United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
United States Department
of Agriculture, Forest
Service; Missouri
Agricultural Experiment
Station; and Missouri
Department of Natural
Resources

Soil Survey of Taney County, Missouri

How to Use This Soil Survey

General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

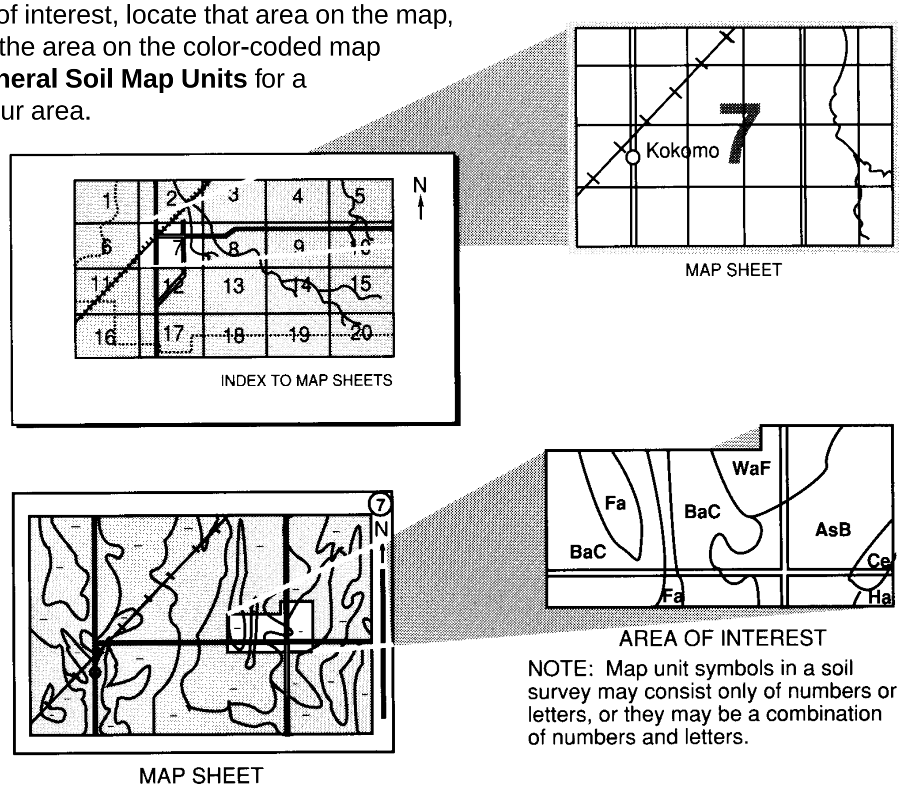
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map units symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.



The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Missouri Department of Natural Resources and the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership of the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey are in 1990. This survey was made cooperatively by the United States Department of Agriculture, Natural Resources Conservation Service and Forest Service; the Missouri Agricultural Experiment Station; and the Missouri Department of Natural Resources. The Taney County Soil and Water District provided funds for a soil scientist to assist with the fieldwork. The survey is part of the technical assistance furnished to the Taney County Soil and Water District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misrepresentation of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: An area of the Knobby-Rock outcrop-Gasconade association, which supports eastern redcedar and warm-season grasses, and the Rueter-Clarksville-Hailey and Ocie-Gatewood-Gasconade associations, which support hardwoods or are cleared for pasture.

Index to Map Units
in Taney County, MO

Soil Survey of *Taney County, MO*

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Roger A. Hansen
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Taney County, Missouri

By Jerry A. Dodd, Natural Resources Conservation Service, and Ellen J. Dettman, Missouri Department of Natural Resources

Fieldwork by Jerry A. Dodd, Natural Resources Conservation Service; Ellen J. Dettman, Missouri Department of Natural Resources; and Joseph E. Blaine, Taney County Soil and Water Conservation District

United States Department of Agriculture, Natural Resources Conservation Service and Forest Service, in cooperation with Missouri Agricultural Experiment Station and Missouri Department of Natural Resources

TANEY COUNTY is in the south-central part of Missouri (fig. 1). It is bordered on the north by Christian and Douglas Counties, Missouri; on the east by Ozark County, Missouri; on the west by Stone County, Missouri; and on the south by Carroll, Boone, and Marion Counties, Arkansas.

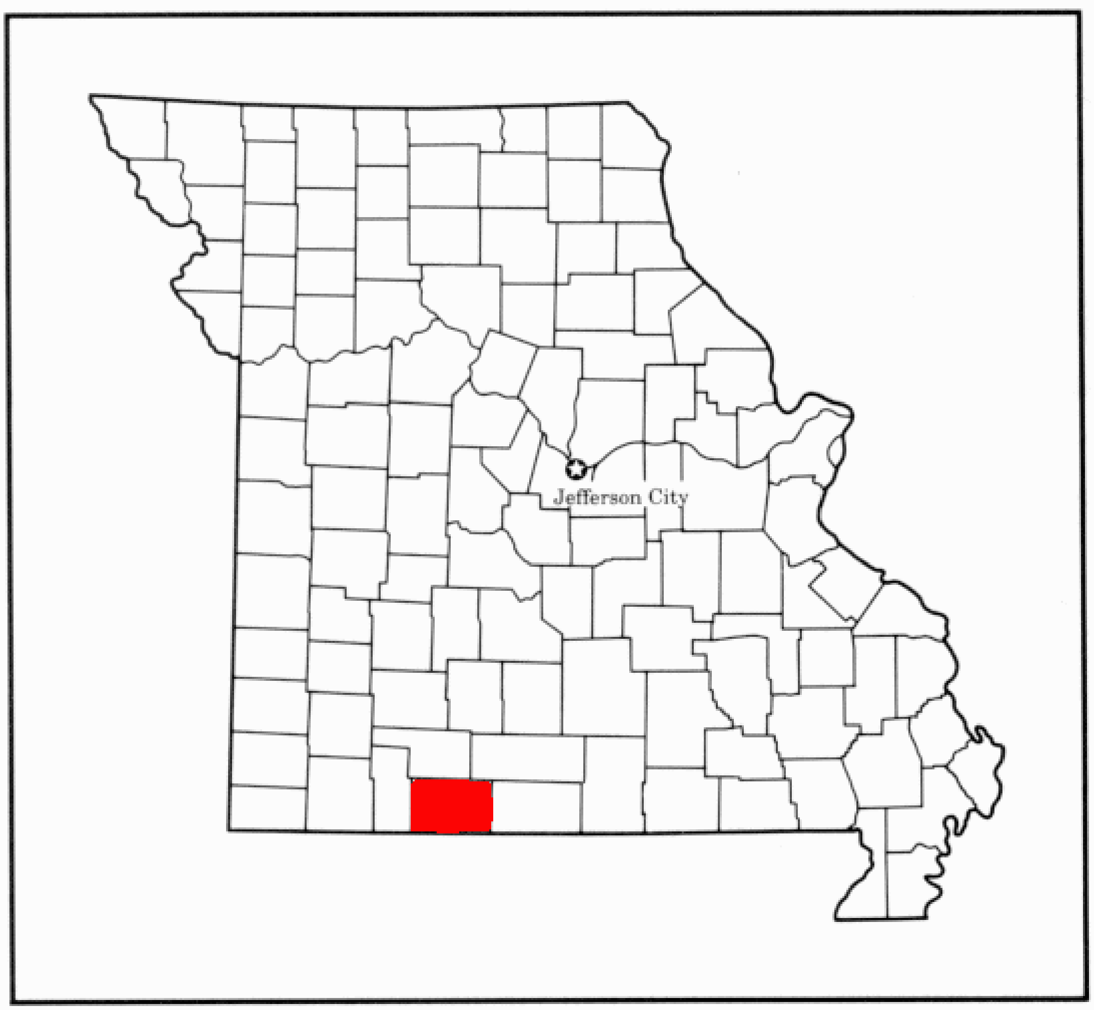


Figure 1.—Location of Taney County in Missouri.

Taney County has an area of 416,871 acres, or about 651 square miles, including 12,945 acres of water in Bull Shoals Lake, Table Rock Lake, and Lake Taneycomo. Forsyth is the county seat. Branson, a center for tourism, is the largest town in the county. Some of the other towns are Hollister, Taneyville, Rockaway Beach, Bradleyville, and Merriam Woods. In 1984, the population of the county was 23,400.

The economy of the county is based on tourism, retirement income, small industry, livestock production, and timber production. The Mark Twain National Forest, in the eastern part of the county, consists of 121,526 acres, of which 63,681 acres is federally administered by the Ava Ranger District, which is headquartered at Ava, in Douglas County.

This soil survey updates a reconnaissance survey of the Ozark region in Missouri and Arkansas published in 1914 *(5)*. It provides more information about the soils and has larger maps, which show the soils in greater detail.

General Nature of the County

|History|Climate|Relief and Drainage|

This section gives general information about the county. It describes history, climate, and relief and drainage.

History

Although Taney County is an area of moderate harvests and limited riches, it has had a rugged attractiveness throughout its development. The area was inhabited by the Osage Indians, by French and Spanish explorers, and later by citizens of the United States, after it was acquired as part of the Louisiana Purchase. Settlers were attracted to the area by stands of virgin forests, mineral wealth, and commerce along the White River.

Few, if any, virgin stands of trees remain in the county. The very steep Brussels soils probably support the closest approximation to virgin timber. Cedar trees formerly were and currently are harvested throughout the county, mainly on Knobby and Gasconade soils in glades. The cedar logs are used for a variety of purposes, including fenceposts, closet-lining lumber, and construction material for tourist novelty gifts. The United States Department of Agriculture, Forest Service, and the Civilian Conservation Corps have planted shortleaf pine (fig.2) on a wide variety of soils, including Clarksville, Ocie, Viraton, Britwater, and Gatewood soils.

Figure 2.—A plantation of shortleaf pine in an area of Britwater silt loam, 2 to 5 percent slopes.

Deposits of lead and zinc are limited in the county, and mining activities have never proved profitable. Current mining activities are restricted to quarrying limestone and dolomite for agricultural lime and stone for construction purposes. The quarries are associated with Clarksville, Hailey, Ocie, Gasconade, and Knobby soils.

The White River provided a means for the settlers to move their goods to market. Wagons eventually hauled merchandise overland as the area began to grow. As land was cleared and harvests were reaped, the soils in the county proved to be less productive than the settlers expected. The alluvial Cedargap, Huntington, Kaintuck, Lecoma, Racket, and Sandbur soils along Swan and Beaver Creeks and the White River were used for corn, wheat, or soybeans. Currently, some of the stream terraces and flood plains along the creeks and Lake Taneycomo and Bull Shoals Lake are used for grain sorghum, winter wheat, or soybeans or for grasses and legumes for pasture or hay. Cotton, which had been an important crop in the history of the county, is no longer grown. Tobacco, although not currently an important crop, has been grown throughout the history of the county. It is still grown on a small acreage of the alluvial soils along Bull Shoals Lake, which once was the White River. Fruits and vegetables formerly were grown on the gravelly soils in the uplands. Tomatoes were grown in areas of Clarksville soils on ridges north of Branson and in areas of Ocie and Britwater soils near Protem. Truck crops are still grown in scattered areas of Britwater, Clarksville, and Viraton soils.

Throughout the history of the county, a rugged topography and a restricted soil depth have limited agricultural development. Livestock enterprises include several dairy farms, farms on which beef calves are raised for the feeder cattle market, and farms on which hogs are raised for the feeder pig market. The farms range from very large to very small. The soils used for livestock farming include Britwater, Clarksville, Gatewood, Hailey, Ocie, Rueter, and Viraton soils and the alluvial soils in the county.

Technology has changed Taney County. Riverboats no longer come up the White River. Dams built in 1913, 1951, and 1959, creating Lake Taneycomo, Bull Shoals Lake, and Table Rock Lake, respectively, have resulted in the development of tourism, which is the economic mainstay of the county. Tourists are attracted to the county by the opportunities for outdoor recreation on the lakes and in the forests; by Silver Dollar City, which is directly across the county line, in Stone County; and by country music shows in Branson. The annual influx of tourists into the county, the development necessary to support tourism, and the growing vacation and retirement community have put a strain on the environment. The Taney County Soil and Water Conservation District was organized in 1966. It has been instrumental in the development of measures that help to eliminate pollution problems. Subsequent local, State, and Federal projects have continued the development of these measures.

Climate

Taney County is hot in summer, especially at low elevations, and moderately cool in winter, especially on mountains and high hills. Rainfall is fairly heavy and is well distributed throughout the year. Snow falls nearly every winter, but the snow cover lasts for only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Ozark Beach for the period 1951 to 1988. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 35 degrees F and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred at Ozark Beach on February 2, 1951, is -19 degrees. In summer, the average temperature is 76 degrees and the average daily maximum temperature is 90 degrees. The highest recorded temperature, which occurred on July 15, 1954, is 116 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 41.66 inches. Of this, nearly 24 inches, or about 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 5.25 inches on December 2, 1982. Thunderstorms occur on about 57 days each year.

The average seasonal snowfall is about 10 inches. The greatest snow depth at any one time during the period of record was 17 inches. On the average, 7 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 13 miles per hour, in spring.

Relief and Drainage

Joseph E. Blaine, soil scientist, Taney County Soil and Water Conservation District, helped prepare this section.

Taney County is in an advanced stage of the present geological erosion cycle. The surface features are mainly a result of the overall Ozark uplift and the subsequent geological erosion (fig. 3). Most of the county is highly dissected and has a moderately sloping to very steep topography. The steeper slopes in the county are in areas of the Rueter-Clarksville-Hailey association, which is described under the heading "General Soil Map Units," and in some areas along the White River. The areas of least relief are in the Britwater-Sandbur-Huntington and Ocie-Britwater-Viraton associations. Elevation ranges from 654 to 1,480 feet. The highest point is in the northeastern part of the county, and the lowest point is the normal pool elevation of Bull Shoals Lake.

Figure 3.—An area of the Ozark uplift, which consists of the Salem Plateau and the Springfield Plateau. The Salem Plateau is in the cleared

area in the foreground. This area is in the Ocie-Gatewood-Gasconade association. The Springfield Plateau is in the timbered area in the background. This area is in the Rueter-Clarksville-Hailey association.

All of the streams in the county are in the drainage basin of the White River and flow into Lake Taneycomo, Bull Shoals Lake, or Table Rock Lake. These lakes were created by the damming of the White River. Table Rock Lake has a normal pool elevation of 915 feet, Lake Taneycomo has one of 701 feet, and Bull Shoals Lake, which extends into Arkansas, has one of 654 feet. The White River has a drainage basin of 4,020 square miles. It originates in Arkansas. It enters Taney County from the west and exits from the southeastern part of the county into Arkansas.

The county has three main streams, all of which enter the county from the north and flow basically southward. These streams, from largest to smallest, are Beaver Creek, Swan Creek, and Bull Creek. Beaver Creek originates in Webster County and drains the eastern part of Taney County, where it flows into Bull Shoals Lake. Swan Creek and Bull Creek drain the central and western parts of the county, respectively. Swan Creek originates in Douglas County and flows into Bull Shoals Lake. Bull Creek originates in Christian County and flows into Lake Taneycomo.

General Soil Map Units

in Taney County, MO

The general soil map at the back of this publication shows the soil associations in this county. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The descriptions, names, and delineations of the soils in this county do not fully agree with those in surveys of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately and giving them different names.

Soil Descriptions

1. Ocie-Gatewood-Gasconade Association

Deep, moderately deep, and shallow, well drained and moderately well drained, gently sloping to very steep soils formed in gravelly sediments and clayey and cherty dolomite residuum; on uplands

This association is on ridgetops and dissected back slopes in the uplands, on foot slopes, and on narrow flood plains. Slopes range from 3 to 50 percent.

This association makes up about 64 percent of the county. It is about 28 percent Ocie soils, 26 percent Gatewood soils, 26 percent Gasconade soils, and 20 percent minor soils (fig. 4).

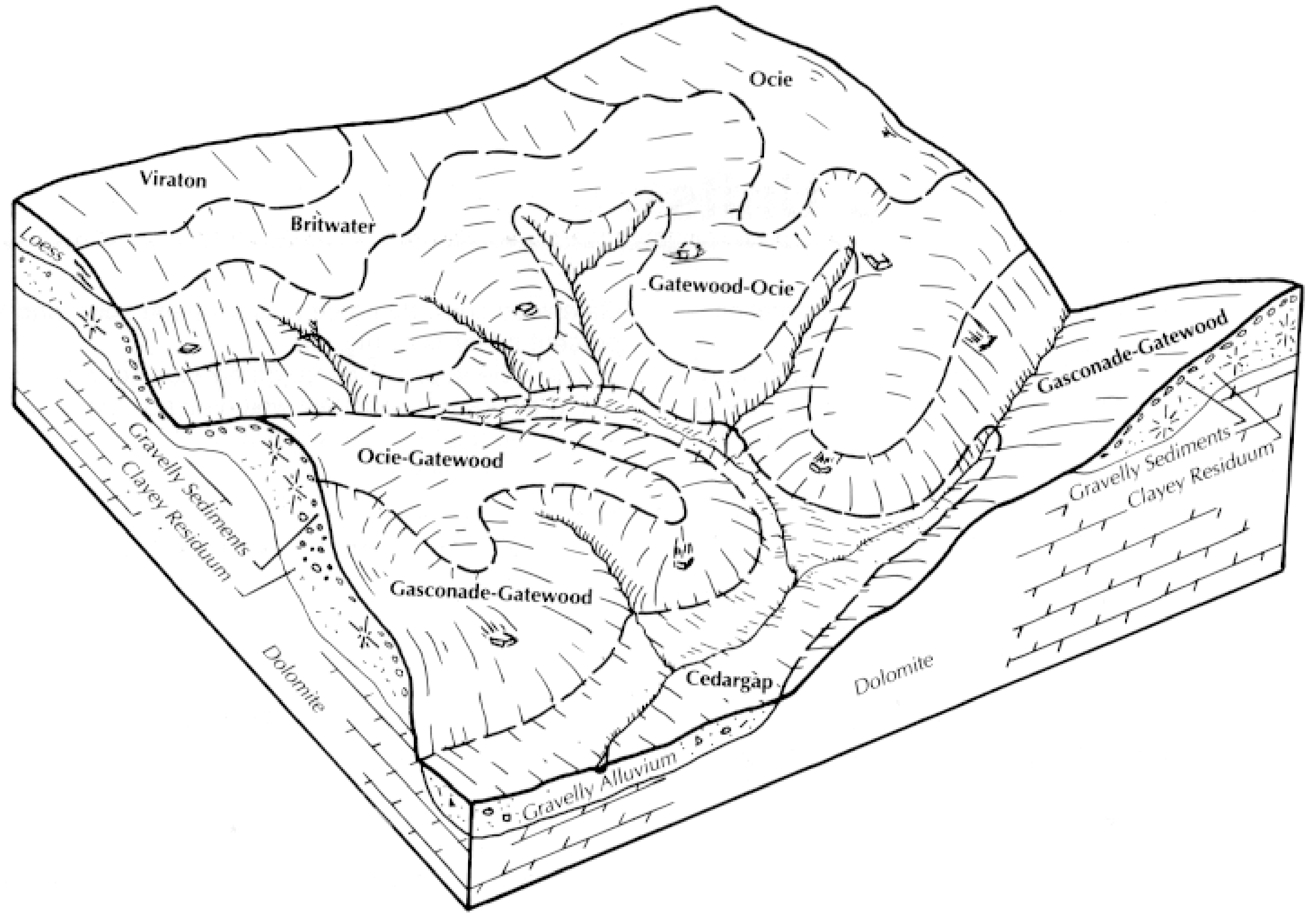


Figure 4.—Pattern of soils and parent material in the Ocie-Gatewood-Gasconade and Ocie-Britwater-Viraton associations.

The Ocie soils are deep, gently sloping to steep, and well drained or moderately well drained. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 2 inches, yellowish brown very gravelly silt loam
Subsoil	2 to 6 inches, brown very gravelly silt loam
	6 to 18 inches, strong brown and yellowish red extremely gravelly silt loam
	18 to 23 inches, yellowish red gravelly clay
	23 to 31 inches, yellowish red and strong brown, mottled clay
	31 to 49 inches, yellowish red and strong brown clay
Bedrock	49 inches, hard dolomite

The Gatewood soils are moderately deep, gently sloping to steep, and moderately well drained. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 6 inches, dark brown very gravelly silt loam
Subsurface layer	6 to 13 inches, yellowish brown very gravelly silt loam
Subsoil	13 to 29 inches, yellowish brown clay
Substratum	29 to 33 inches, yellowish brown and light olive gray channery clay
Bedrock	33 inches, hard dolomite

The Gasconade soils are shallow, moderately steep to very steep, and well drained. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 8 inches, very dark brown very flaggy clay loam
Subsoil	8 to 19 inches, very dark grayish brown very gravelly and extremely flaggy clay loam
Bedrock	19 inches, hard dolomite

Of minor extent in this association are areas of Rock outcrop, the gravelly Cedargap soils on narrow flood plains, the loamy Britwater soils on ridgetops and foot slopes, and the loamy Viraton soils on ridgetops. Viraton soils have a fragipan.

About 55 percent of the acreage in this association supports mixed hardwoods, which range in quality from scrub trees to marketable timber. The rest of the acreage has been cleared of trees and is used for pasture or hay.

The major soils are unsuited to cultivated crops because of the depth to bedrock, the Rock outcrop, the slope, and the hazard of erosion.

The Ocie and Gatewood soils on east and north aspects are suitable for timber production, but the Gasconade soils are poorly suited. Part of the association is within the boundaries of the Mark Twain National Forest. The multiple-use policy of the Forest Service permits both timber production and recreational pursuits, such as hunting and hiking. Some areas of the forest can be leased for grazing. Areas of the association outside the Forest Service boundaries are used as grazed woodland or are converted to pasture after the trees are harvested. The hazard of erosion, an equipment limitation, seedling mortality, and windthrow are the main management concerns.

The Ocie and Gatewood soils are suited to grasses and some legumes. The Gasconade soils are poorly suited to grasses and legumes. The areas used for pasture or hay are mainly those that are limited by the slope, the depth to bedrock, or the Rock outcrop. Raising beef calves for the feeder cattle market is the main farm enterprise in areas of this association. Overgrazing, the depth to bedrock, the Rock outcrop, the slope, and the hazard of erosion are the main management concerns. The Gasconade soils are unsuited to hay on all slopes, and the Ocie and Gatewood soils are unsuited on the steeper slopes.

The major soils are unsuitable for building site development and onsite waste disposal systems. The depth to bedrock, the Rock outcrop, large stones, the shrink-swell potential, permeability, and the slope are the main management concerns.

2. Knobby-Rock Outcrop-Gasconade Association

Very shallow and shallow, somewhat excessively drained and well drained, gently sloping to very steep soils formed in dolomite residuum; on uplands

This association is on ridgetops and dissected side slopes in the uplands. It generally is in part of the Hercules Glades Wilderness Area and in part of the Ruth and Paul Henning State Forest. Slopes range from 3 to 50 percent.

This association makes up about 16 percent of the county. It is about 36 percent Knobby soils, 31 percent Rock outcrop, 23 percent Gasconade soils, and 10 percent minor soils (fig. 5). The Knobby soils are very shallow, strongly sloping to very steep, and somewhat excessively drained. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 5 inches, very dark gray gravelly loam
Subsurface layer	5 to 9 inches, very dark grayish brown very flaggy fine sandy loam
Bedrock	9 inches, hard dolomite

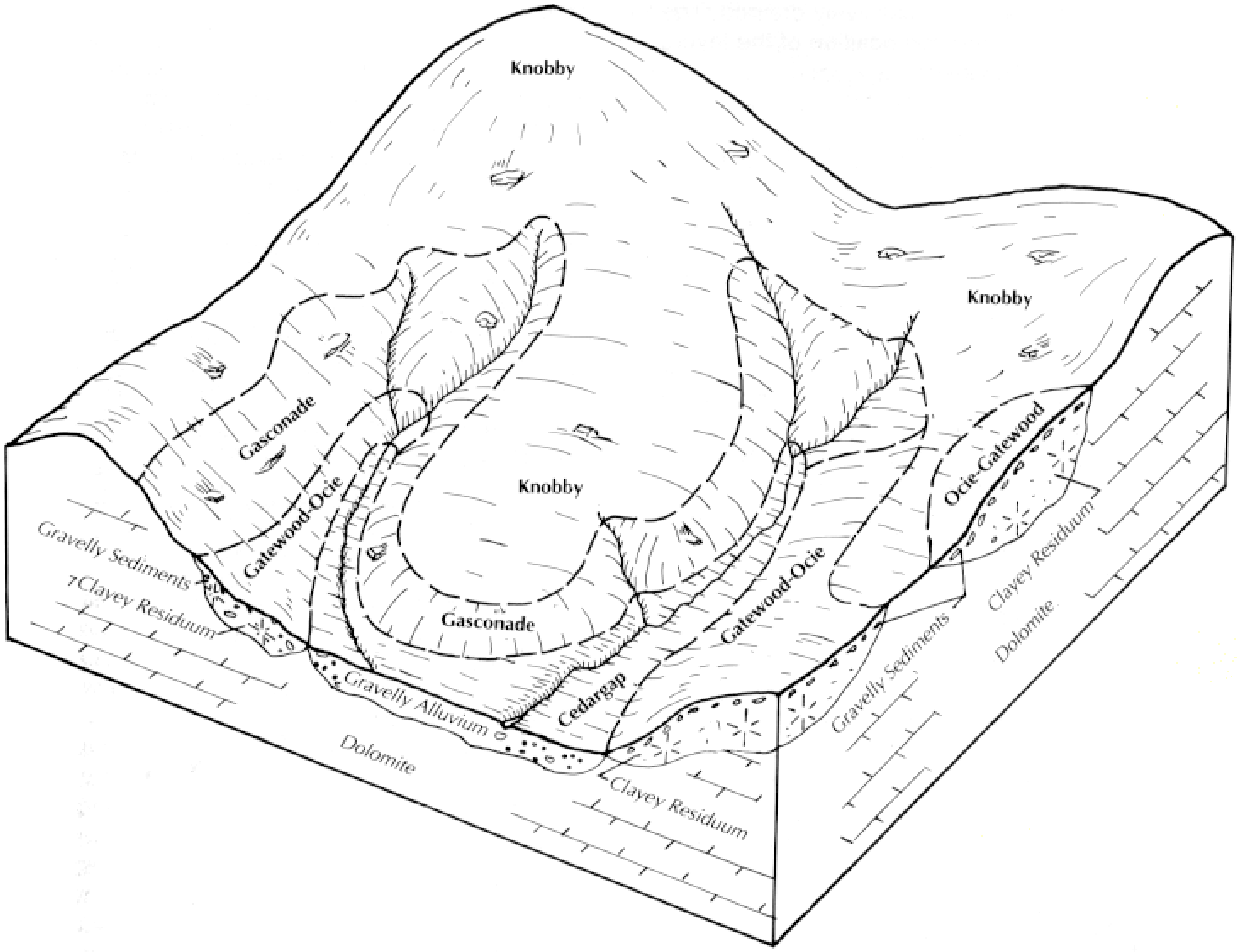


Figure 5.—Pattern of soils and parent material in the Knobby-Rock outcrop-Gasconade association.

Typically, the Rock outcrop occurs as parallel bands of exposed dolomite bedrock. It is in scattered areas throughout the association.

The Gasconade soils are shallow, gently sloping to strongly sloping, and well drained. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 4 inches, very dark grayish brown flaggy clay loam
Subsoil	4 to 8 inches, very dark grayish brown flaggy clay loam
	8 to 14 inches, very dark grayish brown extremely flaggy clay loam
Bedrock	14 inches, hard dolomite

Of minor extent in this association are the moderately deep Gatewood and deep Ocie soils on ridgetops and back slopes in the uplands and the gravelly Cedargap soils on narrow flood plains.

About 65 percent of the acreage in this association is idle land vegetated by native warm-season grasses, eastern redcedar, and some scrub hardwoods. The rest of the acreage is used as marginal pasture.

The major soils are unsuited to cultivated crops because of the slope, the depth to bedrock, and the Rock outcrop.

The Knobby soils are unsuitable for timber production, and the Gasconade soils are poorly suited. Part of the association is within the boundaries of the Mark Twain National Forest. The multiple-use policy of the Forest Service permits both timber production and recreational pursuits, such as hunting and hiking. Some areas of the forest can be leased for grazing. These areas provide marginal pasture. Controlled burning by the Forest Service improves the growth of native warm-season grasses and retards the growth of the eastern redcedar and scrub hardwoods. Areas of the association outside the Forest Service boundaries have been invaded by eastern redcedar. In some areas the cedar is harvested, but very few areas are managed for the production of eastern redcedar. The hazard of erosion, an equipment limitation, seedling mortality, and windthrow are the main management concerns.

The major soils are poorly suited to grasses and legumes for pasture and are unsuited to hay. Most areas are idle or provide marginal pasture. Overgrazing, the slope, the Rock outcrop, and the depth to bedrock are the main management concerns.

The major soils are unsuitable for building site development and onsite waste disposal systems. The depth to bedrock, the Rock outcrop, large stones, the shrink-swell potential, permeability, and the slope are the main management concerns.

3. Rueter-Clarksville-Hailey Association

Very deep, somewhat excessively drained and excessively drained, gently sloping to very steep soils formed in cherty limestone residuum; on uplands

This association is on ridgetops and highly dissected side slopes in the uplands. Slopes range from 3 to 50 percent.

This association makes up about 10 percent of the county. It is about 32 percent Rueter soils, 28 percent Clarksville soils, 21 percent Hailey soils, and 19 percent minor soils (fig. 6).

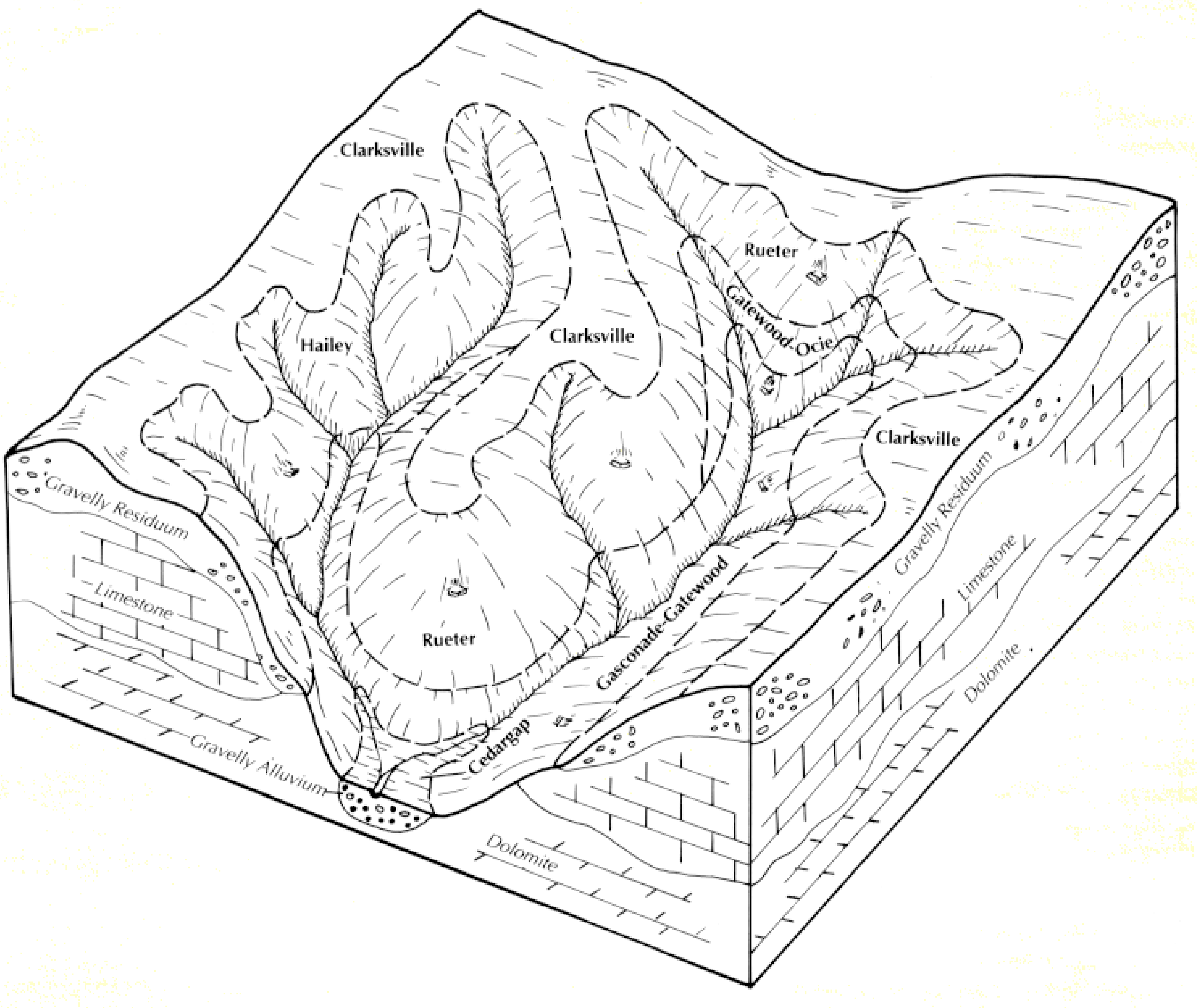


Figure 6.—Pattern of soils and parent material in the Rueter-Clarksville-Hailey association.

The moderately steep to very steep, somewhat excessively drained Rueter soils are on back slopes in the uplands. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 5 inches, dark grayish brown very gravelly silt loam
Subsurface layer	5 to 13 inches, brown very gravelly silt loam
Subsoil	13 to 22 inches, brown very cobbly silt loam
	22 to 42 inches, strong brown extremely gravelly silt loam
	42 to 60 inches, dark red and red very gravelly clay

The gently sloping to strongly sloping, somewhat excessively drained Clarksville soils are on ridgetops and shoulder slopes in the uplands. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 4 inches, dark grayish brown very gravelly silt loam
Subsurface layer	4 to 13 inches, brown very gravelly silt loam
Subsoil	13 to 43 inches, multicolored extremely gravelly silt loam and very gravelly silty clay loam
	43 to 60 inches, dark red or multicolored very gravelly clay

The moderately steep to very steep, excessively drained Hailey soils are on back slopes in the uplands. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 3 inches, very dark grayish brown very gravelly silt loam
Subsurface layer	3 to 12 inches, brown extremely gravelly silt loam
Subsoil	12 to 40 inches, brown extremely cobbly coarse sandy loam
	40 to 60 inches, brown and yellowish brown extremely cobbly loam

Of minor extent in this association are Rock outcrop in scattered areas on the middle and lower slopes; the nearly level, deep Cedargap soils on narrow flood plains; and the shallow Gasconade, moderately deep Gatewood, and deep Ocie soils on the lower slopes.

About 65 percent of the acreage in this association is used for pasture or hay. The rest of the acreage supports hardwoods.

The major soils are unsuited to cultivated crops because of the slope and the hazard of erosion.

The Rueter and Clarksville soils are suited to grasses and some legumes for pasture. The Hailey soils are poorly suited to grasses and legumes for pasture. The Clarksville soils are suited to hay, but the Rueter and Hailey soils are unsuited because of the slope. Raising beef calves for the feeder cattle market is the main farm enterprise in areas of this association. Overgrazing, the slope, and the hazard of erosion are the main management concerns.

The major soils are suitable for timber production. Part of the association is within the boundaries of the Mark Twain National Forest. The multiple-use policy of the Forest Service permits both timber production and recreational pursuits, such as hunting and hiking. Some areas of the forest can be leased for grazing. Areas of the association outside the Forest Service boundaries can produce good-quality trees, but few of these areas are managed for timber production. The hazard of erosion, an equipment limitation, and seedling mortality are the main management concerns.

The Clarksville soils on ridgetops are suitable for building site development and onsite waste disposal systems, but the Rueter and Hailey soils generally are not developed for these uses because of the slope. Permeability, large stones, the shrink-swell potential, and the slope are the main limitations affecting urban development in the association.

4. Britwater-Sandbur-Huntington Association

Very deep, well drained and excessively drained, nearly level to moderately sloping soils formed in loamy alluvium and colluvium; on stream terraces, foot slopes, and flood plains

This association is on flood plains along the major creeks and the White River (Lake Taneycomo and Bull Shoals Lake) and on the adjacent stream terraces and foot slopes (fig. 7). Slopes range from 0 to 9 percent.

Figure 7.—A typical area of the Britwater-Sandbur-Huntington association along Swan Creek.

This association makes up about 5 percent of the county. It is about 37 percent Britwater and similar soils, 24 percent Sandbur and similar soils, 14 percent Huntington and similar soils, and 25 percent minor soils.

The moderately sloping, well drained Britwater soils are on foot slopes and stream terraces. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 4 inches, dark grayish brown silt loam
Subsurface layer	4 to 9 inches, brown silt loam
Subsoil	9 to 20 inches, dark yellowish brown gravelly silt loam
	20 to 24 inches, dark brown, mottled gravelly clay loam
	24 to 60 inches, yellowish red, mottled gravelly clay loam and very gravelly clay loam

The nearly level and very gently sloping, excessively drained Sandbur soils are on flood plains of intermediate size. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 10 inches, very dark grayish brown fine sandy loam
Substratum	10 to 19 inches, very dark grayish brown and yellowish brown loamy fine sand
	19 to 45 inches, very dark grayish brown fine sandy loam and loamy fine sand

	45 to 60 inches, very dark grayish brown and brown fine sand and loamy fine sand

The nearly level and very gently sloping, welt drained Huntington soils are on flood plains of intermediate size. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 10 inches, very dark grayish brown silt loam
Subsurface layer	10 to 14 inches, dark brown silt loam
Subsoil	14 to 28 inches, dark yellowish brown silt loam
	28 to 60 inches, dark yellowish brown and yellowish brown silty clay loam

Of minor extent in this association are the well drained, gravelly Cedargap and moderately well drained, loamy Racket soils on flood plains.

About 85 percent of the acreage in this association is used for pasture or hay. The rest of the acreage is used for cultivated crops or supports hardwoods.

The major soils are suited to grasses and legumes for pasture or hay. Raising beef calves for the feeder cattle market is the main farm enterprise in areas of this association. The hazard of erosion, overgrazing, and flooding are the main management concerns.

The Britwater and Huntington soils are suited to cultivated crops, but the Sandbur soils are suited only to crops grown on a limited basis. The hazard of erosion, flooding, and the slope are the main management concerns.

The major soils are suitable for timber production. An equipment limitation and seedling mortality are the main management concerns.

The Sandbur and Huntington soils are unsuitable for building site development and ons'te waste disposal systems because of flooding. The Britwater soils are suitable for these uses. Permeability and the slope are the main management concerns in areas of the Britwater soils.

5. Ocie-Britwater-Viraton Association

Deep and very deep, moderately well drained and well drained, gently sloping and moderately sloping soils formed in a thin mantle of loess or gravelly sediments and in clayey and cherty dolomite residuum; on uplands

This association is on the tops of ridges in the uplands. Slopes range from 2 to 9 percent.

This association makes up about 5 percent of the county. It is about 28 percent Ocie soils, 27 percent Britwater soils, 23 percent Viraton soils, and 22 percent minor soils (fig. 4).

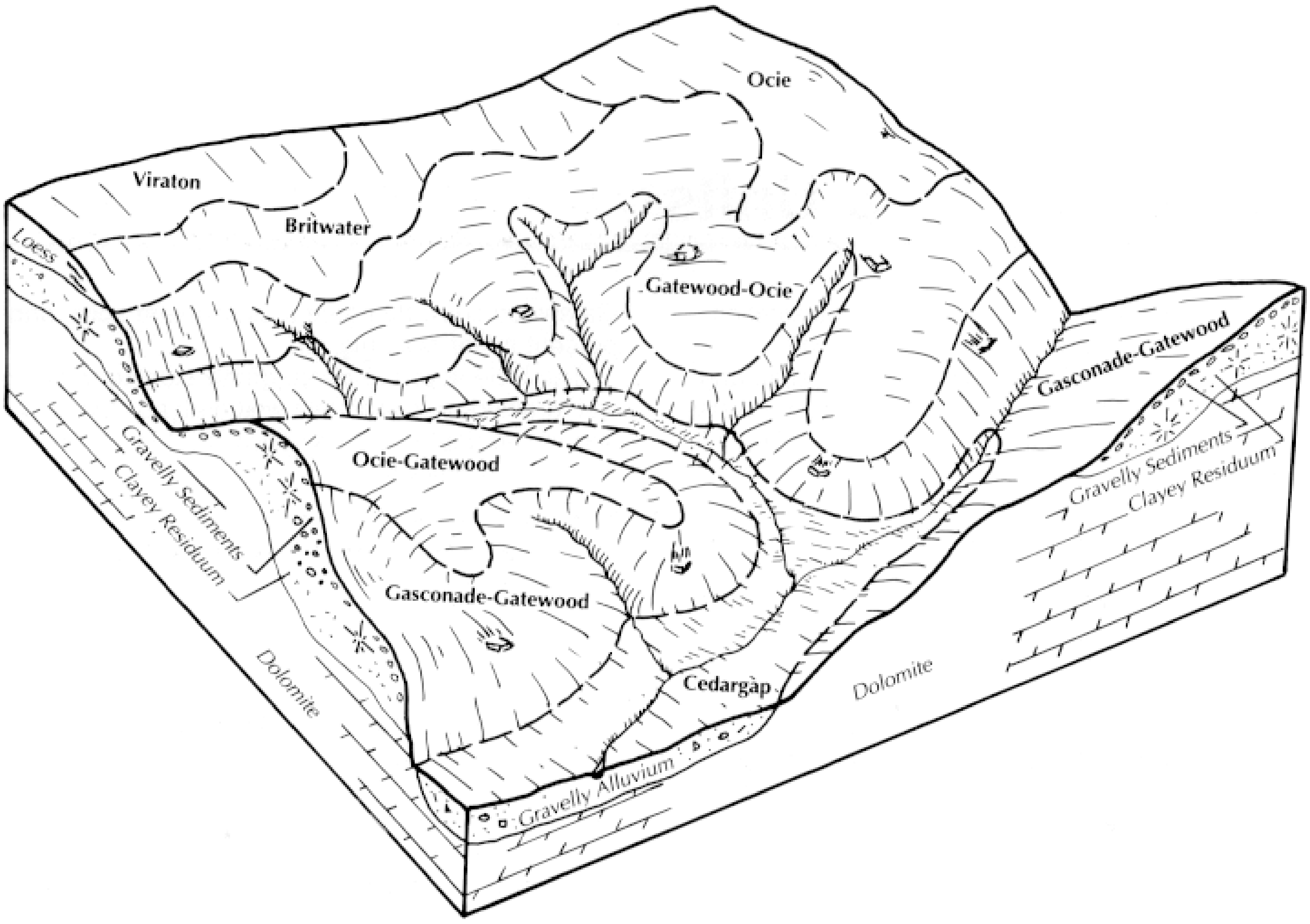


Figure 4.—Pattern of soils and parent material in the Ocie-Gatewood-Gasconade and Ocie-Britwater-Viraton associations.

The deep, gently sloping and moderately sloping, moderately well drained Ocie soils are on ridgetops and shoulder slopes in the uplands. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 7 inches, brown gravelly silt loam
Subsoil	7 to 22 inches, yellowish brown very gravelly loam
	22 to 25 inches, brown and yellowish red, mottled gravelly clay
	25 to 31 inches, multicolored clay
	31 to 44 inches, strong brown and light brownish gray, mottled clay
	44 to 51 inches, yellowish brown and brown gravelly clay
Bedrock	51 inches, hard dolomite

The very deep, gently sloping, well drained Britwater soils are on ridgetops, foot slopes, and stream terraces. The typical sequence, depth, and composition of the layers in these soils are as follows—

Surface layer	0 to 6 inches, dark brown silt loam
Subsurface layer	6 to 11 inches, brown silt loam
Subsoil	11 to 21 inches, strong brown silt loam
	21 to 36 inches, strong brown very gravelly clay loam
	36 to 60 inches, yellowish red gravelly silty clay

The very deep, gently sloping, moderately well drained Viraton soils are on the tops of ridges in the uplands.

Detailed Soil Map Units
in Taney County, MO

14D	Knobby-Rock outcrop complex, 3 to 15 percent slopes
14F	Knobby-Rock outcrop complex, 15 to 50 percent slopes
16G	Brussels-Rock outcrop complex, 50 to 90 percent slopes
18D	Gasconade-Gatewood-Rock outcrop complex, 3 to 15 percent slopes
18F	Gasconade-Gatewood-Rock outcrop complex, 15 to 50 percent slopes
24C	Ocie-Gatewood complex, 3 to 9 percent slopes
24E	Gatewood-Ocie complex, 9 to 35 percent slopes
44D	Clarksville very gravelly silt loam, 3 to 15 percent slopes
45F	Hailey very gravelly silt loam, 15 to 50 percent slopes
46F	Rueter-Rock outcrop complex, 15 to 50 percent slopes
55B	Britwater silt loam, 2 to 5 percent slopes
55C	Britwater silt loam, 5 to 9 percent slopes
57B	Lecoma fine sandy loam, 1 to 6 percent slopes
66A	Huntington silt loam, 0 to 3 percent slopes
76A	Racket silt loam, 0 to 3 percent slopes
81B	Viraton silt loam, 2 to 5 percent slopes
93A	Cedargap gravelly loam, 0 to 3 percent slopes
95A	Kaintuck fine sandy loam, 0 to 3 percent slopes
96A	Sandbur fine sandy loam, 0 to 3 percent slopes
99	Pits, quarries

The map units on the detailed soil maps at the back of this survey represent the soils in the county. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Britwater silt loam, 2 to 5 percent slopes, is a phase of the Britwater series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Knobby-Rock outcrop complex, 15 to 50 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named.

Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The descriptions, names, and delineations of the soils in this county do not fully agree with those in surveys of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately and giving them different names.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

14D—Knobby-Rock outcrop complex, 3 to 15 percent slopes. This map unit occurs as areas of a very shallow, gently sloping to strongly sloping, somewhat excessively drained Knobby soil and areas of Rock outcrop. The unit is in glades on ridgetops and shoulder slopes in the uplands. The glades are known locally as "bald knobs." individual areas range from about 10 to more than 300 acres in size. They are about 55 percent Knobby soil and 45 percent Rock outcrop. The Knobby soil and Rock outcrop could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Knobby soil are as follows—

Surface layer	0 to 3 inches, black very flaggy fine sandy loam
Subsurface layer	3 to 8 inches, black very flaggy fine sandy loam
Bedrock	8 inches, hard dolomite

In some areas the soil has a lower content of rock fragments and a higher content of clay. In other areas it is more than 10 inches deep over bedrock.

Important properties of the Knobby soil—

Permeability	Moderate
Surface runoff	Medium
Available water capacity	Very low
Organic matter content	Moderately low
Depth to bedrock	4 to 10 inches

Typically, the Rock outcrop consists of exposed dolomite bedrock in parallel bands throughout the unit.

Most areas are glades that support native warm-season grasses, eastern redcedar, and scattered scrubby hardwoods or marginal stands of pasture plants. This unit is generally unsuited to cultivated crops because of the slope, the depth to bedrock, the Rock outcrop, and flagstones on the surface. It generally is not managed for commercial timber because of low productivity.

The Knobby soil is poorly suited to cool-season grasses, warm-season grasses, and legumes. If managed for pasture, it can support marginal stands of tall fescue or Caucasian bluestem. It is wet from fall to spring and is droughty in summer. Overgrazing should be avoided. Tilling the surface layer is nearly impossible, and the use of equipment is restricted. This unit is unsuitable for hay because of the Rock outcrop.

This unit is unsuitable for building site development and onsite waste disposal systems because of the Rock outcrop, the depth to bedrock, and the slope. Dwellings with basements should not be constructed because of the depth to bedrock. Alternatives to conventional septic systems are needed. Possible choices are pumping effluent to areas where the soils are better suited to onsite waste disposal, adding fill for a mound system, and using a holding tank for temporary storage. Any system will require professional help.

The land capability classification is VIIs. No woodland ordination symbol is assigned.

14F—Knobby-Rock outcrop complex, 15 to 50 percent slopes. This map unit occurs as areas of a very shallow, moderately slopes in the uplands. Individual areas range from about 40 to more than 600 acres in size. They are about 60 percent Knobby soil and 40 percent Rock outcrop. The Knobby soil and Rock outcrop could not be mapped separately at the scale selected for mapping (fig. 8).

Figure 8.—An area of Knobby-Rock outcrop complex, 15 to 50 percent slopes. The Knobby soil and Rock outcrop occur as areas so intricately intermingled that they could not be mapped separately.

The typical sequence, depth, and composition of the layers in the Knobby soil are as follows—

Surface layer	0 to 5 inches, very dark gray gravelly loam
Subsurface layer	5 to 9 inches, very dark grayish brown very flaggy fine sandy loam
Bedrock	9 inches, hard dolomite

In some areas the soil has a lower content of rock fragments and a higher content of clay. In other areas it is more than 10 inches deep over bedrock.

Important properties of the Knobby soil—

Permeability	Moderate
Surface runoff	Rapid
Available water capacity	Very low
Organic matter content	Moderately low
Depth to bedrock	4 to 10 inches

Typically, the Rock outcrop consists of exposed dolomite bedrock in parallel bands throughout the unit.

Most areas are glades that support native warm-season grasses, eastern redcedar, and scattered scrubby hardwoods or marginal stands of pasture plants. This unit generally is not managed for commercial timber because of low productivity. It is generally unsuited to cultivated crops because of the slope, the depth to bedrock, the Rock outcrop, and flagstones on the surface.

The Knobby soil is poorly suited to cool-season grasses, warm-season grasses, and legumes. If managed for pasture, it can support marginal stands of tall fescue or Caucasian bluestem. It is wet from fall to spring and is droughty in summer. Overgrazing should be avoided. Tilling the surface layer is nearly impossible, and the use of equipment is restricted. This unit is unsuitable for hay because of the slope and the Rock outcrop.

This unit is unsuitable for building site development and onsite waste disposal systems because of the depth to bedrock, the Rock outcrop, and the slope. Dwellings with basements should not be constructed because of the depth to bedrock. Alternatives to conventional septic systems are needed. Possible choices are pumping effluent to areas where the soils are better suited to onsite waste disposal, adding fill for a mound system, and using a holding tank for temporary storage. Any system will require professional help.

The land capability classification is VIIs. No woodland ordination symbol is assigned.

16G—Brussels-Rock outcrop complex, 50 to 90 percent slopes. This map unit occurs as areas of a very deep, very steep, well drained Brussels soil and areas of Rock outcrop. The unit is adjacent to river and lake bluffs. Individual areas range from about 20 to more than 150 acres in size. They average about 55 percent Brussels soil and 30 percent Rock outcrop, but the percentages vary from place to place. The Brussels soil and Rock outcrop could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Brussels soil are as follows—

Surface layer	0 to 13 inches, black very flaggy silty clay loam
Subsoil	13 to 20 inches, black very flaggy silty clay 20 to 34 inches, dark brown and dark yellowish brown extremely flaggy clay 34 to 60 inches, strong brown extremely flaggy clay and silty clay

In some areas stones and boulders are on the surface.

Included in this unit in mapping are areas of the shallow Gasconade and moderately deep Gatewood soils. These soils generally are upslope from the Brussels soil. They make up about 15 percent of the unit.

Important properties of the Brussels soil—

Permeability	Moderate slow
Surface runoff	Very rapid
Available water capacity	Low
Organic matter content	Moderate
Shrink-swell potential	Moderate in the subsoil

Typically, the Rock outcrop occurs as very steep bluffs of exposed dolomite bedrock.

Most areas support timber. This unit is generally unsuited to cultivated crops and to grasses for pasture or hay because of the slope and the Rock outcrop. Because of the slope, slippage is a hazard in areas of the Brussels soil.

Although most areas support native hardwoods, the Brussels soil generally is not managed for commercial timber production. If trees are harvested, the hazard of erosion, an equipment limitation, and seedling mortality are the major management concerns. The use of most logging equipment is severely limited because of the slope. The logs should be yarded uphill or downhill to roads in areas outside of this unit. When harvested areas are replanted, reinforcement planting can increase the seedling survival rate. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

The Brussels soil generally is not used for building site development or onsite waste disposal systems because of the slope, slippage, and large stones.

The land capability classification is VIIs. The woodland ordination symbol is 3R in areas of the Brussels soil.

18D—Gasconade-Gatewood-Rock outcrop complex, 3 to 15 percent slopes. This map unit occurs as areas of gently sloping to strongly sloping soils and areas of Rock outcrop. The Gasconade soil is well drained and shallow. The Gatewood soil is moderately well drained and moderately deep. The unit is on ridgetops and shoulder slopes in the uplands. Individual areas range from about 5 to more than 200 acres in size. They are about 60 percent Gasconade soil, 20 percent Gatewood soil, and

15 percent Rock outcrop. The Gasconade and Gatewood soils and Rock outcrop could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Gasconade soil are as follows—

Surface layer	0 to 4 inches, very dark grayish brown flaggy clay loam
Subsurface layer	4 to 8 inches, very dark grayish brown flaggy clay loam 8 to 14 inches, very dark grayish brown extremely flaggy clay loam
Bedrock	14 inches, hard dolomite

In some areas the subsoil is red clay, has less clay, or has fewer rock fragments.

Important properties of the Gasconade soil—

Permeability	Moderately slow
Surface runoff	Medium
Available water capacity	Very low
Organic matter content	Moderate
Shrink-swell potential	Moderate in the subsoil
Depth to bedrock	10 to 20 inches

The typical sequence, depth, and composition of the layers in the Gatewood soil are as follows—

Surface layer	0 to 6 inches, very dark grayish brown very gravelly silt loam
Subsurface layer	6 to 9 inches, dark brown very gravelly silt loam
Subsoil	9 to 11 inches, strong brown gravelly silty clay 11 to 22 inches, yellowish brown, mottled clay 22 to 25 inches, multicolored gravelly silty clay
Substratum	25 to 29 inches, multicolored channery clay
Bedrock	29 inches, hard dolomite

In some areas, the subsoil is red clay and the dark surface layer is thinner.

Important properties of the Gatewood soil—

Permeability	Slow
Surface runoff	Medium
Available water capacity	Low
Organic matter content	Low
Shrink-swell potential	High in the subsoil
Depth to bedrock	20 to 40 inches

Typically, the Rock outcrop consists of exposed dolomite bedrock in parallel bands throughout the unit. Included in this unit in mapping are areas that have scattered stones and boulders on the surface and areas of the deep Ocie soils. Ocie soils are in landscape positions similar to those of the Gasconade and Gatewood soils. They are in scattered areas throughout the unit. Included soils make up about 5 percent of the unit.

Most areas support scrubby hardwoods, eastern redcedar, and warm-season grasses. Many small areas are used for pasture. This unit is generally unsuited to cultivated crops because of the slope, the depth to bedrock, the Rock outcrop, and flagstones on the surface.

The Gatewood soil is suited to cool-season grasses, warm-season grasses, and some legumes. The Gasconade soil is poorly suited to cool-season grasses, warm-season grasses, and legumes. If managed for pasture, these soils can support stands of cool-season grasses, such as tall fescue; warm-season grasses, such as little bluestem and Caucasian bluestem; and legumes, such as lespedeza. The soils are wet from fall to spring and are droughty in summer. Overgrazing should be avoided. Tilling the surface layer of the Gasconade soil is nearly impossible, and the use of equipment is restricted. This unit is unsuitable for hay because of the Rock outcrop.

The Gasconade and Gatewood soils generally are not managed for commercial timber because of low productivity, but they can support hardwoods. The poorer quality timber is on the shallow Gasconade soil. The main management concerns are an equipment limitation, seedling mortality, and the hazard of windthrow in areas of the Gasconade soil; seedling mortality on the Gatewood soil; and an equipment limitation in areas of the Rock outcrop. The equipment limitation can be minimized by constructing haul roads and skid trails on the contour and between the stair-stepped areas of Rock outcrop. Seeding of disturbed areas may be needed after harvesting is completed. Because the use of site-preparation and tree-planting equipment is severely restricted, hand planting of seedlings or direct seeding may be necessary. Reinforcement planting can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

This unit generally is not used for building site development or onsite waste disposal systems because of the depth to bedrock, the Rock outcrop, the shrink-swell potential, the restricted permeability, and the slope. The Gasconade soil also is limited by large stones. Dwellings with basements should not be constructed because of the depth to bedrock and the shrink-swell potential in the subsoil. Concrete footings and foundations should be constructed with adequate reinforcement and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Alternatives to conventional septic systems are needed. Possible choices are pumping effluent to areas where the soils are better suited to onsite waste disposal, adding fill for a mound system, and installing the lateral lines close enough to the surface for an adequate distance between the bottom of the trench and the bedrock. A curtain drain and enlargement of septic tank absorption fields may be necessary. Any system will require professional help.

The land capability classification is VIs. The woodland ordination symbol is 2D in areas of the Gasconade soil and 2F in areas of the Gatewood soil.

18F—Gasconade-Gatewood-Rock outcrop complex, 15 to 50 percent slopes. This map unit occurs as areas of moderately steep to very steep soils and areas of Rock outcrop. The Gasconade soil is well drained and shallow. The Gatewood soil is moderately well drained and moderately deep. The unit is on back slopes in the uplands. Individual areas range from about 40 to more than 600 acres in size. They are about 60 percent Gasconade soil, 20 percent Gatewood soil, and 15 percent Rock outcrop. The Gasconade and Gatewood soils and Rock outcrop could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Gasconade soil are as follows—

Surface layer	0 to 8 inches, very dark brown very flaggy clay loam
Subsoil	8 to 13 inches, very dark grayish brown very gravelly clay loam 13 to 19 inches, very dark grayish brown extremely flaggy clay loam
Bedrock	19 inches, hard dolomite

In some areas the subsoil is red clay, has less clay, or has fewer rock fragments.

Important properties of the Gasconade soil—

Permeability	Moderately slow
Surface runoff	Rapid
Available water capacity	Very low
Organic matter content	Moderate
Shrink-swell potential	Moderate in the subsoil
Depth to bedrock	10 to 20 inches

The typical sequence, depth, and composition of the layers in the Gatewood soil are as follows—

Surface layer	0 to 6 inches, dark brown very gravelly silt loam
Subsurface layer	6 to 10 inches, brownish yellow very gravelly silt loam
Subsoil	10 to 22 inches, brownish yellow and yellowish brown, mottled clay
	22 to 32 inches, multicolored gravelly clay
Bedrock	32 inches, hard dolomite

In some areas, the subsoil is red clay and the dark surface layer is thinner. In other areas the subsoil has a higher content of rock fragments.

Important properties of the Gatewood soil—

Permeability	Slow
Surface runoff	Rapid
Available water capacity	Low
Organic matter content	Low
Shrink-swell potential	High in the subsoil
Depth to bedrock	20 to 40 inches

Typically, the Rock outcrop consists of exposed dolomite bedrock in parallel bands throughout the unit.

Included in this unit in mapping are areas of Cedargap soils and areas that have scattered stones and boulders on the surface. Cedargap soils are very deep. They are on very narrow flood plains. Included soils make up about 5 percent of the unit.

Most areas support scrubby hardwoods, eastern redcedar, and warm-season grasses. Some areas are used for pasture. This unit is generally unsuited to cultivated crops because of the slope, the hazard of erosion, the depth to bedrock, the Rock outcrop, and flagstones on the surface.

The Gatewood soil is suited to cool-season grasses, warm-season grasses, and some legumes. The Gasconade soil is poorly suited to cool-season grasses, warm-season grasses, and legumes. If managed for pasture, these soils can support stands of cool-season grasses, such as tall fescue; warm-season grasses, such as little bluestem and Caucasian bluestem; and legumes, such as lespedeza. The soils are wet from fall to spring and are droughty in summer. The hazard of erosion is the main management concern. Overgrazing should be avoided. Tilling the surface layer of the Gasconade soil is nearly impossible, and the use of equipment is restricted. This unit is unsuitable for hay because of the slope and the Rock outcrop.

The Gasconade and Gatewood soils generally are not managed for commercial timber because of low productivity, but they can support hardwoods. The poorer quality timber is on the shallow Gasconade soil. The main management concerns are an equipment limitation, seedling mortality, and the hazard of windthrow in areas of the Gasconade and Gatewood soils; the hazard of erosion in areas of the Gatewood soil; and an equipment limitation in areas of the Rock outcrop. The equipment limitation and the hazard of erosion can be minimized by constructing haul roads and skid trails on the contour and between the stair-stepped areas of Rock outcrop and by yarding the logs uphill in the steeper dissected areas. Seeding of disturbed areas may be needed after harvesting is completed. Because the use of site-preparation and tree-planting equipment is severely restricted, hand planting of seedlings or direct seeding may be necessary. Reinforcement planting can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

This unit generally is not used for building site development or onsite waste disposal systems because of the depth to bedrock, the shrink-swell potential, the Rock outcrop, and the slope. The Gasconade soil also is limited by large stones. If dwellings are constructed, land shaping is necessary. Dwellings with basements should not be constructed because of the depth to bedrock and the shrink-swell potential in the subsoil. Concrete footings and foundations should be constructed with adequate reinforcement and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Alternatives to conventional septic systems are needed. Possible choices are pumping effluent to areas where the soils are better suited to onsite waste disposal, adding fill for a mound system, and installing the lateral lines close enough to the surface for an adequate distance between the bottom of the trench and the bedrock. A curtain drain and enlargement of septic tank absorption fields may be necessary. Any system will require professional help.

The land capability classification is VIle. The woodland ordination symbol is 2R in areas of the Gasconade and Gatewood soils.

24C—Ocie-Gatewood complex, 3 to 9 percent slopes. These gently sloping and moderately sloping, moderately well drained soils are on ridgetops and foot slopes in the uplands. The Ocie soil is deep, and the Gatewood soil is moderately deep. Individual areas range from about 5 to more than 200 acres in size. They are about 45 percent Ocie soil and 40 percent Gatewood soil. The two soils could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Ocie soil are as follows—

Surface layer	0 to 7 inches, brown gravelly silt loam
	7 to 22 inches, yellowish brown very gravelly loam

Subsoil	22 to 25 inches, brown and yellowish red, mottled gravelly clay
	25 to 31 inches, multicolored clay
	31 to 44 inches, strong brown and light brownish gray, mottled clay
	44 to 51 inches, yellowish brown and brown gravelly clay
Bedrock	51 inches, hard dolomite

In some areas the surface layer is very gravelly silt loam. In other areas the soil is very deep, has a lower content of rock fragments, has less clay in the subsoil, or is strongly sloping.

Important properties of the Ocie soil—

Permeability	Slow
Surface runoff	Medium
Available water capacity	Low
Organic matter content	Moderately low
Shrink-swell potential	High in the lower part of the subsoil
Depth to bedrock	40 to 60 inches

The typical sequence, depth, and composition of the layers in the Gatewood soil are as follows—

Surface layer	0 to 6 inches, dark brown very gravelly silt loam
Subsurface layer	6 to 13 inches, yellowish brown very gravelly silt loam
Subsoil	13 to 29 inches, yellowish brown clay
Substratum	29 to 33 inches, yellowish brown and light olive gray channery clay
Bedrock	33 inches, hard dolomite

In some areas the dark surface layer is thinner, the subsoil is red clay, or the subsoil has a higher content of rock fragments. In other areas the soil is strongly sloping.

Important properties of the Gatewood soil—

Permeability	Slow
Surface runoff	Medium
Available water capacity	Low
Organic matter content	Moderately low
Shrink-swell potential	High in the subsoil
Depth to bedrock	20 to 40 inches

Included with these soils in mapping are areas of Britwater, Gasconade, and Viraton soils and areas that have stones on the surface. Britwater and Viraton soils are in the same landscape position as the Gatewood soil or are on the flatter parts of the ridgetops. Britwater soils are very deep and have less clay and fewer rock fragments than the Ocie and Gatewood soils. Viraton soils are very deep and have a fragipan. Gasconade soils are shallow. They are at the base of the slopes or on slope breaks. Included soils make up about 15 percent of the unit.

Some areas have been cleared of trees and are used for pasture or hay. Some areas support timber. These soils generally are not used for cultivated crops because of the depth to bedrock, the slope, and the hazard of erosion.

These soils are suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as switchgrass and Caucasian bluestem, and to some kinds of legumes, such as red clover and lespedeza, for pasture or hay. The species that can tolerate seasonal wetness grow best. Droughtiness is a problem during the summer. Overgrazing should be avoided. The hazard of erosion is the main management concern. A good ground cover is necessary at all times if production is to be maintained. Nurse crops reduce the hazard of erosion in newly seeded areas. Timely tillage is needed. Also, the soils should be tilled on the contour. No-till seeding methods help to protect the surface.

These soils are suitable for timber production. Many areas support native hardwoods. There are no management concerns in areas of the Ocie soil. The only management concern in areas of the Gatewood soil is seedling mortality. Reinforcement planting can increase the seedling survival rate. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

These soils are suitable for building site development and onsite waste disposal systems if the shrink-swell potential, the restricted permeability, and the depth to bedrock are overcome during construction (fig. 9).

Figure 9.—An onsite waste disposal system in an area of Ocie-Gatewood complex, 3 to 9 percent slopes, where restricted permeability and

the depth to bedrock were overcome during construction.

Dwellings should be designed so that they conform to the depth to bedrock. Footings and foundations should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Alternatives to conventional septic systems are needed. An adequate distance between the bottom of the lateral trench and the bedrock is needed in the Gatewood soil. Shallow lateral lines may be necessary. An aerator system that includes a large absorption field and a mound system that includes a curtain drain are suitable alternatives. Any system will require professional help.

The land capability classification is IVe. The woodland ordination symbol is 3F in areas of the Ocie soil and 2F in areas of the Gatewood soil.

24E—Gatewood-Ocie complex, 9 to 35 percent slopes. These strongly sloping to steep soils are on back slopes in the uplands. The Gatewood soil is moderately well drained and moderately deep. The Ocie soil is well drained and deep. Individual areas range from about 5 to more than 300 acres in size. They are about 55 percent Gatewood soil and 30 percent Ocie soil. The two soils could not be mapped separately at the scale selected for mapping.

The typical sequence, depth, and composition of the layers in the Gatewood soil are as follows—

Surface layer	0 to 4 inches, very dark gray gravelly silt loam
Subsurface layer	4 to 9 inches, yellowish brown gravelly silt loam
Subsoil	9 to 14 inches, dark yellowish brown gravelly silty clay
	14 to 21 inches, dark yellowish brown, mottled clay
Bedrock	21 inches, hard dolomite

In some areas the dark surface layer is thinner, the clayey subsoil is red, or the subsoil has a higher content of rock fragments.

Important properties of the Gatewood soil—

Permeability	Slow
Surface runoff	Rapid
Available water capacity	Very low
Organic matter content	Moderately low
Shrink-swell potential	High in the subsoil
Depth to bedrock	20 to 40 inches

The typical sequence, depth, and composition of the layers in the Ocie soil are as follows—

Surface layer	0 to 2 inches, yellowish brown very gravelly silt loam
Subsoil	2 to 6 inches, brown very gravelly silt loam
	6 to 18 inches, strong brown and yellowish red extremely gravelly silt loam
	18 to 23 inches, yellowish red gravelly clay
	23 to 31 inches, yellowish red and strong brown, mottled clay
	31 to 49 inches, yellowish red and strong brown clay
Bedrock	49 inches, hard dolomite

In some areas the soil is very deep, has fewer rock fragments, or has less clay in the subsoil.

Important properties of the Ocie soil—

Permeability	Slow
Surface runoff	Rapid
Available water capacity	Low
Organic matter content	Moderately low
Shrink-swell potential	High in the lower part of the subsoil

Depth to bedrock	40 to 60 inches

Included with these soils in mapping are areas of Cedargap and Gasconade soils, areas of Rock outcrop, and some areas that have stones on the surface. Cedargap soils are very deep and have less clay and more sand than the Gatewood and Ocie soils. They are on narrow flood plains. Gasconade soils are shallow. They are at the base of the slopes or on slope breaks. The Rock outcrop occurs in association with the shallow Gasconade soils. Included areas make up about 15 percent of the unit.

Most areas support native hardwoods. Some areas have been cleared of trees and are used for pasture. This unit is generally unsuited to cultivated crops because of the depth to bedrock, the Rock outcrop, the slope, and the hazard of erosion.

These soils are suitable for timber production. East and north aspects are the most productive sites. The hazard of erosion and an equipment limitation are the main management concerns. Carefully designing haul roads and skid trails can minimize the steepness and length of slopes and thus can help to prevent excessive erosion. The slope limits the use of equipment. This limitation can be minimized by constructing haul roads and skid trails on the contour or by yarding the logs uphill to the roads or trails. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

These soils are suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to some kinds of legumes, such as red clover and lespedeza, for pasture. Droughtiness is a problem during the summer. Overgrazing should be avoided. The hazard of erosion is the main management concern. A good ground cover is necessary at all times if production is to be maintained. Nurse crops reduce the hazard of erosion in newly seeded areas. Tillage should be avoided. Because of the slope, the soils are unsuitable for hay.

These soils are suitable for building site development and onsite waste disposal systems if the shrink-swell potential, the restricted permeability, the slope, and the depth to bedrock are overcome during construction. Dwellings should be designed so that they conform to the natural slope of the land and the depth to bedrock. Footings and foundations should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Alternatives to conventional septic systems are needed. An adequate distance between the bottom of the lateral trench and the bedrock is needed in the Gatewood soil. Shallow lateral lines may be necessary. An aerator system that includes a large absorption field and a mound system that includes a curtain drain are suitable alternatives. Any system will require professional help.

The land capability classification is VIe. The woodland ordination symbol is 2R in areas of the Gatewood soil and 3R in areas of the Ocie soil.

44D—Clarksville very gravelly silt loam, 3 to 15 percent slopes. This very deep, gently sloping to strongly sloping, somewhat excessively drained soil is on narrow ridgetops and shoulder slopes in the uplands. Individual areas range from about 5 to more than 350 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 4 inches, dark grayish brown very gravelly silt loam
Subsurface layer	4 to 13 inches, brown very gravelly silt loam
Subsoil	13 to 31 inches, multicolored extremely gravelly silt loam
	31 to 43 inches, multicolored very gravelly silty clay loam
	43 to 60 inches, dark red or multicolored very gravelly clay

In some areas the subsoil is brittle. In other areas it has more clay or less clay. In places the soil is moderately steep.

Important soil properties—

Permeability	Rapid in the upper part of the profile and moderate in the lower part
Surface runoff	Medium
Available water capacity	Low
Organic matter content	Moderate

Shrink-swell potential	Moderate in the lower part of the subsoil

Most areas have been cleared of trees and are used for pasture or hay. Some areas support timber. This soil is generally unsuited to cultivated crops because of the slope, a severe hazard of erosion, a high content of gravel, and droughtiness.

This soil is suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to some kinds of legumes, such as lespedeza and red clover, for pasture or hay. Droughtiness is a problem during the summer. Overgrazing should be avoided. The hazard of erosion is the main management concern. A good ground cover is necessary at all times if production is to be maintained. Nurse crops reduce the hazard of erosion in newly seeded areas. The soil should be tilled on the contour. No-till seeding methods help to protect the surface.

A few areas support native hardwoods. This soil is suitable for timber production. Seedling mortality is the main management concern. Reinforcement planting can increase the seedling survival rate. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

This soil is suitable for building site development and onsite waste disposal systems. The main management concerns are the slope, permeability, and the shrink-swell potential. Land shaping may be necessary to modify the slope. Footings and foundations should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Properly designing septic tank absorption fields helps to overcome the slope. A standard septic system that includes a large absorption field helps to prevent surfacing of the effluent.

The land capability classification is VIe. The woodland ordination symbol is 3F.

45F—Hailey very gravelly silt loam, 15 to 50 percent slopes. This very deep, moderately steep to very steep, excessively drained soil is on the back slopes of strongly dissected uplands. Individual areas range from about 40 to more than 450 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 3 inches, very dark grayish brown very gravelly silt loam
Subsurface layer	3 to 12 inches, brown extremely gravelly silt loam
Subsoil	12 to 40 inches, brown extremely cobbly coarse sandy loam
	40 to 60 inches, brown and yellowish brown extremely cobbly loam

In some areas the subsoil has more clay. In other areas the soil is gently sloping to strongly sloping.

Included with this soil in mapping are areas of Clarksville, Gatewood, and Ocie soils and areas of Rock outcrop. Clarksville soils have more clay in the subsoil than the Hailey soil. They commonly are upslope from the Hailey soil. The moderately deep Gatewood and deep Ocie soils have less gravel and more clay than the Hailey soil. They commonly are between stair-stepped areas of Rock outcrop and below areas of the Hailey soil. The Rock outcrop is near the base of the slopes. Included areas make up about 15 percent of the unit.

Important soil properties—

Permeability	Rapid
Surface runoff	Rapid
Available water capacity	Very low
Organic matter content	Moderately low

Most areas support timber. Some areas have been cleared of trees and are used for pasture (fig. 10). This soil is generally unsuited to cultivated crops because of the slope, a severe hazard of erosion, a high content of gravel, and droughtiness.

Figure 10.—Timber and pasture in an area of Hailey very gravelly silt loam, 15 to 50 percent slopes.

This soil is best suited to timber production. The hazard of erosion, an equipment limitation, and seedling mortality are the main management concerns. Carefully designing haul roads and skid trails can minimize the steepness and length of the slopes and the concentration of water. The slope limits the use of equipment, but this limitation can be minimized by constructing haul roads and skid trails on the contour or by yarding the logs uphill to the roads or trails. Hand planting or direct seeding may be needed because of the seedling mortality rate. Reinforcement planting can increase the seedling survival rate. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

This soil is poorly suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to legumes, such as lespedeza, for pasture. Droughtiness is a problem during the summer. Overgrazing should be avoided. The hazard of erosion is the main management concern. The soil is unsuitable for hay because of the slope.

This soil generally is not used for building site development or onsite waste disposal systems because of the slope, the rapid permeability, and large stones. The soil can be used as a site for dwellings. Land shaping may be necessary. The soil is severely limited as a site for septic tank absorption fields. If they are the only alternative, the absorption fields should be backfilled around the tile with stone-free material. Properly designing the absorption fields helps to overcome the slope. An alternative to a conventional septic system is a low-pressure pipe system that includes a sand-lined trench. Any system will require professional help.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

46F—Rueter-Rock outcrop complex, 15 to 50 percent slopes. This map unit occurs as areas of a very deep, moderately steep to very steep, somewhat excessively drained Rueter soil and areas of Rock outcrop. The Rueter soil is on the back slopes of strongly dissected uplands, and the Rock outcrop is at the base of the slopes in a stair-stepped pattern (fig. 11) and on pinnacles. Individual areas range from about 40 to more than 450 acres in size. They are about 80 percent Rueter soil and 15 percent Rock outcrop. The Rueter soil and Rock outcrop could not be mapped separately at the scale selected for mapping.

Figure 11.—Rock outcrop at the base of a slope in an area of Rueter-Rock outcrop complex, 15 to 50 percent slopes.

The typical sequence, depth, and composition of the layers in the Rueter soil are as follows—

Surface layer	0 to 5 inches, dark grayish brown very gravelly silt loam
Subsurface layer	5 to 13 inches, brown very gravelly silt loam
Subsoil	13 to 22 inches, brown very cobbly silt loam
	22 to 42 inches, strong brown extremely gravelly silt loam
	42 to 60 inches, red and dark red very gravelly clay

In some areas the subsoil has more clay throughout. Important properties of the Rueter soil—

Permeability	Moderately rapid in the upper part of the profile and moderate in the lower part
Surface runoff	Rapid
Available water capacity	Low
Organic matter content	Moderately low
Shrink-swell potential	Moderate in the lower part of the subsoil
Depth to bedrock	20 to 40 inches

Typically, the Rock outcrop consists of exposed limestone or dolomite bedrock at the base of the slopes.

Included in this unit in mapping are areas of the moderately deep Gatewood and deep Ocie soils. These soils have less gravel and more clay than the Rueter soil. They commonly are between the areas of Rock outcrop and below areas of the Rueter soil. Included soils make up about 5 percent of the unit.

Most areas support native hardwoods. Some areas have been cleared of trees and are used for pasture. Because of the slope, a severe hazard of erosion, a high content of gravel, and droughtiness, the Rueter soil is generally unsuited to cultivated crops.

The Rueter soil is suited to cool-season grasses, such as tall fescue, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to legumes, such as lespedeza, for pasture. Droughtiness is a problem during the summer. Overgrazing should be avoided. The hazard of erosion is the main management concern. The soil is unsuitable for hay because of the slope.

The Rueter soil is suitable for timber production. The hazard of erosion, an equipment limitation, and seedling mortality are the main management concerns. The hazard of erosion can be reduced by constructing haul roads and skid trails on the contour or by yarding the logs uphill to the roads or trails. Because the use of site-preparation and tree-planting equipment is limited, hand planting of seedlings or direct seeding may be necessary. Reinforcement planting can increase the seedling survival rate. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

The Rueter soil generally is not used for building site development or onsite waste disposal systems because of the slope. The soil can be used as a site for dwellings. Land shaping may be necessary. Footings and foundations should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. The soil is severely limited as a site for septic tank absorption fields. Properly designing the absorption fields helps to overcome the slope. Any septic system will require professional help.

The land capability classification is VIIe. The woodland ordination symbol is 3R in areas of the Rueter soil.

55B—Britwater silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on the tops of ridges in the uplands, on foot slopes, and on stream terraces. Individual areas range from about 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 6 inches, dark brown silt loam
Subsurface layer	6 to 11 inches, brown silt loam
Subsoil	11 to 21 inches, strong brown silt loam
	21 to 36 inches, strong brown very gravelly clay loam
	36 to 60 inches, yellowish red gravelly silty clay

In some areas the subsoil has more gravel. In other areas it has more clay. In places the soil is moderately sloping.

Included with this soil in mapping are areas of Viraton soils. These soils are in the higher areas on the ridgetops. They have a fragipan. They make up about 5 to 10 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Medium
Available water capacity	Moderate
Organic matter content	Moderately low
Shrink-swell potential	Moderate in the lower part of the subsoil

Most areas have been cleared of trees and are used for pasture or hay. Some areas are used for cultivated crops. A few areas support timber.

This soil is well suited to cool-season grasses, such as orchardgrass and tall fescue, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to legumes, such as red clover and alfalfa. There are no serious problems in the areas used for pasture or hay. Overgrazing should be avoided. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

A few areas support native hardwoods. This soil is suitable for timber production. No major limitations or hazards affect planting or harvesting.

This soil is suited to cultivated crops. The hazard of erosion is the main management concern. Erosion can be minimized by a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, grassed waterways, diversion terraces, contour farming, and a conservation cropping system that includes close-growing pasture or hay crops. Some type of grade stabilization structure generally is needed in grassed waterways.

This soil is suitable for building site development and onsite waste disposal systems. Footings and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Septic tank absorption fields can function properly. Because of the restricted permeability, however, the length of the lateral field should be increased.

The land capability classification is IIe. The woodland ordination symbol is 4A.

55C—Britwater silt loam, 5 to 9 percent slopes. This very deep, moderately sloping, well drained soil is on stream terraces, on foot slopes, and on the tops of ridges in the uplands. Individual areas range from about 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 4 inches, dark grayish brown silt loam
Subsurface layer	4 to 9 inches, brown silt loam
Subsoil	9 to 20 inches, dark yellowish brown gravelly silt loam
	20 to 44 inches, dark brown and yellowish red, mottled gravelly clay loam
	44 to 60 inches, yellowish red, mottled very gravelly clay loam

In some areas the subsoil has a higher content of rock fragments or a higher content of clay. In other areas the soil is strongly sloping.

Included with this soil in mapping are areas of Cedargap and Ocie soils. Cedargap soils are very deep and are gravelly throughout. They are on narrow flood plains. Ocie soils are deep and have more gravel and clay in the subsoil than the Britwater soil. They are in landscape positions similar to those of the Britwater soil. Included soils make up about 5 to 10 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Medium
Available water capacity	Moderate
Organic matter content	Moderately low
Shrink-swell potential	Moderate in the lower part of the subsoil

Most areas have been cleared of trees and are used for pasture or hay. Some areas are used for cultivated crops. A few areas support timber.

This soil is well suited to cool-season grasses, such as orchardgrass and tall fescue, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to legumes, such as red clover and alfalfa, for pasture or hay. There are no serious problems in the areas used for pasture or hay. Overgrazing should be avoided. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

A few areas support native hardwoods. This soil is suitable for timber production. No major limitations or hazards affect planting or harvesting. After timber is harvested, constructing water breaks at specified intervals on skid trails and haul roads helps to control erosion.

This soil is suited to cultivated crops. If cultivated crops are grown, erosion is a severe hazard. It generally can be minimized by a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, grassed waterways, diversion terraces, contour farming, and a conservation cropping system that includes close-growing pasture or hay crops. Some type of grade stabilization structure generally is needed in grassed waterways.

This soil is suitable for building site development and onsite waste disposal systems. Footings and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Septic tank absorption fields can function properly. Because of the restricted permeability, however, the length of the lateral field should be increased. A standard septic system that includes a curtain drain is a suitable alternative.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

57B—Lecoma fine sandy loam, 1 to 6 percent slopes. This very deep, nearly level to gently sloping, well drained soil is on stream terraces and foot slopes. Individual areas range from about 5 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 6 inches, brown fine sandy loam
Subsoil	6 to 10 inches, brown loam
	10 to 55 inches, yellowish red and red clay loam
	55 to 60 inches, yellowish red, mottled gravelly sandy clay loam

In some areas the surface layer is loam or silt loam. In other areas the soil is steeper.

Included with this soil in mapping are areas of a soil that has more than 35 percent rock fragments throughout. This included soil makes up about 10 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Medium
Available water capacity	High
Organic matter content	Moderately low
Shrink-swell potential	Moderate

Most areas have been cleared of trees and are used for pasture or hay. A few areas support timber. A few are used for cultivated crops.

This soil is well suited to cool-season grasses, such as orchardgrass and tall fescue, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to legumes, such as red clover and alfalfa, for pasture or hay. There are no serious problems in the areas used for pasture or hay. Overgrazing should be avoided. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

A few areas support native hardwoods. This soil is suitable for timber production. No major limitations or hazards affect planting or harvesting.

This soil is suited to cultivated crops. Erosion is a hazard in the steeper areas. It generally can be minimized by a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, grassed waterways, diversion terraces, contour farming, and a conservation cropping system that includes close-growing pasture or hay crops. Some type of grade stabilization structure generally is needed in grassed waterways.

This soil is suitable for building site development and onsite waste disposal systems. The main management concerns are the shrink-swell potential and the restricted permeability. Footings and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by shrinking and swelling in the subsoil. Septic tank absorption fields can function properly. Because of the restricted permeability, however, the length of the lateral field should be increased. A standard septic system that includes a curtain drain is a suitable alternative.

The land capability classification is IIe. The woodland ordination symbol is 3A.

66A—Huntington silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on flood plains. It is occasionally flooded. Individual areas range from about 5 to more than 125 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 10 inches, very dark grayish brown silt loam
Subsurface layer	10 to 14 inches, dark brown silt loam
Subsoil	14 to 28 inches, dark yellowish brown silt loam
	28 to 51 inches, dark yellowish brown and yellowish brown silly clay loam
	51 to 60 inches, dark yellowish brown silty clay loam

In some areas the surface layer is loam. In other areas the soil has more sand throughout. In some places it is darker colored throughout. In other places the subsoil contains gravel.

Included with this soil in mapping are areas of Cedargap, Kaintuck, and Racket soils. Cedargap and Kaintuck soils are adjacent to the stream channels. Cedargap soils are darker colored than the Huntington soil and have more than 35 percent rock fragments throughout. Kaintuck soils are loamy throughout. Racket soils are moderately well drained and are adjacent to areas of the Huntington soil and to bluffs. Included soils make up about 15 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Medium
Available water capacity	Very high
Organic matter content	Moderate

Most areas are used for pasture or hay. Some areas are used for cultivated crops. A few areas support timber.

This soil is well suited to cool-season grasses, such as orchardgrass and tall fescue, to warm-season grasses, such as switchgrass, and to legumes, such as alfalfa and red clover, for pasture or hay. Flooding is the main management concern. The species that can tolerate wetness should be selected for planting in some areas. The pasture should not be grazed immediately after periods of flooding. Controlled grazing is needed to minimize the damage caused by overgrazing.

This soil is suited to cultivated crops. Flooding is the main management concern. The scouring caused by floodwater generally can be minimized by a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, diversion terraces, and a conservation cropping system that includes close-growing pasture or hay crops. The crop damage caused by flooding generally is minimal but can be expected in some years.

This soil is suitable for timber production. No major limitations or hazards affect planting or harvesting.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding. If dwellings are constructed, information about the local regulations that restrict development should be obtained.

The land capability classification is IIw. The woodland ordination symbol is 4A.

76A—Racket silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, moderately well drained soil is on flood plains. It is occasionally flooded. Individual areas range from about 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 10 inches, very dark grayish brown silt loam
Subsurface layer	10 to 25 inches, very dark grayish brown loam
Subsoil	25 to 45 inches, dark grayish brown and dark yellowish brown clay loam
	45 to 56 inches, dark grayish brown and yellowish brown silty clay loam
	56 to 60 inches, dark grayish brown and yellowish brown gravelly silty clay loam

In some areas the surface layer and subsurface layer are lighter colored. In other areas the surface layer and the subsoil have more clay. In some places the soil has no gravel, and in other places it is poorly drained.

Included with this soil in mapping are areas of Huntington soils and a few small areas of a poorly drained soil in small depressions. Huntington soils are well drained and are closer to the stream channels than the Racket soil. Included soils make up about 15 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Slow
Available water capacity	High
Depth to an apparent water table	3.5 to 6.0 feet
Organic matter content	Moderate
Shrink-swell potential	Moderate in the subsoil

Most areas are used for pasture or hay. Some areas are used for cultivated crops. A few areas support timber.

This soil is well suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as switchgrass, and to legumes, such as red clover and alfalfa, for pasture or hay. Flooding can be a problem. The species that can tolerate wetness should be selected for planting in the wetter areas. A drainage system may be beneficial if deep-rooted species are grown. Overgrazing should be avoided.

This soil is well suited to cultivated crops. Wetness and the scouring caused by floodwater are the main management concerns in cultivated areas. The hazard of scouring can be reduced by a system of conservation tillage that leaves a protective cover of crop residue on the surface, a winter cover crop that can tolerate wetness, a diversion terrace, and a conservation cropping system that includes close-growing pasture or hay crops. The crop damage caused by flooding generally is minimal but can be expected in some years.

This soil is suitable for timber production. No major limitations or hazards affect planting or harvesting.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding. If dwellings are constructed, information about the local regulations that restrict development should be obtained.

The land capability classification is IIw. The woodland ordination symbol is 5A.

81B—Viraton silt loam, 2 to 5 percent slopes. This very deep, gently sloping, moderately well drained soil is on the broad tops of ridges in the uplands. Individual areas range from about 5 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 4 inches, dark grayish brown silt loam
Subsurface layer	4 to 11 inches, yellowish brown silt loam
Subsoil	11 to 21 inches, yellowish brown silt loam
	21 to 26 inches, mottled yellowish brown and light brownish gray silt loam
	26 to 32 inches, a fragipan of mottled light brownish gray and yellowish brown very gravelly silt loam
	32 to 51 inches, a fragipan of mottled yellowish red and light brownish gray extremely gravelly silt loam
	51 to 60 inches, multicolored extremely cobbly clay

In some areas the soil has more gravel throughout. In some depressions it is poorly drained.

Included with this soil in mapping are areas of the deep Ocie and very deep Britwater soils. These soils do not have a fragipan. Ocie soils generally are in narrow, convex areas on the lower parts of the landscape. They have more clay in the lower part of the subsoil than the Viraton soil and have rock fragments in the upper part. Britwater soils are in landscape positions similar to those of the Viraton soil. Included soils make up about 15 percent of the unit.

Important soil properties—

Permeability	Moderate above the fragipan and very slow in the fragipan
Surface runoff	Medium
Available water capacity	Low
Depth to a perched water table	1.5 to 3.0 feet
Organic matter content	Moderately low
Shrink-swell potential	Moderate in the part of the subsoil below the fragipan
Depth to the fragipan	15 to 26 inches

Most areas have been cleared of trees and are used for pasture or hay. A few areas support timber. A few are used for cultivated crops.

This soil is suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as big bluestem and Caucasian bluestem, and to legumes, such as red clover and lespedeza, for pasture or hay. The rooting depth is moderately deep, and droughtiness is a problem during the summer. Overgrazing reduces the density of the stand and permits the invasion of weeds. Wetness can be a problem during the fall, winter, and spring. Erosion is a hazard if the pasture or hayland is tilled. Timely tillage and a quickly established ground cover are necessary to minimize erosion.

This soil is suitable for timber production. Seedling mortality and the hazard of windthrow are the main management concerns. Reinforcement planting can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suited to cultivated crops. The hazard of erosion, droughtiness, and seasonal wetness are the main management concerns. Erosion generally can be minimized by a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, grassed waterways, contour farming, and a conservation cropping system that includes close-growing pasture or hay crops. Some type of grade stabilization structure generally is needed in grassed waterways.

This soil is suitable for building site development and onsite waste disposal systems. The shrink-swell potential, seasonal wetness, and the restricted permeability are the main management concerns. Footings, foundations, and basement walls should be constructed with adequately reinforced concrete and backfilled with sand or gravel. These measures minimize the structural damage caused by wetness and by shrinking and swelling. Installing tile drains around foundations and basement walls minimizes the damage caused by seasonal wetness. The soil is unsuitable as a site for conventional septic tank absorption fields because of the seasonal wetness caused by the very slow permeability in the fragipan. A specially designed onsite waste disposal system that includes curtain drains and shallow lateral lines is a suitable alternative. The curtain drains lower the water table, and the shallow lateral lines provide an adequate distance between the bottom of the trench and the fragipan. Proper installation is needed. A mound system also is a suitable alternative.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

93A—Cedargap gravelly loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on narrow flood plains. It is frequently flooded. Individual areas range from about 20 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 3 inches, very dark gray gravelly loam
Subsurface layer	3 to 11 inches, very dark gray gravelly loam
	11 to 20 inches, very dark gray very gravelly loam
	20 to 26 inches, very dark grayish brown extremely gravelly loam
Substratum	26 to 34 inches, dark brown very gravelly clay loam
	34 to 46 inches, dark grayish brown extremely gravelly clay loam
	46 to 60 inches, very dark grayish brown very gravelly loam

In some areas, the dark surface soil is thinner and the substratum has less gravel. In places the substratum has more sand.

Included with this soil in mapping are areas of soils that have a high content of rock fragments. These soils are on gently sloping or moderately sloping foot slopes. Also included are areas of gravel bars and flood debris in the meanders on the depositional side of the streams. Included areas make up about 15 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Slow
Available water capacity	Low
Organic matter content	Moderate

Most areas are used for pasture or hay. Some areas support timber. This soil generally is not used for cultivated crops because of the narrowness of the mapped areas, summer droughtiness, and seasonal flooding.

This soil is suited to cool-season grasses, such as orchardgrass, to warm-season grasses, such as Caucasian bluestem, and to legumes, such as alfalfa and lespedeza, for pasture or hay. Droughtiness and flooding are the main management concerns. Overgrazing reduces the density of the stand and permits the invasion of weeds.

This soil is suitable for timber production. Seedling mortality is the main management concern. Reinforcement planting can increase the seedling survival rate.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 3F.

95A—Kaintuck fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on high flood plains. It is occasionally flooded. Individual areas range from about 10 to 75 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 5 inches, very dark grayish brown fine sandy loam
Substratum	5 to 14 inches, yellowish brown fine sandy loam
	14 to 60 inches, dark yellowish brown fine sandy loam

In some areas the surface layer is silt loam, sandy loam, or loamy sand. In other areas the soil has less sand throughout, has more clay throughout, or is dark throughout.

Included with this soil in mapping are areas of Huntington and Racket soils. Huntington soils are silty throughout. They are in landscape positions similar to those of the Kaintuck soil or are farther from the stream channels. Racket soils are moderately well drained and are in the lower areas on the flood plains adjacent to bluffs. Included soils make up about 15 percent of the unit.

Important soil properties—

Permeability	Moderate
Surface runoff	Slow
Available water capacity	High
Organic matter content	Low

Most areas are used for pasture or hay. Some areas are used for cultivated crops.

This soil is well suited to cool-season grasses, such as orchardgrass and tall fescue, to warm-season grasses, such as big bluestem and switchgrass, and to legumes, such as red clover, for pasture or hay. Flooding is the main management concern. The species that can tolerate wetness should be selected for planting in some low areas. The pasture should not be grazed immediately after periods of flooding. Overgrazing reduces the density of the stand and permits the invasion of weeds.

This soil is suited to cultivated crops. Flooding can occur when lake water backs over areas of this soil. The drowning of crops by back-water flooding in low areas cannot be controlled because of the normal fluctuations in the lake level. In these areas the crops that can tolerate wetness should be considered for planting. In the higher areas a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, diversion terraces, and a conservation cropping system that includes close-growing pasture or hay crops are desirable. In some years irrigation is necessary to increase yields.

Only a few areas support timber. This soil is suitable for timber production. No major limitations or hazards affect planting or harvesting.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 7A.

96A—Sandbur fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, excessively drained soil is on flood plains of intermediate size. It is frequently flooded. Individual areas range from about 30 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers in this soil are as follows—

Surface layer	0 to 10 inches, very dark grayish brown fine sandy loam
Substratum	10 to 19 inches, very dark grayish brown and yellowish brown loamy fine sand
	19 to 45 inches, very dark grayish brown fine sandy loam and loamy fine sand
	45 to 60 inches, very dark grayish brown and brown fine sand and loamy fine sand

In some areas the soil is lighter colored throughout and has less gravel in the substratum. In other areas overwash of fine sand or coarser sand is on the surface.

Included with this soil in mapping are areas of Cedargap, Huntington, and Racket soils and areas of gravel bars and flood debris in the meanders on the depositional side of the streams. Cedargap soils have more than 35 percent gravel throughout. They are along the smaller streams and in fanlike areas. Huntington soils have less sand than the Sandbur soil. Also, they are farther away from the stream channels. Racket soils have more clay than the Sandbur soil. They are moderately well drained and commonly are adjacent to bluffs. Included areas make up about 10 to 15 percent of the unit.

Important soil properties—

Permeability	Moderately rapid
Surface runoff	Slow
Available water capacity	Moderate
Organic matter content	Moderately low

Most areas are used for pasture or hay. Some areas are used for cultivated crops. A few small areas support timber.

This soil is suited to cool-season grasses, such as tall fescue and orchardgrass, to warm-season grasses, such as little bluestem and Caucasian bluestem, and to legumes, such as lespedeza and alfalfa, for pasture or hay. Seasonal flooding and droughtiness are the main management concerns. The pasture should not be grazed immediately after periods of flooding. Overgrazing during dry periods reduces the density of the stand and permits the invasion of weeds. Proper stocking rates, pasture rotation, and timely haying help to maintain a good stand of grasses.

This soil is suited to cultivated crops only if the crops are grown on a limited basis. Scouring by floodwater is the main management concern. It generally can be minimized by applying a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and a conservation cropping system that includes close-growing pasture or hay crops. The soil is seasonally droughty. Irrigation is needed during dry summer months.

This soil is suitable for timber production. An equipment limitation and seedling mortality are the main management concerns. Because of seasonal flooding, planting and harvesting activities should be carefully planned. The use of equipment is limited during dry periods and during periods of flooding. Reinforcement planting can increase the seedling survival rate.

This soil is unsuitable for building site development and onsite waste disposal systems because of the flooding.

The land capability classification is IVw. The woodland ordination symbol is 7W.

99—Pits, quarries. This map unit consists of areas on uplands that currently are or formerly were quarried for limestone and dolomite. Typically, the rock is quarried on one or more of the exposed vertical faces of the pits. These areas generally are made up of quarry pits; stockpiles of limestone, dolomite, and other crushed rock; piles of spoil overburden; sites used for storing equipment; and roads used for transporting the quarried material. Individual areas range from about 5 to 100 acres in size.

Included in this unit in mapping are areas of Clarksville, Hailey, Knobby, Ocie, and Rueter soils. Clarksville soils are in areas of limestone formations on the tops of ridges, and Hailey and Rueter soils are in areas of limestone formations on back slopes. Ocie and Knobby soils are in areas of dolomite formations on back slopes. The included soils are in areas above the exposed rock faces and commonly are referred to as overburden. They make up about 10 percent of the unit.

Many of the pits support no vegetation. Some have a sparse cover of grasses, weeds, and trees. Onsite investigation is needed to determine the suitability for any proposed use and the limitations affecting that use.

No land capability classification or woodland ordination symbol is assigned.

areas above the Britwater and Ocie soils. The typical sequence, depth, and composition of the layers in the Viraton soils are as follows—

Surface layer	0 to 4 inches, dark grayish brown silt loam
Subsurface layer	4 to 11 inches, yellowish brown silt loam
Subsoil	11 to 21 inches, yellowish brown silt loam
	21 to 26 inches, mottled yellowish brown and light brownish gray silt loam
	26 to 32 inches, a fragipan of mottled light brownish gray and yellowish brown very gravelly silt loam
	32 to 51 inches, a fragipan of mottled yellowish red and light brownish gray extremely gravelly silt loam
	51 to 60 inches, multicolored extremely cobbly clay

Of minor extent in this association are the moderately deep, clayey Gatewood soils near areas of the Ocie soils.

About 90 percent of the acreage in this association is used for pasture or hay. The rest of the acreage is used for cultivated crops or supports hardwoods.

The major soils are suited to grasses and some legumes for pasture or hay. Raising beef calves for the feeder cattle market is the main farm enterprise in areas of this association. Overgrazing, seasonal wetness, seasonal droughtiness, and the hazard of erosion are the main management concerns.

The major soils are suited to cultivated crops. The hazard of erosion, seasonal wetness, and seasonal droughtiness are the main management concerns.

The major soils are suitable for timber production. Seedling mortality and the hazard of windthrow are the main management concerns.

The major soils are suitable for building site development and onsite waste disposal systems. Permeability, the slope, the shrink-swell potential, the depth to bedrock, and seasonal wetness are the main management concerns.

Prime Farmland

in Taney County, MO

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short-and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 19,110 acres in Taney County, or less than 5 percent of the total acreage, meets the soil requirements for prime farmland. The prime farmland is in scattered areas throughout the county, mainly in the Britwater-Sandbur-Huntington and Ocie-Britwater-Viraton associations, which are described under the heading "General Soil Map Units." Most of the prime farmland in the county is used for hay or pasture.

The map units in the county that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Use and Management of the Soils
in Taney County, MO

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

About 96,317 acres in Taney County was used for crops or pasture in 1982. Of that acreage, about 10,910 acres was used for hay and 550 acres for row crops or small grain. About 51,058 acres was pastured woodland.

Most of the areas in the county that have been cleared of trees are used for pasture or hay. Very few areas are used for row crops or small grain. Most of the soils are not suited to intensely grown cultivated crops, mainly because of the slope, the depth to bedrock, a high content of rock fragments, surface stones in some areas, or a combination of these. The soils that are suited to cultivated crops are on bottom land, on terraces, and in a few gently sloping and moderately sloping areas on uplands.

The very deep Huntington, Lecoma, and Racket soils are well suited to cultivated crops, such as grain sorghum. Britwater, Kaintuck, Ocie, Sandbur, and Viraton soils are poorly suited to cultivated crops because of a restricted rooting depth or other properties that reduce the available water capacity. Britwater, Gatewood, Huntington, Lecoma, Kaintuck, Ocie, Racket, Sandbur, and Viraton soils are well suited to small grain.

The hazard of erosion is the main management concern if cultivated crops are grown on Britwater, Gatewood, Ocie, and Viraton soils. Farming on the contour, terracing, establishing grassed waterways, and leaving crop residue on the surface throughout fall and winter help to protect these soils from erosion. Fertility is low in most of the soils in the county. All of the soils require additions of plant food if maximum production is to be obtained. Nearly all of the soils, particularly the ones on uplands, are naturally acid in the upper part of the root zone. Applications of ground limestone or ground dolomite are needed to raise the pH and calcium and magnesium levels and thus achieve good plant growth. On all soils applications of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields.

Soil tilth is an important factor affecting seedbed preparation, the germination of seeds, and the infiltration of water into the soil. Soils that have good tilth are granular and porous. Many of the soils in the county have a surface layer of silt loam that is low or moderately low in content of organic matter. Frequent tillage tends to weaken or destroy the structure of these soils. A crust forms on the surface during periods of intensive rainfall. The crust reduces the rate of water infiltration and increases the runoff rate. Returning crop residue to the soil and adding green manure or barnyard manure improve the soil structure and thus reduce the risk of crusting and increase the rate of water infiltration.

The pasture and hay crops that are suited to the soils and climate in the county include several kinds of legumes, cool-season grasses, and warm-season grasses. Alfalfa and red clover are the most common legumes grown for hay. Huntington, Lecoma, and other very deep, well drained soils that have a high available water capacity and are high in content of calcium and magnesium or are adequately limed are well suited to alfalfa for hay. Britwater and Kaintuck soils are suited to alfalfa for hay. Viraton and other soils that have a fragipan, Gatewood, Ocie, and other soils in which the depth to bedrock is limited, and Racket and other seasonally wet soils are better suited to clover for hay or pasture. If lime and fertilizer are applied, most of the soils that are suited to pasture and hay can be used for red clover or several other legumes.

Many of the soils in the county are suited to tall fescue (fig. 12), orchardgrass, and some other cool-season grasses. These grasses grow best in spring, in early summer, and in fall. Where additional midsummer pasture or hay is needed, warm-season grasses can be grown. Very deep, well drained soils that have a high available water capacity, such as Huntington, Kaintuck, and Lecoma soils, are well suited to warm-season grasses, such as Caucasian bluestem, big bluestem, indiangrass, and switchgrass. Soils that have a low or moderate available water capacity are suited to warm-season grasses. Examples are Britwater, Clarksville, Gatewood, Kaintuck, Ocie, Rueter, Sandbur, and Viraton soils. Warm-season grasses grow best in late spring, in summer, and in early fall.

Figure 12.—Fescue hay in an area of Clarksville very gravelly silt loam, 3 to 15 percent slopes.

A small acreage in the county is used for home orchards or gardens. The orchards and gardens produce little cash income but are important to individual families. Many families can and freeze homegrown fruits and vegetables for home use.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(9)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations or hazards that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

There are no class I, V, or VIII soils in Taney County. *Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e*, *w*, or *s*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the 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); and s shows that the soil is limited mainly because it is shallow, droughty, or stony.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by w ors because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of the map units is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Douglas Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

Forests are more than groups of trees. Together with soil-associated plants and animals, they form an ecosystem that has many valuable properties. A productive forest ecosystem produces wood fiber, results in sustained water quality and quantity, and provides wildlife habitat and opportunities for recreational activities *(6)*.

In 1986, a total of 278,208 acres in Taney County, or about 67 percent of the acreage in the county, was forested *(3)*. Forested uplands are covered by oak-hickory and eastern redcedar communities. White oak, red oak, bitternut hickory, and black oak grow on the better sites. Post oak, blackjack oak, eastern redcedar, and hickories are dominant on the shallower and more droughty soils. Areas where the soils are shallow over bedrock and areas where rock crops out are dominated by eastern redcedar and prairie grasses. These areas are commonly referred to as glades or bald knobs. The most common associated species on flood plains are black walnut, American elm, sycamore, bur oak, hackberry, green ash, and black willow. Variations in tree species and growth depend on site characteristics, soil properties, and management activities.

The site characteristics that affect tree growth include aspect and position on the slope. These characteristics influence the amount of available sunlight, air drainage, soil temperature, soil moisture, and relative humidity. Soils on north and east aspects and in the lower positions on the slope generally are more productive than the same or similar soils on south and west aspects and in the upper positions on the slope because they are cooler and have better moisture conditions. Clarksville, Hailey, Rueter, and Ocie soils exhibit the strongest productivity and species responses to aspect and position on the slope.

Soil properties fundamentally affect timber production. One-quarter or more of the mass of a tree is in the soil, which serves as a reservoir for moisture, provides an anchor for roots, and supplies essential plant nutrients. The most important soil properties in Taney County are wetness, slope, and depth.

Wetness is the result of a high water table or flooding. It causes seedling mortality, limits the use of equipment, and increases the hazard of windthrow by restricting the rooting depth of some trees. The

moderately well drained Viraton soils have a perched water table. Ruts form easily if wheeled skidders are used when these soils are wet. Deep ruts tend to restrict lateral drainage, result in damage to tree roots, and alter soil structure. Flooding is a problem on Cedargap, Huntington, Kaintuck, Racket, and Sandbur soils, which make up 16,990 acres in the county. Equipment should be used on these soils only during dry periods or when the ground is frozen.

Slope can limit the use of forestry equipment. A slope of 15 percent or more limits the use of equipment in logging areas, on skid trails, in yarding areas, and on logging roads. Erosion is a hazard in these disturbed areas. On 264,661 acres in the county, the slope limits the use of equipment and the soils are susceptible to erosion. This acreage includes Brussels, Hailey, and Rueter soils and the steeper areas of Gasconade, Gatewood, Knobby, and Ocie soils. Applying special erosion-control measures, such as water bars and dips, and designing logging roads and skid trails so that the steepness and length of the slopes and the concentration of water are minimized help to control erosion. Operating equipment can be hazardous on the steeper slopes. The equipment should be operated on the contour where possible. The logs in the steepest areas should be moved uphill to skid trails and yarding areas.

The depth to bedrock generally is one of the most significant soil properties affecting woodland productivity. It affects the ability of a soil to provide an anchor for tree roots and to provide available water and nutrients. Shallow soils produce trees that have shallow root systems. Such trees are prone to water stress during dry years or dry periods and are susceptible to windthrow during periods of strong winds. Gasconade and Knobby soils have bedrock within a depth of 20 inches. The limited depth to bedrock and rock outcrops not only restrict the use of equipment but also hinder the construction of logging roads. Careful planning can route proposed logging roads around areas where the depth to bedrock and rock outcrops are likely to be obstacles.

Management activities can influence woodland productivity and should be aimed at eliminating tree damage. Generally, good management involves controlling erosion, thinning overstocked young stands, planting trees where natural regeneration is insufficient or undesirable, harvesting mature trees, and preventing destructive fire and grazing.

Fire and grazing have very negative impacts on tree growth and quality. About 22 percent of the woodland in the county is subject to moderate or heavy grazing. Grazing destroys the leaf layer on the surface, compacts the soil, and destroys or damages tree seedlings. Fire damage is a major concern throughout the forests in the Ozarks. Fire not only damages the trees, resulting in reduced wood quality and tree growth, but also destroys wildlife habitat. Woodland sites that are have not been grazed or burned have the highest potential for optimum timber production, wildlife habitat, and recreational opportunities.

Tables 7 and 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. Table 7 lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol,* a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X,* stoniness or rockiness; *W,* excess water in or on the soil; *T,* toxic substances in the soil; D, restricted rooting depth; *C,* clay in the upper part of the soil; *S,* sandy texture; and *F,* a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed also are subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume,* a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Table 8 gives information about operating woodland equipment on haul roads, on log landings, on skid trails and in logging areas, and during site preparation and planting. It also specifies the most limiting season or seasons. The most limiting season in this survey area generally is spring or winter. On some soils, however, it is any wet period when saturated soil conditions limit trafficability on the finer textured (clayey) soils.

In table 8, a rating of *slight* indicates that the use of conventional logging equipment is not restricted if normal logging methods are used. A rating of *moderate* indicates that the use of equipment is restricted because of one or more soil factors. A rating of *severe* indicates that the kind of equipment that can be used is seriously restricted.

Haul roads are access roads leading from primary or surfaced roads to logging areas. The haul roads serve as transportation routes for wheeled logging equipment and logging trucks. Generally, they are unpaved roads. Some are graveled.

Log landings are areas where logs are assembled for transportation. Wheeled equipment can be used more frequently in these areas than in any other area affected by logging.

Skid trails and logging areas include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid trails, which generally are within the logging area, are trails over which the logs are dragged or hauled from the stump to a log landing.

Site preparation and planting are mechanized reforestation activities. The potential for topsoil displacement or concentrated storm runoff is high in areas that are being reforested.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Taney County offers many opportunities for recreation. Fishing, boating, swimming, and waterskiing are popular on Table Rock Lake, Lake Taneycomo, and Bull Shoals Lake. Bull, Swan, and Beaver Creeks offer opportunities for swimming, fishing, and canoeing. There are many indoor attractions in Branson and the surrounding communities. Country music shows and theme parks attract many tourists to the county each year.

The county is becoming a retirement area. Numerous resorts, boat docks, condominiums, country music shows, hotels, and restaurants not only accommodate tourists but also attract retirees. Associated developments, such as golf courses, campgrounds, and shopping malls, also attract residents from adjoining counties and from other parts of the State.

Part of the Mark Twain National Forest is within the boundaries of the county. This forest and the Hercules Glades Wilderness Area offer opportunities for hunting and hiking. Several State forests also provide opportunities for hunting and hiking. Although camping is allowed, the part of the Mark Twain National Forest in Taney County has no improved campsites. The county has many private campgrounds and has three U.S Army Corps of Engineers campgrounds along Bull Shoals Lake. Campgrounds also are available in Table Rock Lake State Park.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are nearly level to gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Prepared by Bob Schroeppel, biologist, Missouri Department of Conservation.

Taney County is in the south-central section of the State, where the eastern edge of the presettlement prairie blends into the Ozark timber. While early records indicate that the county included only 1 square mile of presettlement tall grass prairie, there is some question about what the early surveyors called "prairie." The term "barrens" was used to describe about 5,000 miles of section lines in the Ozarks. Most commonly, this term indicated stunted or large trees, generally scattered, but it also indicated a considerable extent of grass.

A survey of eastern Taney County in the winter of 1847-48, when cedars would have been most obvious, did not once use the word "glade," "grass," or "cedar." By the time that Curtis F. Marbut finished his survey a half century later, however, hills were described as supporting a mixture of cedars and grasses and "cedar glades" was a commonly used landscape term *(7)*.

The regular occurrence of fires, reported as often as every 3.2 years in some Ozark glades, was the main reason for this open grassy upland landscape. These fires, whether caused by lightning strikes or intentionally set, were eventually controlled by the early settlers. As a result, the open, grass-covered uplands became oak-hickory forests. This merger of grassland and timber is accompanied by a diversity of geography, climate, soils, and plant and animal distribution within the county.

Taney County is in the White River Section of the Ozark Natural Division. The White River and its tributaries have dissected the limestone bedrock of this section, making one of the most rugged landscapes in the State. The landscape is characterized by long, steep-sided ridges; extensive limestone glades (known locally as cedar glades); fast, clear streams; and cliffs, caves, springs, and sinkholes *(8)*. This rugged natural beauty has made Taney County one of the most important tourist areas in Missouri.

About 67 percent of the county is forested. Much of the forested acreage is in the Mark Twain National Forest. A total of 63,681 acres is administered by the Forest Service. This acreage includes the Hercules Glades Wilderness Area, which is more than 12,000 acres in size. This area and the White River Balds Natural Area, which is administered by the Missouri Department of Conservation, provide public access to the glades that dot the landscape in the county. Other public lands in the county include the Drury-Mincy Wildlife Area (4,088 acres), the Boston Ferry Natural History Area (177 acres), the Ruth and Paul Henning State Forest (1,534 acres), the Shepherd of the Hills Wildlife Area and Fish Hatchery (211 acres), and the areas surrounding Bull Shoals Lake and Table Rock Lake. Bull Shoals Lake, Table Rock Lake, and Lake Taneycomo were created by the damming of the White River.

The county has a total of 234 documented fish and wildlife species. Another 106 species are listed as "likely to occur," according to the Missouri Fish and Wildlife Information System, Missouri Department of Conservation. The typical nongame species include green frog, spotted salamander, broad-winged hawk, northern mockingbird, yellow warbler, deer mouse, and southern flying squirrel. The most common game species are white-tailed deer (fig. 13), wild turkey, gray squirrel, eastern cottontail rabbit, northern bobwhite quail, rainbow trout, brown trout, smallmouth bass, largemouth bass, and crappie.

Figure 13.—Deer browsing in a timbered area of Ocie-Gatewood complex, 3 to 9 percent slopes.

Several unusual species, such as eastern collared lizard, prairie-lined racerunner, western pygmy rattlesnake, and greater roadrunner, inhabit the glades in the county. Knobby and Gasconade soils are in these glades. Several species in the county are regarded as rare or endangered. Examples are southern brook lamprey, Oklahoma salamander, sharp-shinned hawk, long-tailed weasel, and black bear. A black bear was reported as recently as the summer of 1989.

The county has a good population of furbearers. The species harvested for fur are opossum, striped skunk, spotted skunk, muskrat, raccoon, mink, red fox, gray fox, coyote, bobcat, and beaver. Wildlife indices compiled by the Missouri Department of Conservation from a cooperative archery hunter survey in 1986 show that the county has a higher number of gray fox and bobcat than the State average. This survey is based on the number of sightings per 1,000 hours of hunting.

The woodland in the county is dominantly in areas of Clarksville, Hailey, Rueter, Brussels, Ode, and Gatewood soils. The primary game species in these areas are white-tailed deer and wild turkey. Hunters show a high interest in these species and a fair interest in squirrels. Several factors affect the quality of the woodland habitat in the county. Large expanses of woodland, which have few or no edge areas, are characterized by little plant and animal diversity. All of the woodland species suffer greatly from misuse of the timber resource, most notably the grazing of timbered areas and poor management. Grazing of woodland can result in tree damage, destruction of wildlife habitat, increased erosion, and compaction of the soil.

Poor woodland management in the Ozarks generally results in stands that have a closed canopy and thus eliminates the understory vegetation that provides food and cover for many woodland species. Illegal harvest also plays a major role in limiting the population of deer and turkey.

Hunters in the county show only a fair interest in openland wildlife species, such as bobwhite quail and rabbits. The shallow, infertile soils generally have a low carrying capacity for these species. Less than 1 percent of the cropland in the county is used for small grain. The shortage of small grain limits the winter food supply for many birds and animals. Much of the higher quality cropland, which is in areas of Huntington, Lecoma, and Kaintuck soils, is within the boundaries of the lakes administered by the Corps of Engineers and is subject to flooding in some years. Nearly 42 percent of the county is pastured, mainly with tall fescue. The population of small game is limited because of the growth characteristics of the fescue and the common management practices in these pastured areas, such as early haying and overgrazing. Interseeding of legumes, such as clover and lespedeza, into the tall fescue is improving the habitat to some extent. Better management of native warm-season grasses can improve the quality and diversity of the grassland for wildlife. Prescribed burning can decrease the extent of woody species and increase the extent of nesting cover.

The county has very little wetland habitat. The upper reaches of Bull Shoals Lake, Lake Taneycomo, a small portion of Table Rock Lake, and the numerous small streams account for nearly all of the wetland habitat in the county. While waterfowl species, such as ruddy ducks, hooded mergansers, and northern shovelers, have been recorded, the principal species are small resident populations of wood ducks along the streams and giant Canada geese on the three lakes. In a 1989 inventory of the White River Lakes area, the Missouri Department of Conservation counted 811 resident giant Canada geese. The major bodies of water in the county are Table Rock Lake, Lake Taneycomo, and Bull Shoals Lake, Beaver Creek, Swan Creek, and Bull Creek. Game fish species include rainbow trout, largemouth bass, smallmouth bass, channel cat, bluegill, redhorse sucker, flathead cattish, white bass, black crappie, and white crappie. The county has active heron rookeries. The largest of these had 157 individual birds and 112 active nests in 1989.

One of the major problems affecting the wildlife habitat in the county is the extent of development and urban sprawl. From 1970 to 1980, the county was the fastest growing county in Missouri *(4)*. The population increased slightly more than 57 percent during that period. This kind of growth infringes on the habitat of all fish and wildlife species.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of poor indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, grain sorghum, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are tall fescue, little bluestem, big bluestem, lespedeza, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are foxtail, croton, goldenrod, beggarweed, and partridge pea.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwoods and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, persimmon, cherry, deciduous holly, hawthorn, sassafras, wild plum, dogwood, and hickory. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good are* Russian-olive, autumn-olive, and hazelnut.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness.

Examples of coniferous plants are shortleaf pine, eastern redcedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, bobcat, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, the shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), the shrink-swell potential, the potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Table 14 gives the potential for onsite waste treatment and waste disposal systems. Soil potential ratings indicate the relative suitability of a soil for a particular use compared with that of other soils in a given area. The production or performance level, the feasibility and relative cost of applying modern technology to minimize the effects of soil limitations, and the adverse effects of continuing limitations, if any, on social, economic, or environmental values are considered. The criteria used in developing soil potential ratings for a particular use are established specifically for the area to which the ratings apply. The criteria may be different in nearby areas, counties, or regions. Thus, the rating assigned to a soil for a given use in one area may differ from the rating assigned to the same soil in another area.

The ratings are developed primarily for planning purposes and are not intended as recommendations for land use. They do not identify the most profitable land use. The ratings help decision makers to determine the relative suitability of soils for a given use. They are used along with other resource information as a guide in making land use decisions. They supplement the capability classes, soil limitation ratings, and other soil interpretations in soil handbooks and technical guides. They may be substituted for these interpretations or may supplement them in inventories and evaluations, interim soil reports, watershed work plans, and river basin studies prepared by the Natural Resources Conservation Service or in reports released by conservation districts or other units of government.

Four rating classes are used to indicate the comparative potential of the soils for a given use. These classes are high, medium, low, and very low. The paragraphs that follow define these rating classes.

High potential.—Production or performance meets or exceeds local standards, the cost of measures that can overcome soil limitations is favorable in relation to the expected performance or production, and the limitations continuing after corrective measures are applied do not appreciably detract from environmental quality or restrict economic returns.

Medium potential.—Production or performance is somewhat below local standards, the cost of measures that can overcome soil limitations is high, or the limitations continuing after corrective measures are applied detract from environmental quality or restrict economic returns.

Low potential.—Production or performance is significantly below local standards, the measures required to overcome soil limitations are very costly, or the limitations continuing after corrective measures are applied appreciably detract from environmental quality or restrict economic returns.

Very low potential.—Production or performance is much below local standards because of unfavorable soil properties, economically feasible measures to overcome severe soil limitations are unavailable, or the soil limitations continuing after corrective measures are applied seriously detract from environmental quality or restrict economic returns.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor as* a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and the shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair are* more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated poor have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor are* very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability in the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Engineering index properties
Physical and chemical properties
Soil and water features

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

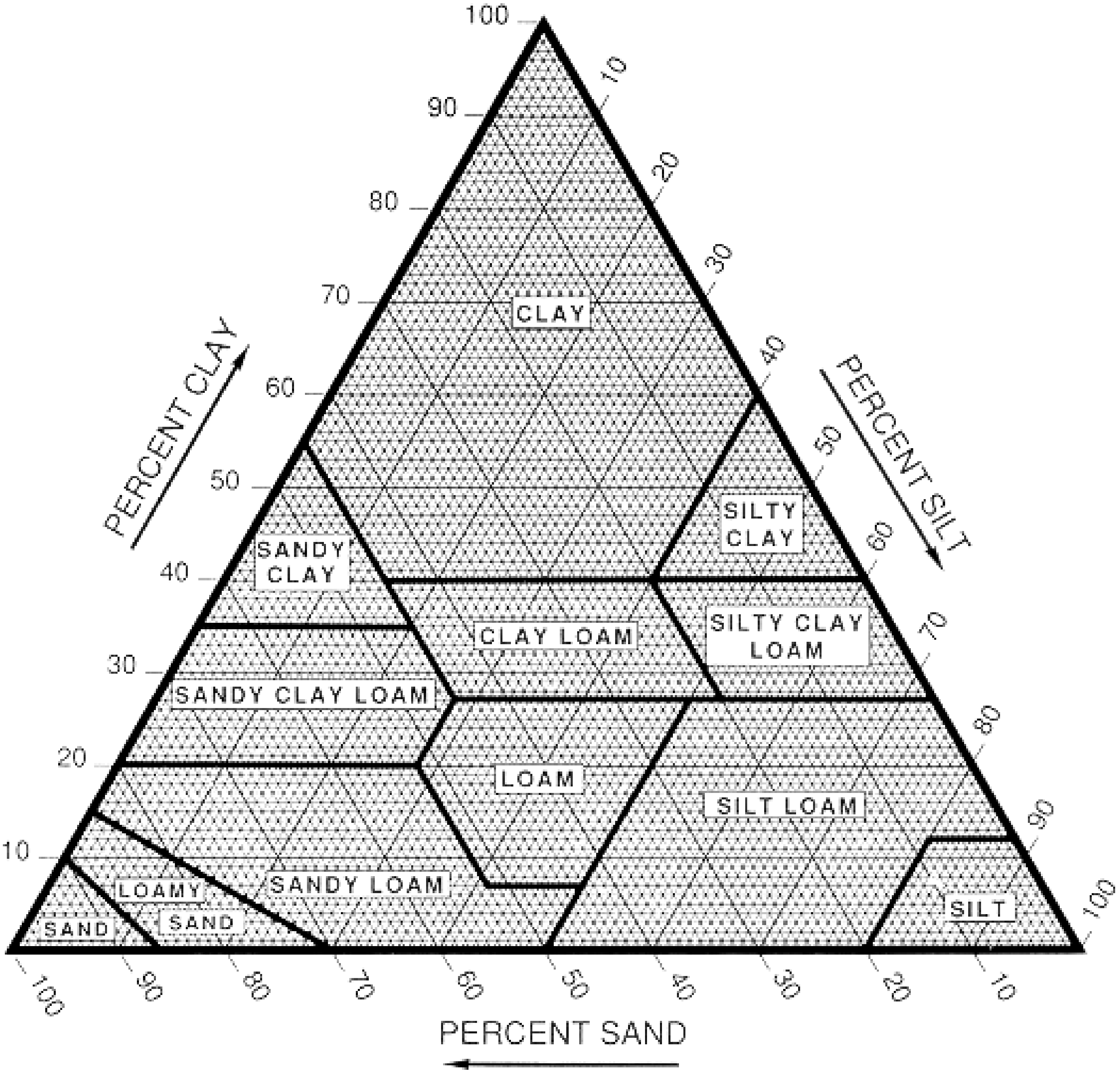


Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5. A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at Vs bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time. *Soil reaction* is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high. shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low,* a change of less than 3 percent *moderate,* 3 to 6 percent; and *high,* more than 6 percent. *Very high,* greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

in Taney County, MO

- Soil Series and Their Morphology

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Udifluvents (*Udi*, meaning humid, plus *fluvent*, the suborder of the Entisols that is on flood plains).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Mollic Udifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, siliceous, nonacid, mesic Mollic Udifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

|Britwater|Brussels|Cedargap|Clarksville|Gasconade|Gatewood|Hailey|
|Huntington|Kaintuck|Knobby|Lecoma|Ocie|Racket|Rueter|Sandbur|Viraton|

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(11)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(10)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Britwater Series--------------------------------

The Britwater series consists of very deep, well drained soils on high stream terraces, foot slopes, and uplands. These soils formed in loess and dolomite residuum, colluvium, or loamy alluvium. Permeability is moderate. Slopes range from 2 to 9 percent.

Taxonomic classification: Fine-loamy, mixed, mesic Typic Paleudalfs.

Typical pedon of Britwater silt loam, 2 to 5 percent slopes, about 2,580 feet south and 1,800 feet east of the northwest corner of sec. 35, T. 22 N., R. 19 W.

A—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; many fine and medium and common coarse roots; about 5 percent chert gravel; strongly acid; clear smooth boundary.

E—6 to 11 inches; brown (10YR 5/3) silt loam; weak fine granular structure; friable; many fine and medium and common coarse roots; about 5 percent chert gravel; strongly acid; gradual smooth boundary.

Bt1—11 to 21 inches; strong brown (7.5YR 5/6) silt loam; moderate fine subangular blocky structure; friable; common fine, medium, and coarse roots; few distinct clay films on faces of peds; about 5 percent chert gravel; strongly acid; clear wavy boundary.

2Bt2—21 to 36 inches; strong brown (7.5YR 5/6) very gravelly clay loam; weak fine subangular blocky structure parting to moderate fine angular blocky; firm; few fine, medium, and coarse roots; common distinct clay films on faces of peds; about 40 percent chert gravel; moderately acid; clear wavy boundary.

3Bt3—36 to 60 inches; yellowish red (5YR 4/6) gravelly silty clay; weak fine angular blocky structure parting to moderate fine subangular blocky; firm; few fine, medium, and coarse roots; common distinct clay films on faces of peds; common distinct stains of manganese oxide; about 20 percent chert gravel; moderately acid.

The Bt horizon has hue of 7.5YR to 2.5YR, value of 3 to 5, and chroma of 4 to 8. It is silt loam, silty clay loam, clay loam, or the gravelly or very gravelly analogs of those textures. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is the gravelly or very gravelly analogs of clay, clay loam, or silty clay loam. The 3Bt horizon has hue of 5YR to 10R, value of 3 to 5, and chroma of 4 to 8. It is the gravelly or very gravelly analogs of clay, silty clay, or silty clay loam.

Brussels Series

The Brussels series consists of very deep, well drained soils on uplands. These soils formed in flaggy and clayey colluvium. Permeability is moderately slow. Slopes range from 50 to 90 percent.

Taxonomic classification: Clayey-skeletal, mixed, mesic Typic Hapludolls.

Typical pedon of Brussels very flaggy silty clay loam, in an area of Brussels-Rock outcrop complex, 50 to 90 percent slopes, about 2,600 feet north and 800 feet east of the southwest corner of sec. 7, T. 23 N., R. 18 W.

Oi—1 inch to 0; slightly decomposed leaves, roots, and twigs.

A—0 to 13 inches; black (10YR 2/1) very flaggy silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to weak very fine granular; friable; many fine and medium and common coarse roots; about 20 percent chert gravel and 20 percent dolomite flagstones; slightly alkaline; clear smooth boundary.

BA—13 to 20 inches; black (10YR 2/1) very flaggy silty clay, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; firm; common fine, medium, and coarse roots; about 25 percent chert gravel and 30 percent dolomite flagstones; moderately alkaline; clear smooth boundary.

Bw1—20 to 28 inches; dark brown (10YR 4/3) extremely flaggy clay; weak fine angular blocky structure; firm; common fine, medium, and coarse roots; few organic coatings; about 20 percent chert gravel and 45 percent dolomite flagstones; moderately alkaline; clear smooth boundary.

Bw2—28 to 34 inches; dark yellowish brown (10YR 4/4) extremely flaggy clay; weak fine angular blocky structure; firm; common fine, medium, and coarse roots; common organic coatings; about 20 percent chert gravel and 45 percent dolomite flagstones; moderately alkaline; gradual smooth boundary.

Bw3—34 to 45 inches; strong brown (7.5YR 4/6) extremely flaggy clay; weak fine angular blocky structure; very firm; few fine and common medium and coarse roots; common organic coatings; about 25 percent chert gravel and 50 percent dolomite flagstones; slightly alkaline; gradual smooth boundary.

Bw4—45 to 60 inches; strong brown (7.5YR 4/6) extremely flaggy silty clay; weak fine angular blocky structure; very firm; common medium and few coarse roots; common organic coatings; about 35 percent chert gravel and 50 percent dolomite flagstones; moderately alkaline.

The A horizon has value of 2 or 3. The Bw horizon has value of 3 or 4 and chroma of 2 to 6. It is the very flaggy or extremely flaggy analogs of clay, silty clay, or silty clay loam.

Cedargap Series--------------------------------

The Cedargap series consists of very deep, well drained soils on flood plains. These soils formed in gravelly alluvium. Permeability is moderately rapid. Slopes range from 0 to 3 percent.

Taxonomic classification: Loamy-skeletal, mixed, mesic Cumulic Hapludolls.

Typical pedon of Cedargap gravelly loam, 0 to 3 percent slopes, about 1,600 feet north and 2,580 feet east of the southwest corner of sec. 11, T. 22 N., R. 17 W.

A1—0 to 3 inches; very dark gray (10YR 3/1) gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; about 30 percent chert gravel; slightly alkaline; clear smooth boundary.

A2—3 to 11 inches; very dark gray (10YR 3/1) gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; many fine and medium and common coarse roots; about 20 percent chert gravel; slightly alkaline; clear wavy boundary.

A3—11 to 20 inches; very dark gray (10YR 3/1) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine, medium, and coarse roots; about 45 percent chert gravel; slightly alkaline; clear wavy boundary.

A4—20 to 26 inches; very dark grayish brown (10YR 3/2) extremely gravelly loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; friable; common fine and medium and few coarse roots; about 75 percent chert gravel; moderately alkaline; gradual wavy boundary.

C1—26 to 34 inches; dark brown (10YR 3/3) very gravelly clay loam, brown (10YR 5/3) dry; massive; firm; few fine, medium, and coarse roots; about 45 percent chert gravel; moderately alkaline; gradual wavy boundary.

C2—34 to 46 inches; dark grayish brown (10YR 4/2) extremely gravelly clay loam; massive; very firm; few fine and medium roots; about 65 percent chert gravel; slightly alkaline; gradual wavy boundary.

C3—46 to 60 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam; massive; firm; few fine and medium roots; about 50 percent chert gravel; moderately alkaline.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The C horizon has chroma of 2 to 4.

Clarksville Series

The Clarksville series consists of very deep, somewhat excessively drained soils on uplands. These soils formed in cherty limestone residuum. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. Slopes range from 3 to 15 percent.

Taxonomic classification: Loamy-skeletal, siliceous, mesic Typic Paleudalfs.

Typical pedon of Clarksville very gravelly silt loam, 3 to 15 percent slopes, about 2,000 feet south and 2,480 feet east of the northwest corner of sec. 23, T. 24 N., R. 22 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very gravelly silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; many fine and very fine roots; about 40 percent chert gravel; very strongly acid; clear smooth boundary.

E—4 to 13 inches; brown (10YR 5/3) very gravelly silt loam; weak fine subangular blocky structure parting to weak fine granular; very friable; many fine and common medium roots; about 40 percent chert gravel; strongly acid; clear wavy boundary.

BE—13 to 22 inches; dark yellowish brown (7.5YR 4/4), strong brown (7.5YR 5/6), and brown (7.5YR 5/4) extremely gravelly silt loam; weak fine subangular blocky structure; friable; common fine and few medium roots; about 65 percent chert gravel; strongly acid; clear wavy boundary.

Bt1—22 to 31 inches; brown (7.5YR 5/4) and strong brown (7.5YR 4/6) extremely gravelly silt loam; weak fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 70 percent chert gravel; very strongly acid; clear wavy boundary.

Bt2—31 to 43 inches; red (2.5YR 4/6), strong brown (7.5YR 5/6), and light brown (7.5YR 6/4) very gravelly silty clay loam; moderate fine subangular blocky structure; firm; few medium roots; common distinct clay films on faces of peds; about 45 percent chert gravel and 10 percent chert cobbles; very strongly acid; gradual wavy boundary.

2Bt3—43 to 49 inches; dark red (2.5YR 3/6) very gravelly clay; moderate fine angular blocky structure; very firm; many prominent clay films on faces of peds; about 45 percent chert gravel and 10 percent chert cobbles; very strongly acid; gradual wavy boundary.

2Bt4—49 to 60 inches; mixed dark red (2.5YR 3/6), yellowish red (5YR 5/6), and yellowish brown (10YR 5/6) very gravelly clay; moderate fine and medium angular blocky structure; very firm; many prominent clay films on faces of peds; about 45 percent chert gravel and 5 percent cobbles; very strongly acid.

The A or Ap horizon has value of 3 or 4 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR to 2.5YR and value and chroma of 4 to 6. It is the very gravelly, very cobbly, or extremely gravelly analogs of silty clay loam or silt loam. The 2Bt horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 4 to 6. It is the gravelly, very gravelly, or extremely gravelly analogs of clay or silty clay.

Gasconade Series

The Gasconade series consists of shallow, well drained soils on uplands. These soils formed in dolomite residuum. Permeability is moderately slow. Slopes range from 3 to 50 percent.

Taxonomic classification: Clayey-skeletal, mixed, mesic Lithic Hapludolls.

Typical pedon of Gasconade very flaggy clay loam, in an area of Gasconade-Gatewood-Rock outcrop complex, 15 to 50 percent slopes, about 2,000 feet south and 580 feet east of the northwest corner of sec. 19, T. 24 N., R. 20 W.

Oi—1 inch to 0; partially decomposed leaves, twigs, and roots.

A—0 to 8 inches; very dark brown (10YR 2/2) very flaggy clay loam, very dark gray (10YR 3/1) dry; strong medium subangular blocky structure; very firm; many fine and medium and few coarse roots; about 25 percent chert gravel, 5 percent chert cobbles, and 25 percent dolomite flagstones; slightly alkaline; clear wavy boundary.

Bw1—8 to 13 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; firm; common fine and medium and few coarse roots; about 30 percent chert gravel, 10 percent chert cobbles, and 5 percent dolomite flagstones; slightly alkaline; gradual wavy boundary.

Bw2—13 to 19 inches; very dark grayish brown (10YR 3/2) extremely flaggy clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; very firm; common fine and medium and few coarse roots; about 30 percent chert gravel, 10 percent chert cobbles, and 40 percent flagstones; slightly alkaline; abrupt wavy boundary.

R—19 inches; dolomite bedrock.

The depth to bedrock is 10 to 20 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is flaggy or very flaggy clay loam. The Bw horizon has chroma of 2 or 3. It is the very flaggy, extremely flaggy, or very gravelly analogs of clay, silty clay, clay loam, or silty clay loam.

Gatewood Series

The Gatewood series consists of moderately deep, moderately well drained soils on uplands. These soils formed in gravelly sediments and in the underlying clayey and cherty material weathered from dolomite. Permeability is slow. Slopes range from 3 to 35 percent.

Taxonomic classification: Very fine, mixed, mesic Typic Hapludalfs.

Typical pedon of Gatewood very gravelly silt loam, in an area of Ocie-Gatewood complex, 3 to 9 percent slopes, about 900 feet south and 800 feet west of the northeast corner of sec. 24, T. 23 N., R. 21 W.

A—0 to 6 inches; dark brown (10YR 3/3) very gravelly silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common medium and many fine and very fine roots;

about 40 percent chert gravel; moderately acid; clear smooth boundary.

E—6 to 13 inches; yellowish brown (10YR 5/4) very gravelly silt loam; weak fine granular structure; friable; many fine and very fine roots; about 55 percent chert gravel; slightly acid; abrupt wavy boundary.

2Bt1—13 to 18 inches; yellowish brown (10YR 5/6) clay; moderate fine angular blocky structure; very firm; few fine and coarse roots; common distinct clay films on faces of peds; common fine concretions of manganese oxide; about 10 percent chert gravel; neutral; gradual smooth boundary.

2Bt2—18 to 29 inches; yellowish brown (10YR 5/8) clay; moderate fine angular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; common fine concretions of manganese oxide; about 5 percent chert gravel; slightly alkaline; clear wavy boundary.

2C—29 to 33 inches; yellowish brown (10YR 5/8) and light olive gray (5Y 6/2) channery clay; weak thin platy structure parting to weak fine angular blocky; very firm; few fine roots; common fine concretions of manganese oxide; about 30 percent dolomite channers; moderately alkaline; abrupt wavy boundary.

2R—33 inches; dolomite bedrock.

The depth to bedrock ranges from 20 to 40 inches. The A or Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is gravelly or very gravelly silt loam. The E horizon has value of 4 or 5 and chroma of 3 or 4. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is clay, silty clay, or the gravelly analogs of those textures. The 2C horizon has hue of 10YR to 5Y, value of 5 or 6, and chroma of 2 to 8. It is clay or channery or very channery clay.

Hailey Series

The Hailey series consists of very deep, excessively drained soils on uplands. These soils formed in cherty limestone residuum. Permeability is rapid. Slopes range from 15 to 50 percent.

Taxonomic classification: Loamy-skeletal, siliceous, mesic Typic Dystrochrepts.

Typical pedon of Hailey very gravelly silt loam, 15 to 50 percent slopes, about 2,400 feet south and 1,700 feet east of the northwest corner of sec. 24, T. 21 N., R. 21 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) very gravelly silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; many fine and medium roots; about 45 percent chert gravel; moderately acid; clear smooth boundary.

E—3 to 12 inches; brown (10YR 5/3) extremely gravelly silt loam; weak fine granular structure; friable; many fine and medium and common coarse roots; about 65 percent chert gravel; strongly acid; clear wavy boundary.

Bw1—12 to 40 inches; brown (10YR 5/3) extremely cobbly sandy loam; weak very fine subangular blocky structure; friable; many fine and medium and common coarse roots; about

30 percent chert gravel, 25 percent chert cobbles, and 20 percent chert stones; strongly acid; gradual wavy boundary.

Bw2—40 to 60 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) extremely cobbly loam; weak very fine subangular blocky structure; friable; few fine and common medium roots; about 40 percent chert gravel, 25 percent chert cobbles, and 20 percent chert stones; strongly acid.

The A horizon has value of 3 or 4. The E horizon has value of 5 or 6. It is very gravelly or extremely gravelly silt loam. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is the very gravelly analogs of silt loam or loam; the extremely gravelly analogs of silt loam, loam, or sandy loam; or the extremely cobbly analogs of loam or sandy loam.

Huntington Series

The Huntington series consists of very deep, well drained soils on flood plains. These soils formed in silty alluvium. Permeability is moderate. Slopes range from 0 to 3 percent.

Taxonomic classification: Fine-silty, mixed, mesic Fluventic Hapludolls.

Typical pedon of Huntington silt loam, 0 to 3 percent slopes, about 1,980 feet south and 1,450 feet west of the northeast corner of sec. 5, T. 23 N., R. 20 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

AB—10 to 14 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few very fine roots; neutral; clear smooth boundary.

Bw1—14 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; few very fine roots; slightly alkaline; clear smooth boundary.

Bw2—20 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; firm; few very fine roots; slightly alkaline; gradual smooth boundary.

Bw3—28 to 51 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few fine irregular stains of manganese oxide; neutral; gradual smooth boundary.

Bw4—51 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; neutral.

The A or Ap horizon has chroma of 2 or 3. The Bw horizon has value of 4 or 5 and chroma of 3 or 4.

Kaintuck Series

The Kaintuck series consists of very deep, well drained soils on flood plains. These soils formed in loamy alluvium. Permeability is moderately rapid. Slopes range from 0 to 3 percent.

Taxonomic classification: Coarse-loamy, siliceous, nonacid, mesic Typic Udifluvents.

Typical pedon of Kaintuck fine sandy loam, 0 to 3 percent slopes, about 1,200 feet north and 2,600 feet west of the southeast corner of sec. 34, T. 23 N., R. 19 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; neutral; clear smooth boundary.

C1—5 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; very friable; common very fine and fine roots; neutral; gradual smooth boundary.

C2—14 to 26 inches; dark yellowish brown (10YR 4/4) fine sandy loam; massive; very friable; few fine and very fine roots; neutral; clear smooth boundary.

C3—26 to 60 inches; dark yellowish brown (10YR 4/6) fine sandy loam; massive; very friable; few fine roots; neutral.

The A or Ap horizon has value of 3 or 4 and chroma of 2 to 4. The C horizon has chroma of 3 to 8. It is loam, fine sandy loam, sandy loam, or loamy sand.

Knobby Series

The Knobby series consists of very shallow, somewhat excessively drained soils on uplands. These soils formed in dolomite residuum. Permeability is moderate. Slopes range from 3 to 50 percent.

Taxonomic classification: Loamy-skeletal, mixed, mesic Lithic Hapludolls.

Typical pedon of Knobby gravelly loam, in an area of Knobby-Rock outcrop complex, 15 to 50 percent slopes, about 650 feet south and 2,180 feet east of the northwest corner of sec. 35, T. 23 N., R. 21 W.

A1—0 to 5 inches; very dark gray (10YR 3/1) gravelly loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; many fine, many medium, and few coarse roots; about 30 percent chert gravel; slightly alkaline; abrupt wavy boundary.

A2—5 to 9 inches; very dark grayish brown (10YR 3/2) very flaggy fine sandy loam, grayish brown (10YR 5/2) dry; massive; friable; few fine and medium roots; about 20 percent dolomite gravel and 40 percent dolomite flagstones; slightly alkaline; abrupt wavy boundary.

R—9 inches; dolomite bedrock.

The depth to bedrock is 4 to 10 inches. The A horizon has value of 2 or 3. It is the gravelly, very gravelly, extremely gravelly, flaggy, or very flaggy analogs of loam, fine sandy loam, or coarse sandy loam.

Lecoma Series

The Lecoma series consists of very deep, well drained soils on stream terraces and foot slopes. These soils formed in loamy alluvium. Permeability is moderate. Slopes range from 1 to 6 percent.

Taxonomic classification: Fine-loamy, siliceous, mesic Typic Paleudalfs. Typical pedon of Lecoma fine sandy loam, 1 to 6 percent slopes, about 2,520 feet north and 1,000 feet east of the southwest corner of sec. 21, T. 24 N., R. 18 W.

Ap—0 to 6 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; moderate very fine and fine granular structure; very friable; common fine and common medium and coarse roots; strongly acid; clear smooth boundary.

BA—6 to 10 inches; brown (7.5YR 4/4) loam; weak very fine and fine subangular blocky structure; friable; common fine and medium roots; common medium concretions of manganese oxide; about 10 percent chert gravel; strongly acid; clear smooth boundary.

Bt1—10 to 15 inches; yellowish red (5YR 4/6) clay loam; moderate very fine and fine subangular blocky structure; firm; common fine and few medium roots; few distinct clay films on faces of peds; common medium concretions of manganese oxide; about 10 percent chert gravel; strongly acid; gradual smooth boundary.

Bt2—15 to 28 inches; red (2.5YR 4/6) clay loam; moderate very fine and fine subangular blocky structure; firm; few fine and medium roots; few distinct clay films on faces of peds; few fine concretions of manganese oxide; about 10 percent chert gravel; strongly acid; gradual smooth boundary.

Bt3—28 to 43 inches; yellowish red (5YR 4/6) clay loam; moderate very fine and fine subangular blocky structure; firm; few fine and medium roots; few distinct clay films on faces of peds; about 5 percent chert gravel; moderately acid; gradual smooth boundary.

Bt4—43 to 55 inches; yellowish red (5YR 4/6) clay loam; moderate very fine and fine subangular blocky structure; very firm; few faint clay films on faces of peds; about 5 percent chert gravel; moderately acid; clear wavy boundary.

Bt5—55 to 60 inches; yellowish red (5YR 4/6) gravelly sandy clay loam; common fine distinct red (2.5YR 4/8) mottles; weak very fine and fine subangular blocky structure; very firm; few distinct clay films on faces of peds; about 30 percent chert gravel; moderately acid.

The Ap or A horizon has value of 3 or 4. The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, sandy clay loam, or loam.

Ocie Series

The Ocie series consists of deep, well drained and moderately well drained soils on uplands. These soils formed in gravelly sediments and in the underlying clayey and cherty material weathered from dolomite. Permeability is slow. Slopes range from 3 to 35 percent.

Taxonomic classification: Loamy-skeletal over clayey, mixed, mesic Typic Hapludalfs.

Typical pedon of Ocie gravelly silt loam, in an area of Ocie-Gatewood complex, 3 to 9 percent slopes, about 2,280 feet south and 1,600 feet east of the northwest corner of sec. 35, T. 22 N., R. 19 W.

Ap—0 to 7 inches; brown (10YR 4/3) gravelly silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine and medium and few coarse roots; about 30 percent chert gravel; strongly acid; clear smooth boundary.

Bt1—7 to 14 inches; yellowish brown (10YR 5/4) very gravelly loam; weak fine granular structure; very friable; common fine and medium and few coarse roots; few faint clay films on faces of peds; about 50 percent chert gravel; strongly acid; clear wavy boundary.

Bt2—14 to 22 inches; yellowish brown (10YR 5/4) very gravelly loam; weak fine subangular blocky structure; friable; common fine and medium and few coarse roots; few faint clay films on faces of peds; about 55 percent chert gravel; strongly acid; clear wavy boundary.

2Bt3—22 to 25 inches; brown (7.5YR 5/4) and yellowish red (5YR 5/6) gravelly clay; few fine prominent red (2.5YR 4/6) mottles; weak fine angular blocky structure; firm; common fine and medium and few coarse roots; many distinct clay films on faces of peds; about 30 percent chert gravel; strongly acid; clear wavy boundary.

2Bt4—25 to 31 inches; mixed brown (7.5YR 5/4), red (2.5YR 4/6), and yellowish red (5YR 5/6) clay; moderate fine angular blocky structure; very firm; few fine and medium roots; many distinct clay films on faces of peds; about 5 percent chert gravel; strongly acid; gradual wavy boundary.

2Bt5—31 to 44 inches; strong brown (7.5YR 4/6) and light brownish gray (10YR 6/2) clay; few fine prominent red (2.5YR 4/6) mottles; weak fine and medium angular blocky structure; very firm; few fine and medium roots; many distinct clay films on faces of peds; about 10 percent chert gravel; strongly acid; clear wavy boundary.

2Bt6—44 to 51 inches; yellowish brown (10YR 5/4) and brown (10YR 5/3) gravelly clay; moderate fine and medium angular blocky structure; very firm; few fine and medium roots; many prominent clay films on faces of peds; many black stains; about 15 percent dolomite gravel and 5 percent chert gravel; neutral; abrupt wavy boundary. 2R—51 inches; dolomite bedrock.

The depth to bedrock ranges from 40 to 60 inches. The A or Ap horizon has value of 3 to 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR to 5YR, value of 3 to 6, and chroma of 4 to 8. It is the very gravelly, extremely gravelly, very cobbly, or extremely cobbly analogs of silty clay loam, silt loam, or loam. The 2Bt horizon has hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 2 to 8. It is clay or gravelly or cobbly clay.

Racket Series

The Racket series consists of very deep, moderately well drained soils on flood plains. These soils formed in loamy alluvium. Permeability is moderate. Slopes range from 0 to 3 percent.

Taxonomic classification: Fine-loamy, mixed, mesic Cumulic Hapludolls.

Typical pedon of Racket silt loam, 0 to 3 percent slopes, about 2,200 feet south and 500 feet west of the northeast corner of sec. 12, T. 23 N., R. 19 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many fine and medium roots; slightly acid; abrupt smooth boundary.

A—10 to 25 inches; very dark grayish brown (10YR 3/2) loam, gray (10YR 5/1) dry; weak thin platy structure parting to weak fine subangular blocky; friable; common fine and medium roots; common prominent silt coatings; neutral; clear smooth boundary.

Bw1—25 to 45 inches; dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) loam; moderate fine subangular blocky structure; firm; few fine and medium roots; few distinct concretions and stains of manganese oxide; neutral; gradual smooth boundary.

Bw2—45 to 56 inches; mottled dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular blocky structure; very firm; common concretions of manganese oxide; neutral; clear smooth boundary.

Bw3—56 to 60 inches; mottled dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) gravelly silty clay loam; moderate fine subangular blocky structure; very firm; about 30 percent chert gravel; common distinct concretions of manganese oxide; neutral.

The A and Ap horizons have value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 6. It is silty clay loam or gravelly silty clay loam in the lower part.

Rueter Series

The Rueter series consists of very deep, somewhat excessively drained soils on back slopes in the uplands. These soils formed in cherty limestone residuum. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. Slopes range from 15 to 50 percent.

Taxonomic classification: Loamy-skeletal, siliceous, mesic Typic Paleudalfs.

Typical pedon of Rueter very gravelly silt loam, in an area of Rueter-Rock outcrop complex, 15 to 50 percent slopes, about 1,900 feet north and 2,300 feet east of the southwest corner of sec. 5, T. 22 N., R. 17 W.

Oi—1 inch to 0; slightly decomposed leaves, roots, and twigs.

A—0 to 5 inches; dark grayish brown (10YR 4/2) very gravelly silt loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine granular structure; very friable; many fine and medium and common coarse roots; about 45 percent chert gravel; moderately acid; clear smooth boundary.

E—5 to 13 inches; brown (10YR 5/3) very gravelly silt loam; moderate very fine and fine granular structure; friable; many fine and medium and common coarse roots; about 40 percent chert gravel; strongly acid; clear smooth boundary.

Bt1—13 to 22 inches; brown (7.5YR 5/4) very cobbly silt loam; weak fine subangular blocky structure; friable; many medium and few coarse roots; few faint clay films on faces of peds; about 5 percent chert gravel and 20 percent chert cobbles; strongly acid; clear smooth boundary.

Bt2—22 to 34 inches; strong brown (7.5YR 5/6) extremely gravelly silt loam; weak fine and very fine subangular blocky structure; friable; common medium and fine roots; few faint clay films on faces of peds; about 65 percent chert gravel; strongly acid; gradual wavy boundary.

Bt3—34 to 42 inches; strong brown (7.5YR 4/6) extremely gravelly silt loam; weak fine subangular blocky structure; friable; few fine and medium roots; few faint clay films on faces of peds; about 70 percent chert gravel; moderately acid; abrupt wavy boundary.

2Bt4—42 to 53 inches; red (2.5YR 4/6) very gravelly clay; moderate very fine and fine angular blocky structure; very firm; common fine and few medium roots; common distinct clay films on faces of peds; about 55 percent chert gravel; strongly acid; clear wavy boundary.

2Bt5—53 to 60 inches; dark red (2.5YR 3/6) and red (2.5YR 5/6) very gravelly clay; moderate fine angular blocky structure; very firm; few fine and medium roots; many distinct clay films on faces of peds; about 40 percent chert gravel; very strongly acid.

The A horizon has value of 3 or 4 and chroma of 2 to 4. The E horizon has value of 4 or 5 and chroma of 3 or 4. The E horizon is gravelly or very gravelly silt loam. The BE horizon, if it occurs, has value of 5 or 6 and chroma of 4. It is gravelly silt loam. The Bt horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 3 to 8. It is the very gravelly, very cobbly, or extremely gravelly analogs of silty clay loam or silt loam. The 2Bt horizon has hue of 10YR to 10R, value of 3 to 7, and chroma of 1 to 6. It is the gravelly, very gravelly, extremely gravelly, or cobbly analogs of clay or silty clay.

Sandbur Series--------------------------------

The Sandbur series consists of very deep, excessively drained soils that formed in loamy alluvium on flood plains along streams of intermediate size. These soils are near active channels. Permeability is moderately rapid. Slopes range from 0 to 3 percent.

Taxonomic classification: Coarse-loamy, siliceous, nonacid, mesic Mollic Udifluvents.

Typical pedon of Sandbur fine sandy loam, 0 to 3 percent slopes, about 1,300 feet north and

200 feet west of the southeast corner of sec. 31, T. 24 N., R. 18 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common fine roots; moderately alkaline; clear smooth boundary.

C1—10 to 19 inches; very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/4) loamy fine sand thinly stratified with lenses of fine sand; single grain; loose; few fine roots; slightly alkaline; clear smooth boundary.

C2—19 to 26 inches; very dark grayish brown (10YR 3/2) fine sandy loam; massive; very friable; few fine roots; slightly alkaline; gradual smooth boundary.

C3—26 to 32 inches; very dark grayish brown (10YR 3/2) loamy fine sand; single grain; loose; few fine roots; moderately alkaline; gradual smooth boundary.

C4—32 to 45 inches; very dark grayish brown (10YR 3/2) fine sandy loam thinly stratified with lenses of fine sand; massive; very friable; moderately alkaline; clear smooth boundary.

C5—45 to 52 inches; very dark grayish brown (10YR 3/2) and brown (10YR 5/3) fine sand; single grain; loose; about 5 percent chert gravel; slightly alkaline; clear smooth boundary.

C6—52 to 60 inches; very dark grayish brown (10YR 3/2) and brown (10YR 5/3) loamy fine sand; single grain; loose; slightly alkaline.

The content of gravel ranges, by volume, from 0 to 35 percent throughout the profile. It can be more than 35 percent in individual horizons. It commonly is highest in the C horizon.

The A or Ap horizon has chroma of 2 or 3. The C horizon has value of 3 to 5 and chroma of 1 to 6. It is stratified loam, fine sandy loam, sandy loam, loamy fine sand, loamy sand, fine sand, sand, coarse sand, or the gravelly analogs of those textures.

Viraton Series-------------------------------

The Viraton series consists of very deep, moderately well drained soils on uplands. These soils formed in a thin mantle of loamy material and in the underlying cherty dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and very slow in the fragipan. Slopes range from 2 to 5 percent.

Taxonomic classification: Fine-loamy, siliceous, mesic Typic Fragiudalfs.

Typical pedon of Viraton silt loam, 2 to 5 percent slopes, about 1,025 feet north and 1,200 feet west of the southeast corner of sec. 30, T. 23 N., R. 21 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine and fine granular structure; friable; many fine and common medium roots; about 5 percent chert gravel; strongly acid; abrupt smooth boundary.

E—4 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak very fine and fine granular structure; friable; common fine and very fine roots; slightly acid; clear smooth boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common fine and very fine roots; few faint clay films on faces of peds; about 5 percent chert gravel; neutral; clear smooth boundary.

Bt2—15 to 21 inches; yellowish brown (10YR 5/4) silt loam; moderate very fine and fine subangular blocky structure; firm; common fine and few medium roots; few faint clay films on faces of peds; about 5 percent chert gravel; neutral; gradual smooth boundary.

Bt3—21 to 26 inches; mottled yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) silt loam; weak fine subangular blocky structure; firm; common fine and very fine and few medium roots; few faint clay films on faces of peds; strongly acid; gradual wavy boundary.

2Ex—26 to 32 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) very gravelly silt loam; massive; very firm; brittle; about 45 percent chert gravel and 10 percent chert cobbles; strongly acid; gradual wavy boundary.

2Btx—32 to 51 inches; mottled yellowish red (5YR 4/6) and light brownish gray (10YR 6/2) extremely gravelly silt loam; massive; very firm; brittle; common distinct clay flows in vertical polygonal cracks; about 50 percent chert gravel and 20 percent chert cobbles; strongly acid; abrupt wavy boundary.

3Bt—51 to 60 inches; mixed yellowish red (5YR 4/6), red (2.5YR 4/8), and strong brown (7.5YR 5/6) extremely cobbly clay; weak fine angular blocky structure; firm; many prominent clay films on faces of peds; about 80 percent chert cobbles; neutral.

Depth to the fragipan ranges from 22 to 26 inches. The A or Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam, silt loam, or the gravelly analogs of those textures. The 2Ex and 2Btx horizons have hue of 10YR to 5YR, value of 4 to 6, and chroma of 1 to 6. They are the gravelly, very gravelly, or extremely gravelly analogs of silty clay loam or silt loam. The 3Bt horizon has hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 3 to 8. It is clay, clay loam, silty clay loam, or the gravelly, cobbly, very gravelly, very cobbly, extremely gravelly, or extremely cobbly analogs of those textures.

General Geology and Physiography

in Taney County, MO

|*Geologic Formations*|*Hydrology*|

Prepared by John W. Whitfield, geologist, Missouri Department of Natural Resources.

Taney County is on the Ozark Plateau. Most of the county is within a subprovince called the Salem Plateau. The bedrock consists of Ordovician cherty dolomite and lesser amounts of sandstone. Small areas in the northwestern, southwestern, and east-central parts of the county are on the Springfield Plateau, another subprovince of the Ozark Plateau. This region is underlain by Mississippian cherty limestone. The landscape ranges from steep, wooded hills and narrow, stony valleys to rolling hills with glade slopes and terraced river valleys.

Geologic Formations

From oldest to youngest, the geologic formations in Taney County are Jefferson City Dolomite, Cotter Dolomite, the Bachelor Formation, the Compton Formation, the Northview Formation, the Pierson Formation, the Reeds Spring and Elsey Formations, and Burlington-Keokuk Limestone.

Jefferson City (fig. 15) and Cotter Dolomites have similar lithologies. They consist of massive to thinly bedded dolomites and interbedded cherts. Their combined thickness is about 400 feet. Cotter Dolomite contains sandstone beds, which are widespread and are not of great significance, except in local areas where they thicken sufficiently to affect soil formation and furnish small amounts of water.

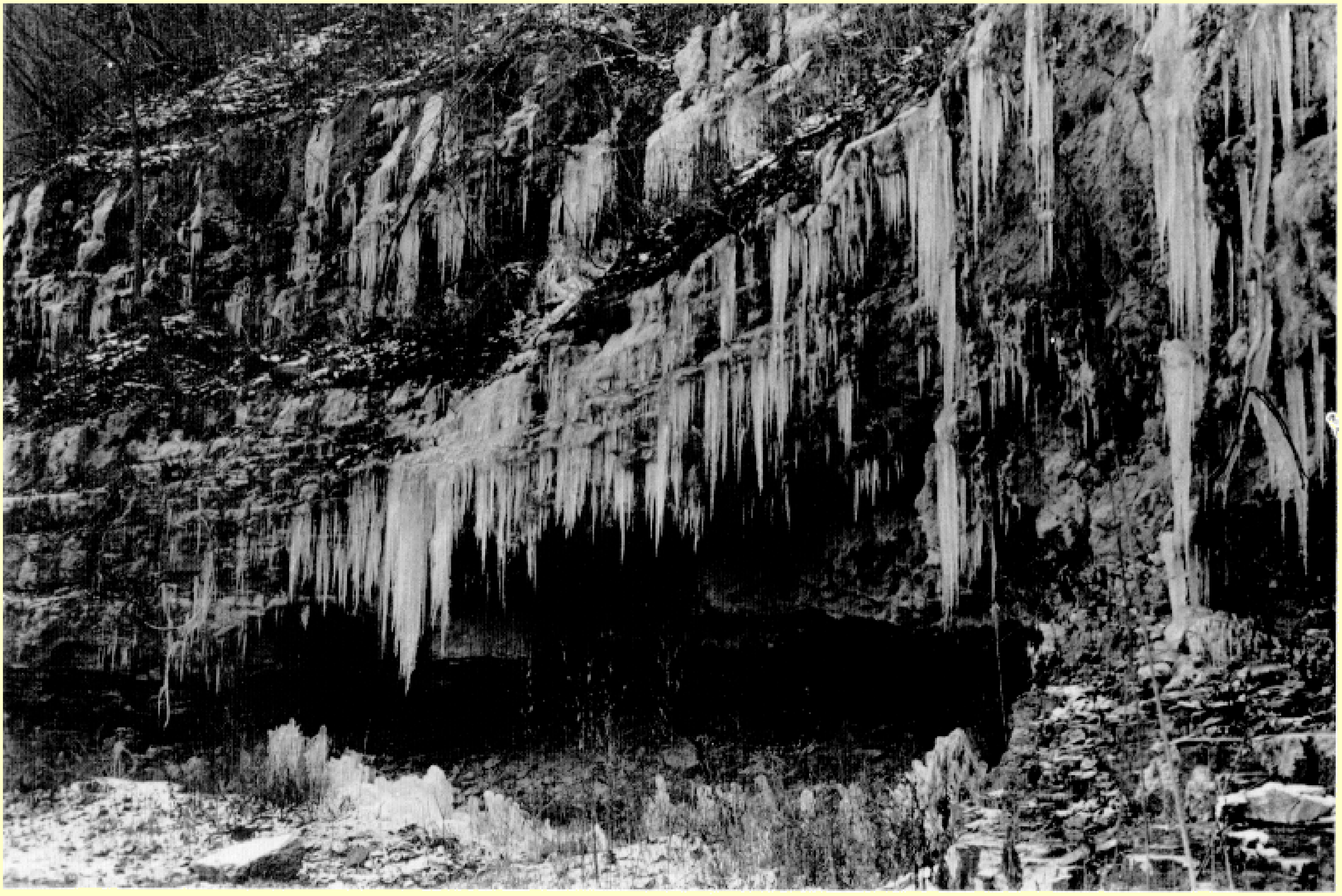


Figure 15.—Exposed Jefferson City Dolomite in an area of Brussels-Rock outcrop complex, 50 to 90 percent slopes. Icicles form as water moves vertically and horizontally through cracks in the dolomite.

The Bachelor Formation, an obscure shaly sandstone that is generally less than 6 inches thick, overlies the Cotter Dolomite. Because it is thin, the Bachelor Formation is rarely exposed, yet it is persistent areally. It is interesting geologically, but it contributes very little to the soils or topography of the county.

The Compton Formation overlies the Bachelor Formation. It is a fine grained, light gray limestone that is 10 to 20 feet thick. It is thinly bedded or moderately bedded and has small fragments of fossils. This formation crops out on the rugged hillsides in the western and eastern parts of the county. Other than forming small stair-step bluffs on the hillsides, the formation contributes very little to the soils or topography of the county.

The Northview Formation occurs as 2 to 5 feet of green, silty shale in the northern part of the county and red limestone in the southern part. The red limestone is known as the Baird Member of the Northview Formation. Many springs are on top of the Northview shale in the northern part of the county. Water percolating from the surface downward collects on top of the clayey shale and moves laterally until it surfaces as springs in gullies and valleys that intersect the shale.

The Pierson Formation in Taney County consists of 30 to more than 70 feet of grayish brown to grayish green, very fine to medium crystalline limestone that has small fragments of fossils. The upper part of the formation commonly contains chert nodules and beds. The highest concentrations of chert are in the southwestern part of the county. In this part of the county, the lower part of the formation commonly has beds of red limestone. The Baird Mountain Quarry near Table Rock Dam, in the western part of the county, provides a good view of the Pierson Formation and its relation to the overlying Reeds Spring Formation and the underlying Northview Formation (fig. 16).

Figure 16.—The Pierson and Reeds Spring Formations exposed in a quarry in an area of the Rueter-Clarksville-Hailey association.

The Reeds Spring and Elsey Formations have similar lithologies. They consist of alternating thin layers of limestone and chert. The layers of chert generally occur as nodules or wavy beds between the thin layers of limestone. The estimated content of chert in the two formations is 40 to 65 percent. The thickness of the formations varies because weathering and erosion have destroyed much of the limestone in the upper part. In places the combined thickness of the formations is more than 70 feet. Where weathering has been severe, most of the bedrock has deteriorated to a reddish brown and red, cherty residuum.

Burlington and Keokuk Limestones are separate formations but have similar lithologies in southwest Missouri. They consist of light gray, coarsely crystalline limestone that is thinly bedded to massive and has discontinuous bands of chert and isolated chert nodules. The limestone varies considerably in thickness because of weathering. In some areas it is 100 to 150 feet thick. In other areas, however, it has deteriorated to a reddish brown and red, cherty residuum.

Although the Reeds Spring, Elsey, and Burlington-Keokuk Formations have had only minor effects on the topography of the county, they have significantly influenced soil formation. Very gravelly soils formed in material weathered from these formations.

Hydrology

The exposed geologic formations in Taney County yield only small amounts of ground water. The Burlington-Keokuk, Elsey, Reeds Spring, and Pierson Formations yield 1 to 10 gallons of water per minute in shallow wells. The Northview Formation, excluding the Baird Member, acts as an "aquitard," which retards the downward percolation of ground water. This formation does not yield ground water. Areas where this formation crops out have numerous springs. The Compton and Bachelor Formations are not important sources of ground water. Cotter and Jefferson City Dolomites yield small but sufficient amounts of water for private wells. Sandstone beds in the Cotter Dolomite also yield small amounts. The water in these beds is of inferior quality because of surface contamination and poorly cased wells.

Drilling private wells in the upland areas of Taney County may be expensive. Wells frequently are drilled into the Jefferson City Dolomite at a depth of 300 to 400 feet before sufficient quantities of water are obtained.

The major sources of ground water in the county are the Gunter Sandstone Member, Gasconade Dolomite, and the Roubidoux Formation. These rock units are 500 to 1,000 feet below the surface. They yield as much as 200 gallons of water per minute.

Formation of the Soils
in Taney County, MO

Joseph E. Blaine, soil scientist, Taney County Soil and Water Conservation District, helped prepare this section.

Soils are continually changing. The characteristics of a soil at any given point are determined by the physical and mineralogical composition of the parent material; the living organisms on and in the soil; the climate under which the soil material accumulated and has existed since accumulation; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Parent Material

Parent material is the weathered mass in which soils form. The soils in Taney County formed in material weathered from dolomite and limestone, in alluvium, in colluvium, in loess, or in a combination of these. Most of the soils formed in material weathered from dolomite or limestone. Both of these kinds of bedrock tend to weather to clayey material.

The limestone in the predominant Reeds Spring and Elsey Formations has significantly more chert than the lower limestone and dolomite formations. The chert is relatively weather resistant and is left in the soils after the bedrock is weathered. Thus, the soils that formed in material weathered from the Reeds Spring and Elsey Formations have more chert than the soils that formed in material weathered from the dolomite formations.

The rate of geologic erosion has been slower in areas of Clarksville, Hailey, Rueter, and other soils that formed in material weathered from the upper limestone formations than in areas of soils that formed in material weathered from the other formations. The rate is slower partly because of the position on the landscape and partly because of a very high content of chert gravel. Because of the slower rate of geologic erosion, most of these soils are considerably older and deeper than the other residual soils in the county.

The shallow Gasconade and very shallow Knobby soils commonly are in areas directly below the Clarksville, Hailey, and Rueter soils. Because the shallow or very shallow soils support poorer hardwoods, cedars, and grasses, a conspicuous pattern of vegetation is evident.

The soils that formed in material weathered from the upper limestone formations are at the higher elevations in the northwestern, southwestern, and eastern parts of the county. The extent of the soils that formed in material weathered from the lower limestone formations is relatively small. These soils are similar to the soils that formed in material weathered from the dolomite formations.

The soils that formed in material weathered from dolomite are the dominant soils in the county. The dolomite bedrock consists almost entirely of the Cotter Formation, but in some areas it is Jefferson City Dolomite and some intermittent beds of sandstone are in the dolomite formations. The dolomite formations are below the limestone formations. Consequently, all of the soils that are underlain by dolomite are in areas below the soils that are underlain by limestone.

Clarksville, Hailey, and Rueter soils formed in cherty limestone residuum. Clarksville soils are on ridgetops, Hailey soils are on the side slopes in the southwestern part of the county, and Rueter soils are on the side slopes in the other areas of limestone in the county. Gatewood, Ocie, Gasconade, and Knobby soils formed in dolomite residuum on both ridgetops and side slopes.

Viraton soils and the Britwater soils on uplands formed in loess over residuum. These soils commonly are characterized by a distinct contrast in content of chert between the layers of loess and the underlying residual material.

Living Organisms

Living organisms in and on the soil have helped to alter the parent material and the properties of the soil. Plants greatly influence soil formation.

The soils in Taney County formed mainly under forest vegetation. On a significant acreage, however, they formed under native grasses. Dark layers in Knobby and Gasconade soils indicate the influence of the native grasses. The dark color is indicative of organic matter, the content of which is increased in soils that formed under grasses. The type of native vegetation in Taney County was controlled mainly by the depth of the soils. The Knobby and Gasconade soils were too shallow to support hardwoods.

Climate

Climate has been a significant factor in the formation of soils in Taney County. The amount of annual precipitation has been high enough to leach plant nutrients and thus to lower the natural fertility level and increase the acidity of the deeper soils.

Because it is uniform throughout the county, climate has had a limited effect on soil diversity within the county. Some microclimatic differences, such as local variations in temperature caused by aspect, however, affect soil diversity. South- and west-facing slopes are warmer and drier than north- and east-facing slopes. The harsher microclimate affects plant growth and thus also affects the rates of soil formation and geologic erosion, which determine soil depth. Thus, if other factors are equal, soils on south- and west-facing slopes are likely to be less deep than those on north-and east-facing slopes.

Relief

Relief has contributed significantly to the diversity of soils in Taney County. Viraton and Britwater soils and the Ocie soils on the wider, flatter ridgetops are in the areas on uplands that have the least relief. Because of a gentle topography, a thin layer of loess overlies the residual material in these soils, resulting in a lower content of rock fragments in the surface layer than is characteristic of the other soils on uplands.

The most significant influence of relief on soil formation in the county is its effect on the rate of geologic erosion. Because of severe geologic erosion in the county, the depth of the average soil over bedrock is only about 30 inches. In most areas of the county, the parent material is dolomite residuum and the soils do not occur in a regular pattern. Shallow soils, however, commonly are in the higher, steeper areas, and the deeper soils commonly are in the lower, less sloping areas. This pattern can be attributed to a high rate of geologic erosion in the higher, steeper areas and the accumulation of soil material in the lower areas.

Time

Time allows climate, living organisms, and relief to exert their influence on the parent material. The degree to which soil-forming processes have changed the parent material determines the age of a soil. Thus, the age is relative, depending on the degree of soil formation rather than the number of years that the soil material has been in place.

The soil properties that indicate the age of the soils in Taney County include an argillic horizon, a fragipan, and the depth of weathering. An argillic horizon and a fragipan require a considerable amount of time to develop. Therefore, they are indicators of older soils. Britwater, Ocie, and Clarksville are examples of soils that have a distinct argillic horizon, which is high in content of translocated clay. Viraton soils are an example of soils that have a fragipan.

The depth to bedrock in the shallow Gasconade and very shallow Knobby soils is indicative of a younger age. Extensive weathering is indicative of an older age. It characterizes very deep soils that formed in bedrock residuum, such as Clarksville soils. Generally, the soils that formed in material weathered from the upper Mississippian limestone formations have been subject to a slower rate of geologic erosion and are considerably older and deeper than the soils that formed in material weathered from the other geologic formations.

The youngest soils in the county formed in alluvial deposits. Cedargap, Huntington, Kaintuck, and Sandbur soils are examples.

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ABC soil. A soil having an A, a B, and a C horizon**.**

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables)**.** An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Ash-flow tuff. A tuff deposited by an ash flow or gaseous cloud; a type of ignimbrite. It is a consolidated but not necessarily welded deposit.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 91
High	9 to 12
Very high.	more than 12

Back slope. The steepest inclined surface and principle element of many hillslopes. Back slopes in the profile typically range from gently sloping to very steep and linear and descend to a foot slope. They are erosional forms produced mainly by mass wasting and running water.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

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.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains much more clay than the horizon above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter: if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible(in table)**.** Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

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 when dry or moist: does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural)**.** Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and the wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)**.** Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)**.** Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables)**.** Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables)**.** Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and otner elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy)**.** A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Head slope. The concave surface at the head of a drainageway where the flow of water converges downward toward the center and contour lines from concave curves.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Highwall. The unexcavated face of exposed overburden and bedrock in a surface mine or the face or bank on the uphill side of a contour strip mining excavation.

Hillslope. The steeper part of a hill between its summit and drainage line at the base of the hill. In descending order, a simple hillslope may include shoulder, back slope, foot slope, and toe slope.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

0 horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an 0, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1 .25 to 1 .75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. The area between two adjacent streams flowing in the same general direction or any elevated area between two drainageways.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions of small basins.

Large stones (in tables)**.** Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly ail such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded 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 of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch)', medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nose slope. The projecting end of an interfluve, where contour lines connecting the opposing side slopes form convex curves around the projecting end and lines perpendicular to the contours diverge downward. The overland flow of water is divergent.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and growth of roots. For example, *hardpan, fragipan, claypan, plowpan, and traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. Fine textured sediment that is similar in composition to the constituents of the underlying material.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables)**.** The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables)**.** Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter(in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soiS that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8

Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface, the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Ridge. A long, narrow elevation of the land surface, usually sharply crested with steep sides forming and extended upland between valleys.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables)**.** Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables)**.** The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The uppermost inclined surface at the top of a hillslope. The area comprises the transitional zone from the back slope to the summit of an upland. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. A side slope is generally linear along the slope width, and overland flow is parallel down the slope.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 1 percent
Nearly level and very gently sloping	0 to 3 percent
Very gently sloping	1 to 3 percent
Gently sloping	2 to 5 percent
Moderately sloping	5 to 9 percent
Strongly sloping	9 to 14 percent
Moderately steep	14 to 20 percent
Steep	20 to 30 percent
Very steep	more than 30 percent

Slope (in tables)**.** Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables)**.** Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. 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 either single grain (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop. and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. A general term for the top or highest level of an upland feature such as a ridge or hill.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic)**.** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology)**.** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water-breaks (or water bars). A mound or small dikelike surface drainage structure, properly used only in closing retired roads to traffic and on fire lines and abandoned skid trails.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

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