oak, black oak, tulip-poplar, and shortleaf pine.	Tulip-poplar, [2] shortleaf pine, and white pine.	Moderate	Moderate	Moderate to severe.	Moderate to severe.
Shortleaf pine and Virginia pine	Shortleaf pine and Virginia pine	Moderate	Slight	Slight to moderate.	Slight to moderate.
White oak, black oak, scarlet oak, shortleaf pine, and tulip-poplar. [2]	Shortleaf pine, Virginia pine, white pine, and tulip-poplar [2].	Moderate	Moderate to severe.	Severe	Moderate to very severe.
([4])	([4])	Moderate	Moderate	Very severe	Severe.

[3] On ridgetops and the upper two-thirds of slopes that have aspects of 125 to 340 degrees.
[4] Data not available.

ability groups in the Area. Also shown in this table is the site index for one or more common trees on each group, the species existing in the present stand, the species preferred in future stands, and the species suitable for planting. Also listed are the hazards and limitations that affect management of each group.

Site index.—This is an index to the productivity of a soil for a specified tree. It was measured on the Muse, Tate, Dekalb, Clymer, Wellston, Tilsit, and Shelocta soils and was interpolated for the other soils in the survey area. Site index, as used in this survey, is the average height, in feet, of the dominant and codominant upland oaks at 50 years of age. In each woodland group, generally two of every three trees measured vary less than 10 percent from the indicated site index. The site index, as related to expected yields of second-growth upland oaks at 50 years of age and to estimated productivity, is shown in table 9. Although site index gives a good indication of potential productivity, the measurements made on trees now growing probably will cause underestimation of the growth potential. This underestimation results from trees now growing in the forest that invaded the Area after logging, burning, grazing, and other practices had damaged the soils and caused erosion.

Tree species.—This indicates which species of trees commonly are growing on each suitability group, which species are preferred in future stands, and which species are suitable for planting.

Plant competition.—This refers to encroachment by annuals, shrubs, and other undesirable plants and the rate at which they invade cleared or open areas. A rating of *slight* means that the early growth of desirable species is essentially unhindered by competing plants. A rating of *moderate* means that early growth of desirable species is satisfactory, but minor treatment is needed to aid establishment. A rating of *severe* means that strong

TABLE 9.—*Expected yields and ratings according to site index of second-growth mixed upland oak*

Site index	Average yield per acre		Approximate number of logs from all trees other than oaks	Priority for management practices[3]	Potential for—		
	Cords[1]	Board feet[2]			Sawlogs	Pulpwood	Special purposes[4]
>80	40.6	13,750	3 to 5	Very high	Very high	Very high	Very high.
70	33.3	9,750	2 to 3	High	High	High	High.
60	26.2	6,300	1½ to 2	Medium	Medium	Medium	Medium.
<50	18.8	2,350	<1½	Low		Low	Low.

[1] Merchantable material at 50 years of age to a 4-inch top outside bark.
[2] International log rule at 50 years of age, ⅛-inch saw kerf to a 5-inch top inside bark. Yields are adapted from data in USDA Tech. Bul. 560 (*19*).
[3] Improvement cuttings and physical improvements, such as permanent roads and trails.
[4] Fence posts or fuel.

treatment is needed to protect the desired species from encroachment by annuals, shrubs, and undesirable species.

Seedling mortality.—Assuming that there is a sufficient amount of viable seed of the preferred tree species, seedling mortality refers to loss of natural or planted seedlings as a result of frost heaving or of too much or too little moisture at the time of germination. In table 8 the rating of *slight* means that establishment of desired species is not a problem. A rating of *moderate* means that natural regeneration cannot be relied on for adequate stocking, or that between 25 and 50 percent of the planted seedlings die. A rating of *severe* means that natural regeneration cannot be relied on, or that less than 50 percent of the planted seedlings survive. On soils rated severe, spraying with herbicides to reduce competition from hardwoods or scarifying to prepare a better seedbed is needed for establishing pines.

Erosion hazard.—This indicates the susceptibility of the soils to be moved primarily by running water and without consideration of the ground cover. A rating of *slight* means that the problem is only minor. Management operations are curtailed only during rainy periods, and waterbars are needed at critical spots. A rating of *moderate* means that special practices are needed to keep much-used areas dry so as to avoid concentration of running water in distributed areas and to keep water from accumulating. On soils rated moderate, filter zones between logging roads and streams are needed (*23*). A rating of *severe* means that detailed planning is needed to control erosion where the surface layer is disturbed. Water must not be allowed to accumulate, the filter zone between logging roads and streams must be wide, and skidding should not be downhill. A rating of *very severe* means that erosion is the main concern of management. On soils rated very severe, erosion can be so rapid that any disturbance of the soil causes serious problems unless intensive erosion control practices are used before, during, and after all operations. Logging must be uphill and by cable or arch with only a few passes over each skid trail. Where roads are built or other improvements are made on these soils, slides and slips commonly occur.

Equipment limitation.—This refers to the relative degree that the use of wheeled or crawler type equipment is prohibited or restricted. The limitation is *slight* if there is no restriction on the type of equipment that can be used. The limitation is *moderate* if the type of equipment and the time it can be used are somewhat restricted. The limitation is *severe* if there are severe restrictions on the type of equipment that can be used or the time during the year that equipment can be used. On soils that are rated severe, special equipment, such as cable or arch logging equipment, generally is needed.

Formation and Classification of the Soils

This section consists of two main parts. The first part tells how the soils formed and explains effects of different soil-forming factors. In the second part, the comprehensive system of soil classification is explained and a table shows the placement of the soils in this system and in the former classification system.

Factors of Soil Formation

Soil has been defined as a natural body on the earth's surface that consists of mineral and organic matter and that is capable of supporting plants. Soil is produced by the integrated effects of the five soil-forming factors. These factors are climate, living organisms, parent material, relief, and time. These five factors cause gains, losses, transfers, and transformations of matter within a soil. As a result, soils develop distinct layers, called horizons, with physical and chemical characteristics that are different. The complex interaction of the soil-forming factors determines the degree of differences between horizons, which make up the soil profile. These factors are discussed in the following paragraphs.

Climate

Climate is a soil-forming factor that affects the physical, chemical, and biological relationships in the soil. Soils in the McCreary-Whitley Area do not freeze, except for the upper inch or two. Consequently, physical and chemical reactions occur almost the year round and, except on very steep slopes, result in deeply weathered soils. The soils not deeply weathered are the Gilpin, and soils underlain by very resistant materials, such as the Ramsey and Dekalb.

Rainwater in this humid temperate climate percolates through the soil profile removing soluble bases and leaving the soils acid. Even Talbott soils, that were derived from limestone, become medium acid as a result of this continual leaching. Some trees, however, have roots that reach the neutral to slightly acid substratum and return some bases to the surface layer, but not enough to offset the trend toward acidity.

The direction a sloping soil faces slightly, but significantly, affects its climate. Tate and Muse soils are darker colored on steep slopes facing north than on steep slopes facing south because of a greater accumulation of dark organic matter in the cooler soil. In a study made near Upper Marsh Creek School, the average annual soil temperature at a depth of 20 inches below the surface was found to be 3° cooler on north-facing slopes than on south-facing slopes. The effect of cooler temperatures on color is most noticeable in the surface layer.

Living organisms

Living organisms, mainly plants, add organic matter and otherwise assist in the formation of soil. Plants also circulate basic elements, alter soil color and structure, influence the soil microclimate, increase soil stability, and aid in infiltration and percolation of water. Animals and micro-organisms mix and decompose organic matter, making it more available to plants.

The kinds of plants growing in an area affect the kinds of soils formed. For example, where litter from shortleaf and Virginia pines decomposes it produces more organic acids than litter from hardwoods. These organic acids affect chemical weathering in the Dekalb and Ramsey soils. Litter from hardwoods contains more bases and tends to neutralize the organic acids. The organic matter from hardwoods and grasses in the Pope, Allegheny, and Huntington soils gives the surface layer a dark color and the upper horizons granular structure.

Forest litter reduces frost penetration and rapid drying. The profile of soils under trees, however, tends to be drier than that of soils in adjacent fields, especially during the summer, because of the continual removal of moisture by the deeper rooted trees. Soils with dry profiles, such as the Ramsey and Gilpin, develop slowly.

Man has altered soil formation in some areas. He has cleared soils of trees and planted row crops, thereby reducing the annual addition of organic matter. In plowing he has mixed the materials in the surface layer and, in places, the upper part of the subsoil. Accelerated erosion, caused by misuse of the land, has removed part or all of the original surface layer from many soils.

Parent material

The degree of soil profile development depends on the length of time parent material has been acted upon by climate and living organisms. In the early stage of profile development, properties inherited from parent material are most evident. Later these properties are modified, and the soil acquires characteristics of its own. The kind of parent material, however, affects the texture and mineral composition of the soil.

Soils in the McCreary-Whitley Area developed from (1) residual rocks, mostly shale and sandstone but in some places limestone and siltstone; (2) alluvium; (3) colluvium; and (4) a limited amount of loess. Figure 13 shows a cross section of the rocks in the Area (*15*).

Soils, such as the Dekalb, that developed from weathered sandstone materials are moderately coarse textured, are low in natural fertility, and have very weak horizonation. Soils that developed from clay shale, such as the Trappist, are clayey but have stronger horizonation than the Dekalb soils. The Tate soils that developed from colluvial materials also have more horizonation than Dekalb soils but generally less than Trappist soils. This lack of horizonation is the result of variance in the content of clay in the parent material. The upper horizons of the Wellston and Tilsit soils have characteristics that indicate the influence of loess in their formation.

Soils of flood plains and stream terraces developed in alluvium that was washed from surrounding landforms. This alluvium consists of a mixture of shale and sandstone sediments that, in most places, were sorted as they were deposited. The moderately coarse textured (fine sandy loam) sediments deposited near the stream channels were the parent material of Pope soils. The finer textured sediments (silt loam or silty clay loam) settled in eddies and still water and became the parent materials for Tyler, Robertsville, and Atkins soils.

Relief

Relief, or the shape of the land surface, influences the kind of soils that develop. The differences in relief of the various landscapes are related to differences in the rate of weathering of the underlying rocks. Shale weathers more rapidly than sandstone; consequently, landscapes underlain by shale have a smooth, rounded appearance with numerous intermittent streams. Landscapes underlain by sandstone have massive appearance, abrupt changes in slope, and fewer but deeper intermittent streams. Where sandstone and shale are interbedded, the landscape generally is benched. Figure 14 shows how the landscape and relief in some of the general soil associations have been influenced by the different rates of weathering of the underlying rocks.

On steep slopes, the unconsolidated parent materials of Tate, Muse, and Shelocta soils gradually creep downhill, thereby retarding the development of distinct horizon boundaries. Soil profiles that developed on steep slopes generally have fewer horizons, and the horizons are not so distinct as those that formed on less steep slopes.

The position of parent materials in relation to the water table is important in profile development. Soils saturated by water for extended periods of time reflect this condition by mottling, graying, or both. Examples are the Cotaco, Robertsville, and Atkins soils.

Soils that developed from similar parent material, such as alluvium, but which differ in characteristics because of differences in internal drainage and relief are called a drainage sequence, or catena. For example, the Pope, Philo, Stendal, and Atkins soils make up the Pope catena. The well drained Pope soils occupy stream terraces that are slightly higher than the rest of the flood plain; the moderately well drained Philo soils occupy a slightly lower position; the somewhat poorly drained Stendal soils occupy nearly level areas; and the poorly drained Atkins soils occupy level or slightly concave areas.

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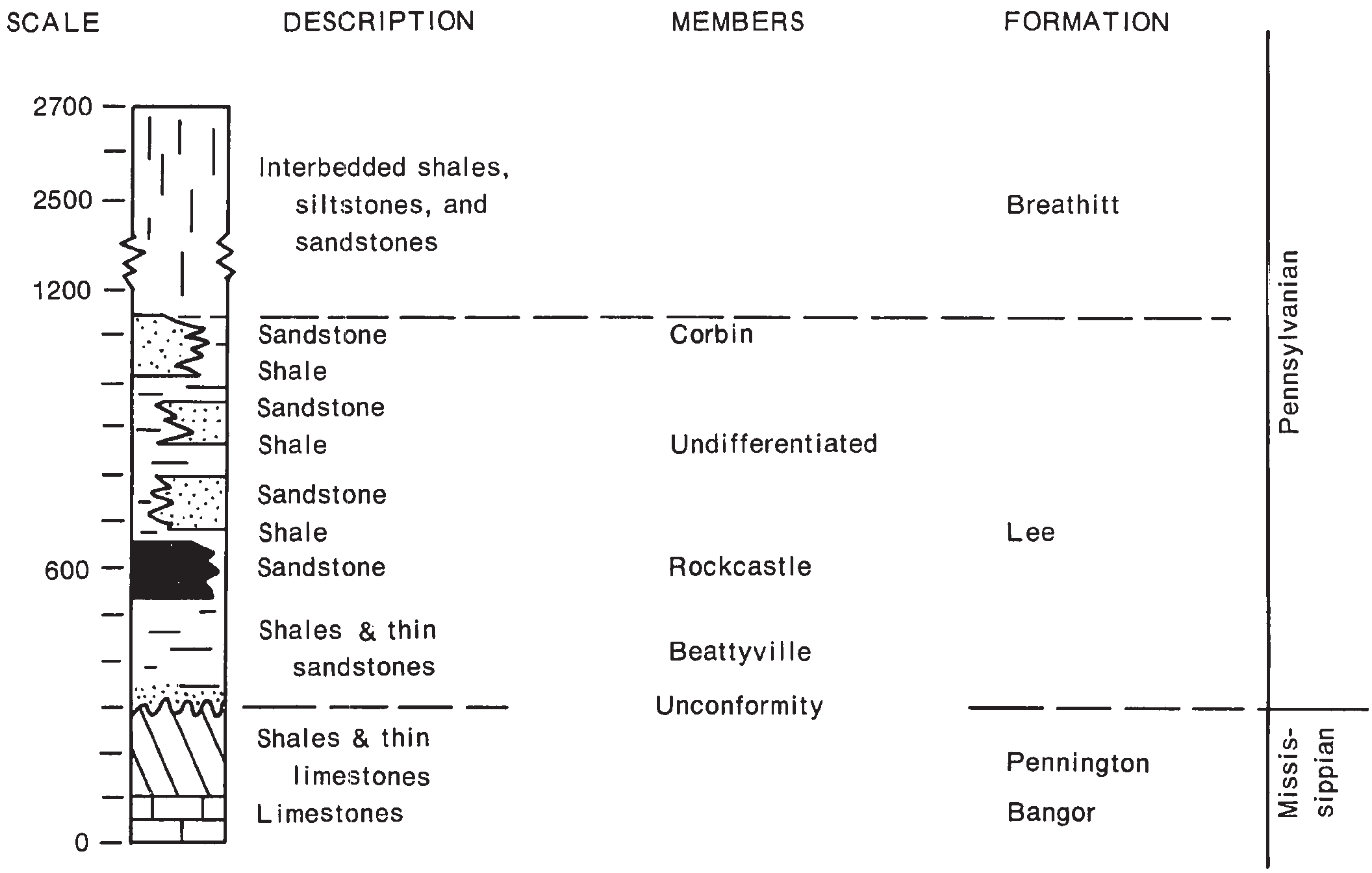

Figure 13.—**Generalized geologic section showing the kinds of rocks exposed in the McCreary-Whitley Area and their approximate thickness.**

In steep areas the direction the side slopes face influences the kind of climate and kind and number of living organisms that act on the parent materials. For example, the deeper Renox soils occur only on north-facing slopes of the Jellico Mountains. The Weikert and Dekalb soils formed on steep narrow ridges and in resistant parent materials; consequently, profile development is retarded because weathering is slow and geologic erosion is nearly as rapid as development. Deeper soils, like the Wellston, formed on gentle slopes where the rate of weathering exceeds geologic erosion.

Time

It takes time for soil to develop. The age of a soil is indicated by the number, kind, thickness, and sequence of horizons; by color changes; and by the formation of soil structure.

In the McCreary-Whitley Area, differences in the rate at which soils develop are caused primarily by variations in parent material and relief. The influence of climate and living organisms varies only slightly, according to whether the slopes face north or south.

The Dekalb soils, which were derived from coarse-textured parent material, have developed weaker horizonation than Muse soils, which were derived from clayey parent material. Although both kinds of soils have been forming for the same length of time, the Dekalb soils have weaker horizon development.

Soils that formed in alluvium vary in degree of development, depending on the age of the alluvium. For example, the Pope soils formed in recent sediments and have weak horizonation. In most places only the surface soil shows any development caused by the accumulation of organic matter. After a long time, and if there is no further addition of sediments, weathering occurs, some finer material moves into the subsoil, and the structure and color of the subsoil change. Elk soils are an example of this condition. Soils that developed from old alluvium and that are rarely flooded develop faster. Organic acids have removed more of the soluble minerals and clay particles from the surface horizons, and these have been moved into the subsoil. More horizons have formed and the change between horizons is more distinct. Captina soils are an example of this condition.

Classification of Soils

Soils are classified so that we can more readily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see

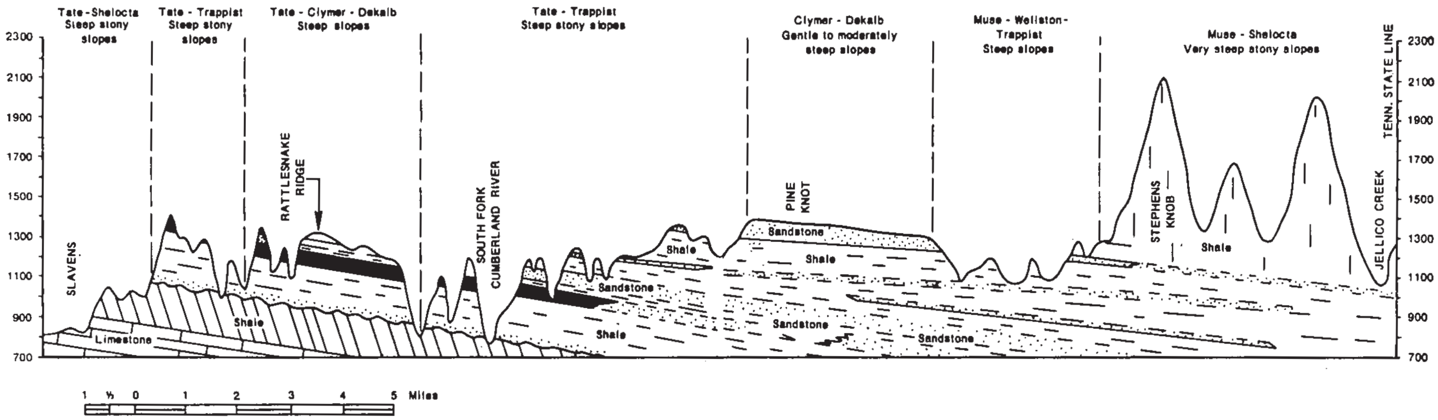

***Figure 14.*—The relationship of rock formations and relief to some of the soil associations on the general soil map of the McCreary-Whitley Area.**

their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

In classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*22*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*20*, *24*). Therefore, readers interested in developments of this system should search for the latest literature available. In this subsection some of the classes in the current system and the great soil groups in the older system are given for each soil series in table 10. The classes in the current system are briefly defined in the following paragraphs.

Order: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates.

Table 10 shows the four soil orders in the McCleary-Whitley Area—Inceptisols, Mollisols, Alfisols, and Ultisols. Inceptisols are soils that have weakly expressed horizons or the beginnings of such horizons. Mollisols have a thick, soft, friable surface layer that has been darkened by organic matter. Alfisols have clay-enriched B horizons that are high in base saturation. Ultisols are soils that are highly developed but still contain some weatherable minerals.

Suborder: Each order is subdivided into suborders, primarily on the basis of those characteristics that seem to produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The suborder is not shown in table 10.

Great group: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated or those that have pans interfering with growth of roots or movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 10 because it is the last word in the name of the subgroup.

Subgroup: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is *Typic Hapludults*.

Family: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils where used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. An example is *fine-loamy, mixed, mesic* family of Typic Hapludults.

Series: The series consists of a group of soils that formed from a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

TABLE 10.—*Soil series classified according to the current system of classification* [1] *and the revised 1938 system*

Series	Current classification			Great soil group (1938 classification)
	Family	Subgroup	Order	
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Atkins	Fine-loamy, mixed, acid, mesic.	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils.
Captina	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils with fragipan.
Clymer [2]	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Colbert	Very fine, montmorillonitic, thermic.[3]	Vertic Hapludalfs	Alfisols	Red-Yellow Podzolic soils.
Cotaco	Fine-loamy, mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Alluvial soils.
Dekalb	Loamy-skeletal, mixed, mesic.[3]	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Elk	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown soils intergrading toward Red-Yellow Podzolic soils.
Huntington	Fine-silty, mixed, mesic	Fluventic Hapludolls	Mollisols	Alluvial soils.
Monongahela	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils with fragipan.
Muse	Clayey, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Philo	Coarse-loamy, mixed, mesic	Aquic Fluventic Dystrochrepts.	Inceptisols	Alluvial soils.
Pope	Coarse-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Ramsey	Loamy, siliceous, mesic	Lithic Dystrochrepts	Inceptisols	Lithosols.
Renox	Fine-loamy, mixed, mesic	Mollic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Robertsville	Fine-silty, mixed, mesic	Typic Fragiaquults	Ultisols	Planosols with fragipan.
Shelocta	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Stendal	Fine-silty, mixed, acid, mesic.[3]	Aeric Fluventic Haplaquepts.	Inceptisols	Alluvial soils intergrading to Low-Humic Gley soils.
Talbott	Fine, mixed, thermic [3]	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils.
Tate	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Tilsit	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils with fragipan.
Trappist	Clayey, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils.
Tyler	Fine-silty, mixed, mesic	Typic Fragiaquults	Ultisols	Planosols with fragipan.
Weikert	Loamy-skeletal, mixed, mesic.	Lithic Dystrochrepts	Inceptisols	Lithosols.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols	Red-Yellow Podzolic soils.

[1] Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

[2] Some Clymer soils in the survey area are less than 40 inches deep to bedrock.

[3] The soils in the Colbert, Dekalb, Stendal, and Talbott series in this survey are taxadjuncts to those series. In this survey area, the B horizon of the Dekalb soils contains a slightly smaller amount of coarse fragments and the C horizon of Stendal soils contains slightly more sand than the defined range for the respective series. The mean annual temperature of the Colbert and Talbott soils in this survey area is slightly lower than the range defined for these series.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. Some of the soils in this survey do not fit in a series that has been recognized in the classification system, and recognition of a new or separate series would not serve a useful purpose. Such soils are named for the series they strongly resemble because they differ from these series in ways too small to be of consequence in interpreting their usefulness or behavior. Soil scientists designate such soils as taxadjuncts to the series for which they are named. In this survey, soils named as in the Colbert, Dekalb, Stendal, and Talbott series are taxadjuncts to those series.

Laboratory Analyses

As part of this soil survey, samples from the profiles of three selected soils were analyzed at the Soil Survey Laboratory of the Soil Conservation Service at Beltsville, Md. Profiles of two of the selected soils are described at the back of this section, and the profile of the other soil is described in the section "Descriptions of the Soils."

The analyses were made according to laboratory methods and procedures of the Soil Conservation Service and described in Soil Survey Investigations Report No. 1 (*25*). The results of these analyses are shown in tables 11, 12, and 13. The data in these tables are useful in classifying soils and developing concepts of soil genesis. They are also helpful in estimating available moisture capacity, fertility, tilth, and other characteristics that affect soil management.

Field and Laboratory Methods

All samples used to obtain the data in tables 11, 12, and 13 were collected from carefully selected pits. The air-dry sample was quartered and subsampled. The subsample was crushed carefully with a wooden rolling pin, care being taken to avoid fragmentation of soft rock. The sample was screened through a 2-millimeter round-hole sieve. All determinations except for bulk density and water content at tension of 1/3 atmosphere were made on material smaller than 2 millimeters in size, or the fine-earth fraction. A small sample was ground to approximately 0.25 millimeter for determinations of organic carbon and total nitrogen. Coarse fragments were reported as the weight, in percent, of material between 2 millimeters and 76 millimeters in size.

Particle-size analyses of the clay fraction were made by the pipette method using sodium hexametaphosphate as a reagent and shaking overnight for dispersion (*14*).

In determining bulk density at 1/3 atmosphere of tension, saran-coated clods were desorbed and reported values were corrected for the material larger than 2 millimeters in size contained in the clods (*4*). These values represent the bulk density of the fine-earth fabric, or material less than 2 millimeters in size. The volume of the ovendry clod was measured and used to calculate bulk density.

Water content at 15 atmospheres of tension was determined with pressure membrane apparatus on sieved samples (*18*).

The cation-exchange capacity, percentage of base saturation, and extractable bases were determined by methods described in U.S. Department of Agriculture Circular 757 (*17*). Organic carbon was determined by wet combustion using sulfuric acid and potassium dichromate mixture and black titration of excess dichromate with ferrous sulfate (*17*).

Total nitrogen was determined by the modified Kjeldahl method using for digestion a mixture of potassium sulfate and concentrated sulfuric acid with selenium metal and copper sulfate as catalytic agents. Ammonia was distilled with steam, collected in boric acid, and titrated with standard sulfuric acid.

Iron was extracted by adding dithionite and citrate and shaking overnight. The amount of iron was then determined by orthophenanthroline colorimetry (*13*).

Extractable acidity was determined by leaching the soil sample in sulfur tubes with barium chloride triethanolamine solution (pH 8.2) and back titrating excess triethanolamine with standard hydrochloric acid (*17*). Reaction, or pH value, was determined with a glass electrode using the water ratio indicated in table 12.

Clay mineralogy reported in table 13 was determined by X-ray diffraction and by differential thermal analysis with apparatus described by Hendricks and Alexander (*12*).

Descriptions of Selected Soil Profiles

Profiles of the Shelocta silt loam and of the Trappist silt loam selected for laboratory analyses are described in the following paragraphs. A profile of the Tilsit silt loam is described on page 26 in the section "Descriptions of the Soils."

SHELOCTA SILT LOAM, S63KY-74-2

Ap1—0 to ½ inch, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; many roots; pH 4.5; boundary clear, smooth.

Ap2—½ inch to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, granular structure; very friable; many roots; pH 4.5; boundary clear, smooth.

B1—8 to 16 inches, strong-brown (7.5YR 5/6) silt loam; weak, fine and medium, subangular blocky structure; friable; 15 percent of volume is sandstone fragments; common roots; pH 4.5; boundary gradual, wavy.

B21—16 to 28 inches, strong-brown (7.5YR 5/6) silt loam; moderate, fine and medium, subangular blocky structure; friable; 15 percent of volume is sandstone fragments; few roots; pH 4.5; boundary gradual, wavy.

B22t—28 to 44 inches, strong-brown (7.5YR 5/6) silty clay loam or silt loam; few, medium, fine variegations of yellowish red (5YR 4/6); moderate, medium, subangular blocky structure; friable; 20 percent of volume is sandstone fragments; few roots; pH 4.5; boundary gradual, wavy.

B3—44 to 58 inches +, yellowish-brown (10YR 5/6) silt loam; few, medium, faint variegations of strong brown (7.5YR 5/6); moderate, medium, subangular blocky structure; friable; 25 percent of volume is sandstone fragments; few roots; pH 4.5; boundary gradual, wavy.

TRAPPIST SILT LOAM, S63KY-74-3

Ap1—0 to ½ inch, very dark gray (10YR 3/1) silt loam; weak, fine, granular structure; very friable; 12 percent of volume is shale fragments; many roots; pH 5.0.

Ap2—½ inch to 5 inches, yellowish-brown (10YR 5/6) silty clay loam or silt loam; moderate, medium, granular structure; friable; 12 percent of volume is shale fragments; many roots; pH 4.5.

B1—5 to 9 inches, brown (7.5YR 5/4) silty clay loam; strong, fine and medium, subangular blocky structure; common clay films; firm, slightly sticky, slightly plastic; 12 percent of volume is shale fragments; many roots; pH 4.5.

B21t—9 to 21 inches, strong-brown (7.5YR 5/6) to yellowish-red (5YR 5/6) silty clay; few variegations of yellowish red (5YR 4/6); strong, fine and medium, subangular blocky structure; many clay films; firm, sticky, slightly plastic; 12 to 20 percent of volume is shale fragments; few ironstone geodes; common roots; pH 4.5.

B22t—21 to 35 inches, red (2.5YR 5/6) silty clay; common, medium, distinct variegations of yellowish red (5YR 5/6) and yellowish brown (10YR 5/6); weak, fine, prismatic structure that breaks easily to moderate subangular blocky; some relict platiness; many clay films; very firm, sticky, plastic; 50 percent of volume is shale fragments; few ironstone geodes; few roots; pH 4.5.

R—35 to 60 inches +, shale; new surface is grayish brown (2.5Y 5/2), old surface is yellowish brown (10YR 5/6) to red (2.5YR 4/6).

General Nature of the Area

This section describes the physiography and geology, relief and drainage, and vegetation of the McCreary-Whitley Area. It also gives some important facts about the climate.

Physiography and Geology

The McCreary-Whitley Area lies in two major physiographic regions of Kentucky. About 4 percent of the Area occurs as a narrow belt along the eastern edge of the Eastern Pennyroyal physiographic region that is part of the Mississippian Plateau. The remaining 96 percent is in the Mountains and Eastern Coal Fields

TABLE 11.—*Physical characteristics*

[Analyses by Soil Survey Laboratory, Soil Conservation Service,

Soil	Horizon	Depth	Particle-size distribution						
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)	Very fine sand (0.1–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (0.002 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Shelocta silt loam.	Ap2	½–8	3. 6	1. 7	0. 9	2. 8	17. 6	54. 0	19. 4
Location: north of State Route 759	B1	8–16	4. 3	2. 2	. 9	2. 4	16. 6	52. 5	21. 1
and about 2.2 miles east of U.S.	B21	16–28	6. 0	2. 4	1. 0	2. 2	16. 2	49. 0	23. 2
Highway No. 27.	B22t	28–44	6. 7	3. 3	1. 2	2. 1	11. 1	44. 9	30. 7
Laboratory No. S63KY–74–2	B3	44–58	7. 3	4. 0	1. 5	2. 6	12. 8	46. 6	25. 2
Tilsit silt loam.	Ap2	1–9	. 4	1. 1	2. 0	7. 1	14. 2	63. 9	11. 3
Location: one-half mile west of Goodin	B	9–16	. 5	. 7	1. 5	5. 1	13. 2	60. 8	18. 2
on Forest Service Road 51.	A′2	16–19	. 2	. 6	1. 3	4. 2	14. 6	56. 8	22. 3
Laboratory No. S63KY–74–7	B′x	19–28	. 1	. 4	1. 0	4. 0	13. 9	39. 4	41. 2
	IIB21t	28–32	. 1	. 3	. 9	3. 7	13. 9	32. 8	48. 3
	IIB22t	32–38	. 1	. 4	. 9	3. 4	15. 8	31. 5	47. 9
	IIB3t	38–44	. 4	. 8	1. 2	4. 9	19. 6	33. 4	39. 7
	IIC	44–64	. 4	1. 0	1. 1	4. 8	24. 6	35. 7	32. 4
Trappist silt loam.	Ap2	½–5	1. 9	1. 3	. 6	1. 9	9. 4	52. 3	32. 6
Location: north of State Route 759	B1	5–9	2. 0	1. 9	. 8	1. 2	2. 0	47. 6	44. 5
and about 2.2 miles east of U.S.	B21t	9–21	1. 5	1. 9	. 8	1. 4	1. 7	48. 2	44. 5
Highway No. 27.	B22t	21–35	. 3	. 6	. 3	. 6	1. 0	50. 0	47. 2
Laboratory No. S63KY–74–3	R (shale).	35							

[1] Coefficient of linear extensibility. [2] Coarse-fragment covnersion factor. [3] Less than minimum reportable.

TABLE 12.—*Chemical characteristics of*

[Analyses by Soil Survey Laboratory, Soil Conservation Service,

Soil	Horizon	Depth	Reaction (pH) 1:1 H_2O	Organic carbon	Nitrogen	C/N ratio
		Inches		*Percent*	*Percent*	
Shelocta silt loam.	Ap2	½–8	4. 6	1. 33	0. 056	24
Location: north of State Route 759 and about 2.2	B1	8–16	4. 7	. 40	. 036	11
miles east of U.S. Highway No. 27.	B21	16–28	4. 9	. 20		
Laboratory No. S63KY–74–2	B22t	28–44	5. 1	. 12		
	B3	44–58	5. 2	. 02		
Tilsit silt loam.	Ap2	1–9	4. 9	. 71	. 032	22
Location: one-half mile west of Goodin on Forest	B	9–16	4. 7	. 18		
Service Road 51.	A′2	16–19	4. 7	. 14		
Laboratory No. S63KY–74–7	B′x	19–28	4. 8	. 11		
	IIB21t	28–32	4. 8	. 12		
	IIB22t	32–38	4. 9	. 06		
	IIB3t	38–44	4. 9	. 06		
	IIC	44–64	4. 9	. 04		
Trappist silt loam.	Ap2	½–5	4. 5	. 98	. 091	11
Location: north of State Route 759 and about 2.2	B1	5–9	4. 7	. 50	. 079	6
miles east of U.S. Highway No. 27.	B21t	9–21	4. 7	. 29		
Laboratory No. S63KY–74–3	B22t	21–35	4. 9	. 19		
	R (shale).	35				

[1] Less than minimum reportable.

of three selected soils

Beltsville, Maryland. Absence of data indicates determinations were not made]

International: II (0.2–0.02 mm.)	International: III (0.02–0.002 mm.)	Coarse fragments: Weight of 2 mm. to 76 mm. material	Coarse fragments: Volume <2 mm. fabric of whole soil	Bulk density: Tension of 1/3 atmosphere	Bulk density: Ovendry	COLE[1]	Water content: Tension of 1/3 atmosphere	Water content: Tension of 15 atmospheres	Water-retention difference
Percent	*Percent*	*Percent*	*Cm³*	*Gm/cc*	*Gm/cc*		*Percent*	*Percent*	*Inches per inch*
33. 1	40. 4	20	0. 89	1. 36	1. 39	0. 007	23. 2	7. 8	0. 19
31. 0	39. 8	30	. 67	1. 66	1. 70	. 005	19. 0	7. 7	. 12
30. 1	36. 5	31	. 66	1. 65	1. 70	. 007	20. 0	8. 5	. 12
23. 6	33. 7	40	. 57	1. 62	1. 69	. 008	21. 6	12. 1	. 09
25. 8	35. 0	40	. 53	1. 67	1. 73	. 007	20. 5	10. 2	. 09
37. 8	45. 0	2	. 99	1. 32	1. 32	. 001	18. 3	4. 5	. 18
33. 4	44. 2	2	. 99	1. 61	1. 66	. 010	18. 8	7. 1	. 19
34. 3	39. 9	1	----------	----------	----------	----------	----------	8. 5	----------
29. 7	26. 3	(3)	. 90	1. 51	1. 62	. 022	23. 6	15. 8	. 11
29. 3	20. 1	(3)	. 91	1. 45	1. 60	. 029	26. 1	19. 9	. 08
30. 8	18. 8	(3)	. 91	1. 48	1. 62	. 027	25. 5	19. 8	. 08
38. 7	17. 8	(3)	. 91	1. 67	1. 76	. 017	19. 4	17. 5	. 03
45. 8	18. 0	(3)	. 91	1. 57	1. 68	. 020	22. 7	14. 3	. 12
19. 3	43. 6	14	. 82	1. 22	1. 29	. 015	25. 2	12. 5	. 12
7. 0	43. 2	2	. 87	1. 39	1. 47	. 018	23. 9	18. 7	. 06
6. 2	44. 5	4	. 82	1. 42	1. 57	. 027	28. 5	19. 1	. 11
5. 7	45. 6	0	. 50	1. 52	1. 70	. 018	25. 7	19. 9	. 04

three selected soils

Beltsville, Maryland. Absence of data indicates determinations were not made]

Extractable iron as Fe	Sum, cation-exchange capacity (meq. per 100 gm. of soil)	Extractable bases (meq. per 100 gm. of soil): Ca	Mg	Na	K	Extractable acidity (meq. per 100 gm. of soil)	Base saturation (sum)	Ratio to clay: Cation-exchange capacity	Ratio to clay: Extractable iron	Ratio to clay: Water retention at tension of 15 atmospheres
Percent							*Percent*			
2. 0	13. 2	0. 4	0. 2	0. 1	0. 2	12. 3	7	0. 68	0. 10	0. 40
2. 4	9. 3	. 1	. 3	. 1	. 2	8. 6	8	. 44	. 11	. 36
2. 8	8. 5	. 1	. 6	(1)	. 2	7. 6	11	. 37	. 12	. 37
3. 1	10. 6	. 1	1. 0	. 1	. 3	9. 1	14	. 34	. 10	. 39
2. 9	9. 0	(1)	1. 1	. 1	. 2	7. 6	16	. 36	. 12	. 40
. 9	5. 8	. 1	(1)	(1)	. 1	5. 6	3	. 51	. 08	. 40
1. 5	7. 7	. 3	. 6	(1)	. 1	6. 7	13	. 42	. 08	. 39
1. 5	9. 9	. 1	. 5	. 1	. 1	9. 1	8	. 44	. 06	. 38
3. 0	18. 0	. 1	1. 0	. 1	. 2	16. 6	7	. 44	. 07	. 38
3. 7	21. 2	. 2	1. 1	(1)	. 1	19. 8	7	. 44	. 08	. 41
3. 9	20. 3	(1)	1. 2	. 1	. 1	18. 9	7	. 42	. 08	. 41
4. 3	16. 8	. 1	1. 0	. 1	. 1	15. 5	8	. 42	. 11	. 44
3. 2	14. 4	. 1	. 8	. 1	. 1	13. 3	8	. 44	. 10	. 44
2. 4	15. 3	(1)	. 2	. 1	. 2	14. 8	8	. 47	. 07	. 41
4. 1	15. 7	(1)	1. 1	(1)	. 2	14. 4	8	. 35	. 09	. 42
3. 9	15. 6	(1)	1. 3	(1)	. 3	14. 0	10	. 35	----------	. 43
3. 9	12. 2	(1)	1. 4	(1)	. 3	10. 5	14	. 26	. 08	. 42

TABLE 13.—*Clay and*

[In some places the amount of minerals is given in percent; in other places the amount is indicated as x, small; xx, moderate;

Soil	Horizon	Depth	Mineral content of— Clay (less than 0.002 mm.) [1] Montmorillonite	Chlorite	Vermiculite
		Inches			
Shelocta silt loam. *Location:* north of State Route 759 and about 2.2 miles east of U.S. Highway No. 27. *Laboratory No.* S63KY-74-2	Ap2	½–8			xxx
	B1	8–16			
	B21	16–28			
	B22t	28–44		tr	xx
	B3	44–58			
Tilsit silt loam. *Location:* one-half mile west of Goodin on Forest Service Road 51. *Laboratory No.* S63KY-74-7	Ap2	1–9			xxx
	B	9–16			xxx
	A′2	16–19			xxx
	B′x	19–28			xxx
	IIB21t	28–32			xxx
	IIB22t	32–38			xxx
	IIB3t	38–44			xxx
	IIC	44–64			xxx
Trappist silt loam. *Location:* north of State Route 759 and about 2.2 miles east—of U.S. Highway No. 27. *Laboratory No.* S63KY-74-3	Ap2	½–5			xxx
	B1	5–9			
	B21t	9–21			
	B22t	21–35	tr		x

[1] All tests were by X-ray diffraction except for kaolinite and gibbsite in the Shelocta and Trappist soils, which were by differential thermal analysis.

physiographic region, which is a part of the Cumberland Plateau section of the Appalachian Plateaus Province (*11*).

The McCreary-Whitley Area is underlain by sedimentary rocks that dip gently to the southeast at about 40 to 60 feet per mile. This dip, caused by a gradual uplift called the Cincinnati Arch, is more fully exposed toward the north and west. Limestone of the Bangor formation and multicolored calcareous shale of the Pennington formation are the only rocks of Mississippian age exposed. These formations are on the lower slopes of mountains along Little South Fork, the South Fork Cumberland River, and the main western tributaries.

Younger Pennsylvanian rocks of the Lee and Breathitt formations are dominant in the rest of the Area. These formations occur in alternating layers of sandstone and shale that are about equal in thickness except in the more mountainous southeastern part where the layers are largely shale. The sandstone is coarse grained and, in most places, conglomeratic. The conglomerate has many rounded pebbles of quartz that locally are called bean stones. In most places the soft, highly weathered shale contains thin layers of fine-grained sandstone. A geologic cross section and the relief in areas where these rocks are exposed are shown in figure 14 in the section "Formation and Classification of Soils." The dominance of sandstone or shale in different parts of the McCreary-Whitley Area is discussed in the section "General Soil Map."

In some places a mantle of silty material covers broad ridgetops in western and northern parts of the Area. This silty material is less than 24 inches thick in most places and probably was deposited by wind.

Relief and Drainage

The McCreary-Whitley Area is a dissected plateau in the early stage of mature geologic erosion. Elevations range from 723 feet, which is the water level of the normal pool of Lake Cumberland, to 2,165 feet on top of Ryans Creek Mountain, but the average elevation is about 1,300 feet. Generally, the landscape is rugged and consists of narrow winding ridges, large cliffs of sandstone, steep side slopes, and V-shaped valleys. All of these features are related to resistance to weathering of the various geologic formations. Small areas of nearly level land occur where large sandstone layers support a stream, such as Marsh Creek, or as broad upland flats, such as those in the vicinity of Gilreath or Rye. A small acreage near Slavans that is underlain by limestone has karst topography. Steep, mountainous relief occurs between Creekmore and Jellico, and the elevations of these mountaintops are more than 2,000 feet. The variation in elevations between valleys and ridgetops in the different parts of the McCreary-Whitley Area is discussed in the section "General Soil Map."

The Area lies within the watershed of the Cumberland River and Lake Cumberland, which is a manmade lake *coarse silt mineralo gy*

xxx, large; and tr, trace. Dashed lines indicate that the mineral was not detected or that tests were not made]

Mineral content of—Continued								
Clay (less than 0.002 mm.) [1]—Continued					Coarse silt (20μ to 50μ)			
Mica	Inter-stratified layer	Quartz	Kaolinite	Gibbsite	Weather-able minerals [2]	Quartz	Other resistant minerals	Aggregates [3]
			Percent		*Percent*	*Percent*	*Percent*	*Percent*
x	----------	x	28	----------	25	52	5	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------
xx	----------	tr	30	----------	32	50	2	17
----------	----------	----------	----------	----------	----------	----------	----------	----------
tr	----------	x	x	----------	----------	----------	----------	----------
----------	----------	x	x	----------	----------	----------	----------	----------
----------	----------	x	x	----------	----------	----------	----------	----------
----------	----------	x	xx	----------	----------	----------	----------	----------
----------	----------	x	xx	----------	----------	----------	----------	----------
tr	----------	x	xx	----------	----------	----------	----------	----------
tr	----------	x	xxx	----------	----------	----------	----------	----------
tr	----------	x	xxx	----------	----------	----------	----------	----------
x	----------	x	30	----------	[4] 19	49	2	30
----------	----------	----------	----------	----------	----------	----------	----------	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------
xxx	----------	tr	32	----------	[4] 6	11	1	81

[2] Feldspar, mica, and iron minerals. [3] Aggregates are mainly shale fragments. [4] Dominantly feldspar and mica.

formed by a dam on the Cumberland River. The river flows generally westward in a meandering pattern. In this Area, all the main tributaries except the Laurel River flow in a general northward direction, but the flow of the smaller tributaries is generally toward the east or west. The Laurel River flows toward the west. These variations in direction of streamflow have resulted in a dendritic pattern of drainage.

The main streams that flow through the survey area but originate outside are the South Fork Cumberland River, the Laurel River, Clear Fork, Little South Fork, Rock Creek, Jellico Creek, Marsh Creek, Roaring Paunch Creek, and Spruce Creek. Beaver Creek, Indian Creek, and Laurel Creek are important streams that originate within the survey area. In most streams of the survey area, the gradient of the channel is less than 50 feet per mile.

Vegetation

The native vegetation of the McCreary-Whitley Area predominantly was deciduous trees, mainly oak, tulip-poplar, and hickory. The original forest also contained some hemlock that generally was on side slopes and on bottom lands in deep drainageways. Virginia, shortleaf, and pitch pines were common only near cliffs and on the sandy and rocky ridgetops.

The Area is described as a complex forest that has more tree species per acre than most hardwood forests in temperate zones in the United States (*5*). Because shrubs, herbs, and forbs are numerous and in great variety, this Area is of great interest to naturalists. Fire and misuse of the land have reduced the number of plants, but most of the original plant species can be found in out-of-the-way or sheltered places.

Today, about 85 percent of the Area is still forested, but many changes have occurred. The American chestnut, once an important commercial tree, has been killed by the chestnut blight and now is almost extinct. The Area is covered mainly by a young, second-growth forest of which less than 5 percent of the stand is 100 years old. The present stand consists of about 20 percent southern yellow pine; 60 percent, mixed oak and hickory; and the remaining 20 percent, mixed tulip-poplar, maple, elm, ash, beech, and hemlock. Of this group, tulip-poplar is the most common. Less than half of the forested part of this Area is producing timber at its maximum potential, because of understocking of stands or competition from economically undesirable trees.

Climate [5]

The climate of the McCreary-Whitley Area is temperate. Winters are moderately cold and summers are warm and humid. Monthly rainfall is relatively uni-

[5] By A. B. ELAM, JR., State climatologist, U.S. Weather Bureau, Lexington, Kentucky.

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TABLE 14.—*Temperature and precipitation*[1]

[Data from U.S. Weather Bureau Station at Williamsburg, Ky.]

Month	Temperature				Precipitation		
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	Two years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Average monthly total	One year in 10 will have— Less than—	One year in 10 will have— More than—
	° F.	° F.	° F.	° F.	Inches	Inches	Inches
January	51	28	69	8	4. 7	2. 0	7. 8
February	53	29	70	10	4. 4	1. 5	8. 7
March	61	35	77	18	4. 8	2. 3	7. 4
April	71	44	85	30	3. 9	2. 2	6. 6
May	80	53	90	38	4. 0	1. 5	6. 6
June	87	61	96	49	3. 9	1. 6	7. 2
July	90	65	98	55	4. 9	2. 5	8. 1
August	89	64	97	54	3. 8	1. 8	6. 0
September	81	57	94	44	2. 7	1. 1	4. 7
October	73	45	86	30	2. 4	1. 0	4. 5
November	60	34	75	20	3. 4	1. 4	6. 0
December	51	29	66	12	3. 8	1. 9	5. 9
Year	71	45	[2] 98	[3] 2	46. 7	40. 7	57. 1

[1] Record for the period 1931–60.
[2] Average annual highest temperature.
[3] Average annual minimum temperature.

form throughout the year but is lowest during September and October. Temperature, rainfall, and humidity, however, stay within limits suitable for varied plant and animal life. Table 14 shows the temperature and precipitation data for Williamsburg, which is just outside the survey area in Whitley County. These data are representative for the Area.

Monthly average temperatures are warmer at lower elevations, such as at Williamsburg where the elevation is 1,100 feet, than at higher elevations, such as at Stearns where the elevation is 1,400 feet. These differences generally are least in spring and in fall. Likewise, the average monthly maximum temperatures generally are higher at Williamsburg for all months. The average monthly minimum temperatures at Stearns are about the same or warmer than those at Williamsburg.

The Area has a wide range of temperature throughout the year, as shown in table 14. This table indicates that Williamsburg, on an average of 2 years in 10, will have at least 4 days in July with temperatures of 98° F. or higher; and 4 days in January with temperatures of 8° or lower. These 4 days are not necessarily consecutive.

Temperatures drop to freezing, 32° or below, on 97 days during the average year. Some variations occur over short distances because of differences in altitude, slope, or air drainage. Because the temperature on most of these days rises above freezing, a daily freeze-thaw cycle is normal. Table 15 shows the probable risk of the last damaging temperature in spring and the first in fall on indicated dates at Williamsburg. These temperatures are 32° or lower, 28° or lower, 24° or lower, 20° or lower, and 16° or lower. Because of relief and location, some variations occur from the dates shown. The average length of the growing season—from the last freezing temperature in spring to the first in fall—is about 185 days at Williamsburg.

The McCreary-Whitley Area receives annual precipitation of about 47 inches. Table 16 shows the average monthly precipitation for a 10-year period at Williamsburg, Stearns, and Cumberland Falls State Park. Measurable precipitation is recorded on about 115 days during the average year. Table 14 shows the probability of very low and very high monthly precipitation at Williamsburg. On the average, about 1 year in 10 will have less than 1.5 inches total precipitation in May, and 1 year in 10 will have more than 8.7 inches in February.

During the ordinary year, the heaviest precipitation in a period of 1 hour is about 1.2 inches. The chance of this 1.2 inches falling in July is 30 percent in any year; the chance from December through February is less than 1 percent. Once in 10 years a total of 4.5 inches in 24 hours can be expected. The chance that this will occur in July is about 2 percent; it is less than 2 percent for all other months.

On the average, thunderstorms occur on about 47 days each year. These storms are more frequent from March through August, but they may occur in any month. Thunderstorms of short duration bring most of the heavy rainfall. Lighter rainfall but lasting for several days sometimes occurs late in spring. This is the kind most likely to cause local flooding, as it generally occurs when the soil is saturated, frozen, or covered with snow. Long periods of mild, sunny weather typically occur in fall.

Average annual snowfall in the Area is about 10 to 14 inches, depending on the relief. Most snow falls at the higher elevations.

TABLE 15.—*Probabilities of last freezing temperatures in spring and first in fall, Williamsburg, Ky.*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 20	March 27	April 6	April 19	May 4
2 years in 10 later than	March 12	March 21	April 1	April 14	April 29
5 years in 10 later than	February 26	March 8	March 19	April 2	April 19
Fall:					
1 year in 10 earlier than	November 20	November 6	October 27	October 17	October 6
2 years in 10 earlier than	November 25	November 12	November 1	October 22	October 11
5 years in 10 earlier than	December 5	November 22	November 12	October 31	October 21

TABLE 16.—*Average monthly precipitation*

[Record for 10-year-period, 1952–61]

Month	Station		
	Williamsburg (elevation 1,000 feet)	Stearns (elevation 1,420 feet)	Cumberland Falls State Park (elevation 1,070 feet)
	Inches	*Inches*	*Inches*
January	5. 1	5. 1	5. 4
February	4. 8	4. 9	4. 5
March	5. 0	5. 5	4. 9
April	4. 5	4. 6	4. 4
May	4. 1	4. 2	4. 3
June	4. 3	4. 6	4. 4
July	5. 0	4. 0	5. 3
August	3. 6	3. 3	2. 9
September	2. 7	2. 8	2. 5
October	2. 6	2. 4	2. 3
November	3. 7	3. 8	3. 4
December	4. 4	4. 5	4. 7
Year	49. 8	49. 7	49. 0

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Glossary

Acidity. See Reaction, soil.

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity and the permanent wilting point. Commonly expressed as inches of water per inch of soil depth.

Bench. A narrow, steplike protrusion from a hillside that is not so steep as the surrounding side slopes and that is parallel to the contour.

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.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

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; soil will not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil is 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, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, soil is moderately resistant to pressure; can be broken.

Soft.—When dry, soil breaks into powder or individual grains under very slight pressure.

Cemented.—Soil is hard and brittle; little affected by moistening.

Diversion or diversion terrace. A ridge of earth, generally a terrace, built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artifically.

Fragipan. A dense brittle subsurface horizon very low in organic matter and clay but rich in silt or very fine sand. The layer seems to be cemented when it is dry, is hard or very hard, 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, and they generally occur below the B horizon, 15 to 40 inches below the surface.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and it is therefore marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. The combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath the A and B horizons.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Karst topography. Topography peculiar to an area underlain by limestone where underground solution and underground streams have caused many depressions, or sinkholes, and caves.

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.

Permeability, soil. 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.*

pH. A numerical means of designating relatively weak acidity and alkalinity, as in soils and other biological systems. A pH of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

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	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

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 of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

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.

Slope gradient. Terms used in this survey to describe the range of slopes are: *nearly level,* 0 to 2 percent; *gently sloping,* 2 to 6 percent; *sloping,* 6 to 12 percent; *strongly sloping,* 12 to 20 percent; *moderately steep,* 20 to 30 percent; *steep,* 30 to 50 percent; and *very steep,* more than 50 percent.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

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 unaggragegated 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).

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (mechanical). An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be like the rest of the field. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

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."

Variegation. Contrasting color patches that vary in number and size; assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bar. A low embankment, or ridge, built across a logging road or skidroad at a slight angle to divert water from the surface of the road.

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