United States Department of Agriculture

Soil Conservation Service

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

Soil Survey of Pulaski County, Missouri

How To Use This Soil Survey

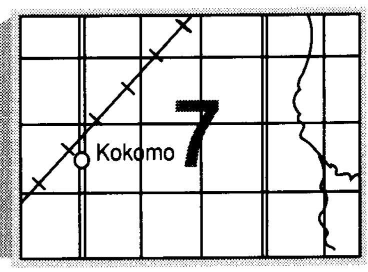
General Soil Map

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.

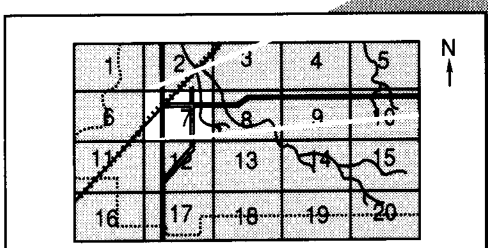
Detailed Soil Maps

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



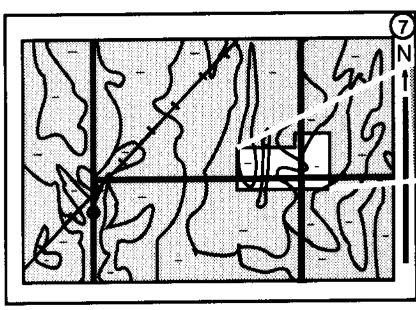
MAP SHEET

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.

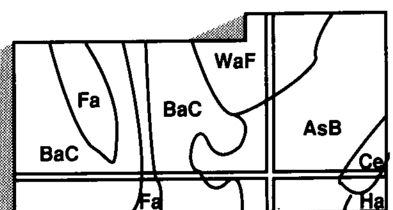


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **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 Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided soil scientists to assist with the fieldwork. The County Court, through the Lake of the Ozarks Council of Local Governments and through the Comprehensive Employment and Training Act (CETA), provided funds to the Pulaski County Soil and Water Conservation District for employment of soil scientists to assist with the fieldwork. The survey is part of the technical assistance furnished to the Pulaski County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding 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.

Cover: An area of the Gasconade River in Pulaski County.

Contents

Soil Series

Issued February 1989

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Pulaski County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, 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, 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.

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 Soil Conservation Service or the Cooperative Extension Service.

Paul F. Larson
State Conservationist
Soil Conservation Service

Soil Survey of Pulaski County, Missouri

By David W. Wolf, Soil Conservation Service

Fieldwork by David W. Wolf and J. Sybill Kizer, Soil Conservation Service; Jeff Lamb, Duane Viele, Clayton Robertson, and Douglas Waugh, Missouri Department of Natural Resources; and Sam Grimes, Pulaski County Soil and Water Conservation District

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

General Nature of the County

PULASKI COUNTY is in the south-central part of Missouri (fig. 1). It has an area of 352,883 acres, or about 550 square miles. Waynesville, the county seat, is in the central part of the county.

Beef cattle, dairy cattle, and hogs are the dominant livestock in the county. Cool-season grasses and shallow-rooted legumes, such as fescue and clover, are the main forage species grown for pasture and hay. Corn, grain sorghum, and soybeans are the most common row crops. They are used on the farm as livestock feed. The gently and moderately sloping uplands and most of the bottom land along rivers are used for pasture and hay. The row crops in the county are grown almost exclusively on the bottom land. The deeply dissected uplands support most of the trees in the county.

The county is dominantly rural. The local economy is based on retail business, livestock farming, and service facilities. Several small towns have business districts that are supported by the surrounding rural areas. The Gasconade and Big Piney Rivers provide opportunities for some recreational activities, such as fishing, camping, canoeing, and hiking.

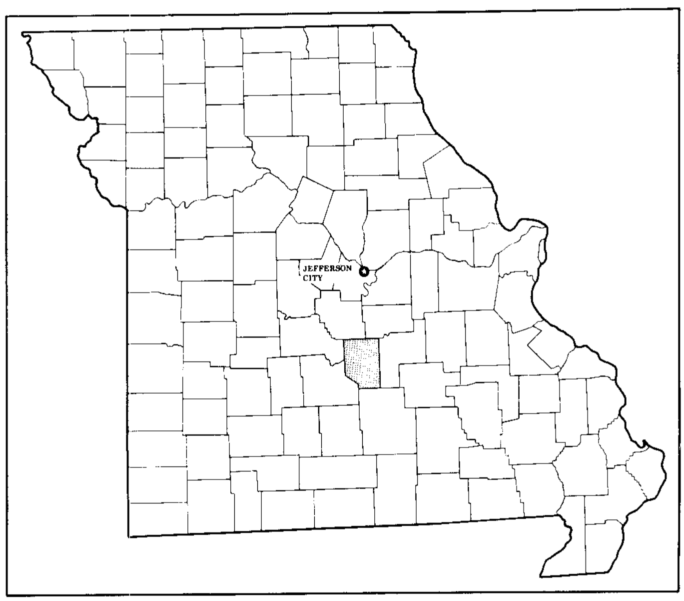


Figure 1.—Location of Pulaski County in Missouri.

The county has 20 different soil series. The soils vary widely in texture, natural drainage, and other characteristics. Most of those on uplands formed in material weathered from cherty or chert-free limestone or in a thin layer of loess and the underlying cherty limestone residuum.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Pulaski 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 only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Waynesville in the period 1951 to 1980. 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 Waynesville on February 2, 1951, is -23 degrees. In summer the average temperature is 75 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Waynesville on July 14, 1952, is 115 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 39.84 inches. Of this, 23 inches, or nearly 58 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 17 inches. The heaviest 1-day rainfall during the period of record was 4.35 inches at Waynesville on April 11, 1979. Thunderstorms occur on about 45 days each year.

The average seasonal snowfall is 13.3 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 13 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 85 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 12 miles per hour, in spring.

Settlement and Population

Prior to permanent settlement of the area, Kickapoo, Osage, and Delaware Indians were the chief frequenters of what is now Pulaski County. They usually traveled through the area on hunting and fishing excursions.

The earliest known settler was Josiah Turpin, who settled within the present limits of Pulaski County in 1813. The first settlement was established near the Gasconade River, at the noted Nitre Cave, 5 miles west of what is now Waynesville (*3*).

On December 15, 1818, the Territorial Legislature determined that a county was to be named Pulaski, in honor of Count Pulaski, the Polish patriot. The boundaries were not specifically defined until January 26, 1833, when the county of Pulaski was established out of a portion of Crawford County. Pulaski County originally included all of the territory now in Laclede and Wright Counties and much of Dallas, Webster, Phelps, Texas, Maries, Camden, and Miller Counties. In 1859, the present boundaries of Pulaski County were established (*4*).

The pioneers had to undergo many privations and hardships. The Indians were troublesome, and supplies had to be carried for many miles on the back of horses. The early settlers were occupied chiefly with clearing and cultivating their little valley farms and raising hogs and cattle. Because of the excellent water supply and grazing land, the raising of livestock was the most extensive enterprise. Most of the settlers also hunted, trapped, and traded with the Indians.

Fort Leonard Wood makes up about 15 percent of the total acreage in the county. It was the training site for about 320,000 fighting men during World War II. Since the war, hundreds of thousands more soldiers have received training at the fort. The population of the fort was 20,240 in February 1982.

The population of Pulaski County was 7,200 in 1880 and an estimated 10,400 in 1900. In 1970, it was 53,967, of which approximately 65 percent was at Fort Leonard Wood. In 1980, the county had a population of 42,011. Waynesville had a population of 3,375 in 1970 and 2,879 in 1980.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data.

The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. 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 identified on the general soil map of this county do not fully agree with those of the soils identified on the maps 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.

Soil Descriptions

1. Nolin-Huntington-Kickapoo Association

Deep, nearly level and very gently sloping, well drained, silty and loamy soils; on flood plains

This association consists of soils on flood plains along the Gasconade and Big Piney Rivers and Roubidoux Creek. The flood plains average about 1,000 feet wide. They are bordered by steep bluffs and gently sloping to very steep uplands.

This association makes up about 7 percent of the county. It is about 32 percent Nolin soils, 21 percent Huntington soils, 15 percent Kickapoo soils, and 32 percent minor soils.

Nolin soils are nearly level. They are in the higher areas on the flood plains. Typically, the surface layer is dark grayish brown silt loam. The subsoil is mottled silt loam. It is yellowish brown in the upper part and dark brown in the lower part.

Huntington soils are nearly level. They are in low areas on the flood plains. Typically, the surface layer is very dark grayish brown silt loam. The subsoil is dark brown, mottled silt loam. The substratum is dark brown, mottled fine sandy loam.

Kickapoo soils are nearly level and very gently sloping. They are in low areas on the flood plains adjacent to the current channel of the rivers. Typically, the surface layer is very dark grayish brown fine sandy loam. The upper substratum is stratified, multicolored fine sandy loam. Next is a buried layer of very dark grayish brown, mottled loam. The lower substratum is brown and yellowish brown, loose sand.

The minor soils in this association are the Cedargap, Claiborne, Hartville, and Moniteau soils. The poorly drained Moniteau soils are on terraces adjacent to the uplands. The somewhat excessively drained Cedargap soils are adjacent to the current stream channels and on alluvial fans along small streams entering the major flood plains. They have cherty layers. The gently sloping and moderately sloping Claiborne and gently sloping, somewhat poorly drained Hartville soils are on foot slopes and terraces.

Some of the larger farms in the county are in areas of this association. Most raise beef cattle, but a few are dairy farms. Cool-season grasses and legumes are the most common species grown for pasture and hay. Some areas are used for corn, soybeans, or wheat or other small grain crops. A few areas where access is limited and a few streambanks are wooded.

The major soils generally are well suited to grasses, legumes, and cultivated crops, including irrigated crops, especially alfalfa. Crops respond well to soil amendments. The main management concern is flooding. In areas that are flooded in spring, planting should be delayed.

The major soils generally are unsuited to sanitary facilities and building site development because of the flooding.

2. Clarksville-Gepp Association

Deep, moderately steep to very steep, somewhat excessively drained and well drained, very cherty, cherty, and stony soils; on uplands

This association consists dominantly of cherty and very cherty soils on complex, dissected side slopes, narrow ridgetops, and high benches. In a few areas the soils are stony. Valleys are deep and narrow and generally are no more than 1/8 mile wide.

This association makes up about 30 percent of the county. It is about 41 percent Clarksville soils, 40 percent Gepp and similar soils, and 19 percent minor soils.

Clarksville soils are somewhat excessively drained and are moderately steep and steep. They are on convex side slopes. Typically, the surface layer is brown very cherty silt loam. The subsoil is strong brown very cherty silt loam in the upper part and strong brown and yellowish red, mottled extremely cherty silty clay loam and silty clay in the lower part.

Gepp soils are well drained and are moderately steep to very steep. They are on the lower side slopes and benches. Typically, the surface layer is dark grayish brown very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The subsoil is yellowish red, mottled cherty silty clay loam in the upper part and red, mottled clay and cherty clay in the lower part.

The minor soils in this association are the Cedargap and Claiborne soils. Cedargap soils have less clay than the major soils. They are on narrow flood plains. The silty, gently sloping and moderately sloping Claiborne soils are on foot slopes and stream terraces.

Most areas of this association are used as woodland or wildlife habitat. A large acreage is second-growth woodland that supports trees used for logs, lumber, and other wood products. Some of the less sloping areas are used as pasture.

Most of the major soils are suited to trees. The best sites for trees are the north- and east-facing slopes on uplands, foot slopes, and small stream bottoms. The erosion hazard, the equipment limitation, and seedling mortality on both of the major soils and plant competition on the Gepp soils are the main management concerns.

The major soils generally are unsuited to cultivated crops, building site development, and onsite waste disposal because of the slope, the high content of chert, low fertility, and the hazard of erosion. Pasture grasses and legumes can be grown in the less sloping areas where access is feasible.

3. Viraton-Clarksville-Doniphan Association

Deep, gently sloping to steep, moderately well drained to somewhat excessively drained, silty and very cherty soils; on uplands

This association consists dominantly of silty soils on loess-covered ridges and very cherty soils on side slopes. It makes up about 26 percent of the county. It is about 44 percent Viraton and similar soils, 31 percent Clarksville soils, 21 percent Doniphan soils, and 4 percent minor soils (fig. 2).

Viraton soils are gently sloping and moderately sloping and are on convex ridgetops. They are moderately well drained. Typically, the surface layer is dark brown silt loam. The subsoil is strong brown, mottled silty clay loam and cherty silty clay loam in the upper part; a fragipan of pale brown, mottled extremely cherty silty clay loam in the next part; and strong brown, mottled very cherty silty clay in the lower part.

Clarksville soils are gently sloping to steep and are on narrow ridgetops and side slopes. They are somewhat excessively drained. Typically, the surface layer is grayish brown very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The subsoil is light brown extremely cherty silt loam in the upper part; strong brown, mottled extremely cherty silt clay loam in the next part; and red and reddish brown, mottled extremely cherty silty clay in the lower part.

Doniphan soils are gently sloping and moderately sloping and are on narrow ridgetops and side slopes. They are well drained. Typically, the surface layer is dark grayish brown very cherty silt loam. The subsurface layer is light yellowish brown very cherty silt loam. Next is a layer of mixed strong brown silty clay loam and yellowish brown silt loam. The subsoil is yellowish red, red, and dark red, mottled clay.

The minor soils in this association are the Cedargap soils. These soils have a thick, dark surface soil. They are on narrow flood plains.

Most areas of this association are used as woodland or wildlife habitat. A large acreage is second-growth woodland that supports trees used for logs, lumber, and other wood products. The Viraton soils and the less sloping Clarksville and Doniphan soils are used for pasture or hay.

The major soils are suited to trees, but the fragipan in the Viraton soils restricts tree growth. The best sites for trees are the north- and east-facing slopes. The erosion hazard, the equipment limitation, and seedling mortality are the main management concerns on the Clarksville soils. Seedling mortality on the Doniphan soils and windthrow on the Viraton soils also are concerns.

The gently sloping to moderately steep areas of the major soils are suited to grasses and legumes for hay and pasture. The Clarksville and Doniphan soils are generally unsuitable for cultivation because of the high content of chert in the surface layer. The Viraton soils are suited to cultivated crops. The most commonly grown crops are grain sorghum and small grain. The main management concerns are droughtiness and erosion.

Most of the major soils are suitable for sanitary facilities and building site development. The slope and chert in areas of the Clarksville and Doniphan soils and slow permeability and wetness in the Viraton soils are the main limitations.

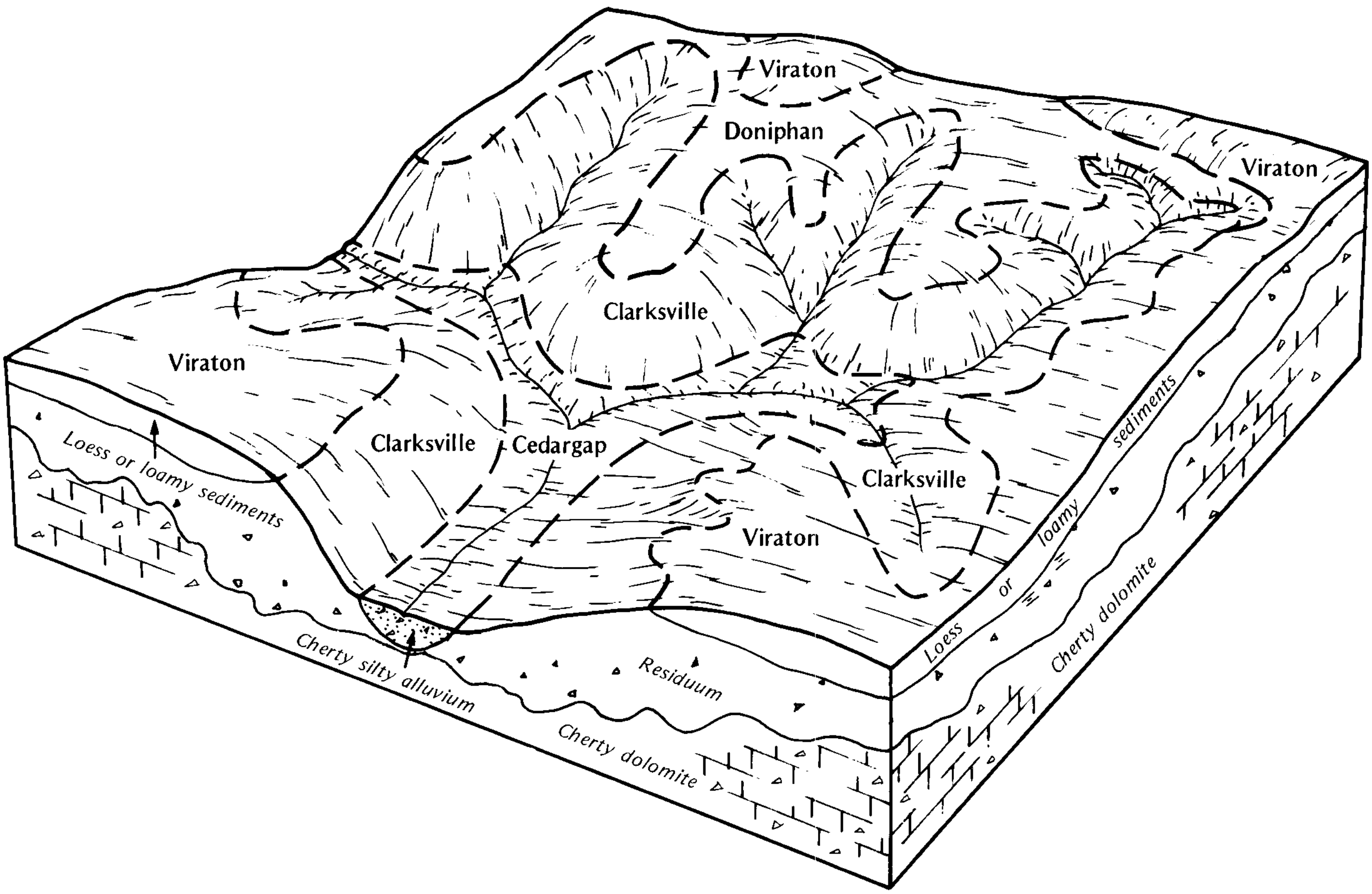


Figure 2.—Pattern of soils and parent material in the Viraton-Clarksville-Doniphan association.

4. Poynor-Ocie-Gunlock Association

Deep, gently sloping to steep, well drained and moderately well drained, very cherty, cherty, and silty soils; on uplands and terraces

This association consists dominantly of cherty and very cherty soils on narrow, rounded ridgetops and side slopes and silty soils on terraces. It makes up about 22 percent of the county. It is about 31 percent Poynor soils, 25 percent Ocie soils, 12 percent Gunlock soils, and 32 percent soils of minor extent (fig. 3).

Poynor soils are well drained and are moderately steep and steep. They are on side slopes. Typically, the surface layer is grayish brown very cherty silt loam. The subsurface layer is light yellowish brown very cherty silt loam. The subsoil is strong brown, mottled very cherty silty clay loam in the upper part; red, mottled clay in the next part; and strong brown, mottled clay in the lower part.

Ocie soils are moderately well drained and are moderately sloping and strongly sloping. They are on rounded ridgetops and side slopes. Typically, the surface layer is dark brown cherty silt loam. The subsurface layer is light yellowish brown very cherty silt loam. The subsoil is yellowish brown, mottled very cherty silt loam in the upper part and yellowish brown, mottled clay in the lower part. The substratum is olive brown, mottled clay. It is underlain by hard, gray dolomite bedrock.

Gunlock soils are moderately well drained and are gently sloping and moderately sloping. They are on the lower side slopes, foot slopes, and terraces. Typically, the surface layer is dark grayish brown silt loam. The subsoil extends to a depth of 73 inches or more. In sequence downward, it is yellowish brown, mottled silty clay loam; brown, mottled silty clay; a somewhat brittle layer of grayish brown and yellowish brown, mottled silty clay loam; and yellowish brown, mottled extremely cherty silty clay loam and cherty silty clay.

The minor soils in this association are the Doniphan, Gatewood, Razort, and Viraton soils. Doniphan and Gatewood soils have more clay throughout the subsoil than the major soils. They are on narrow ridgetops and

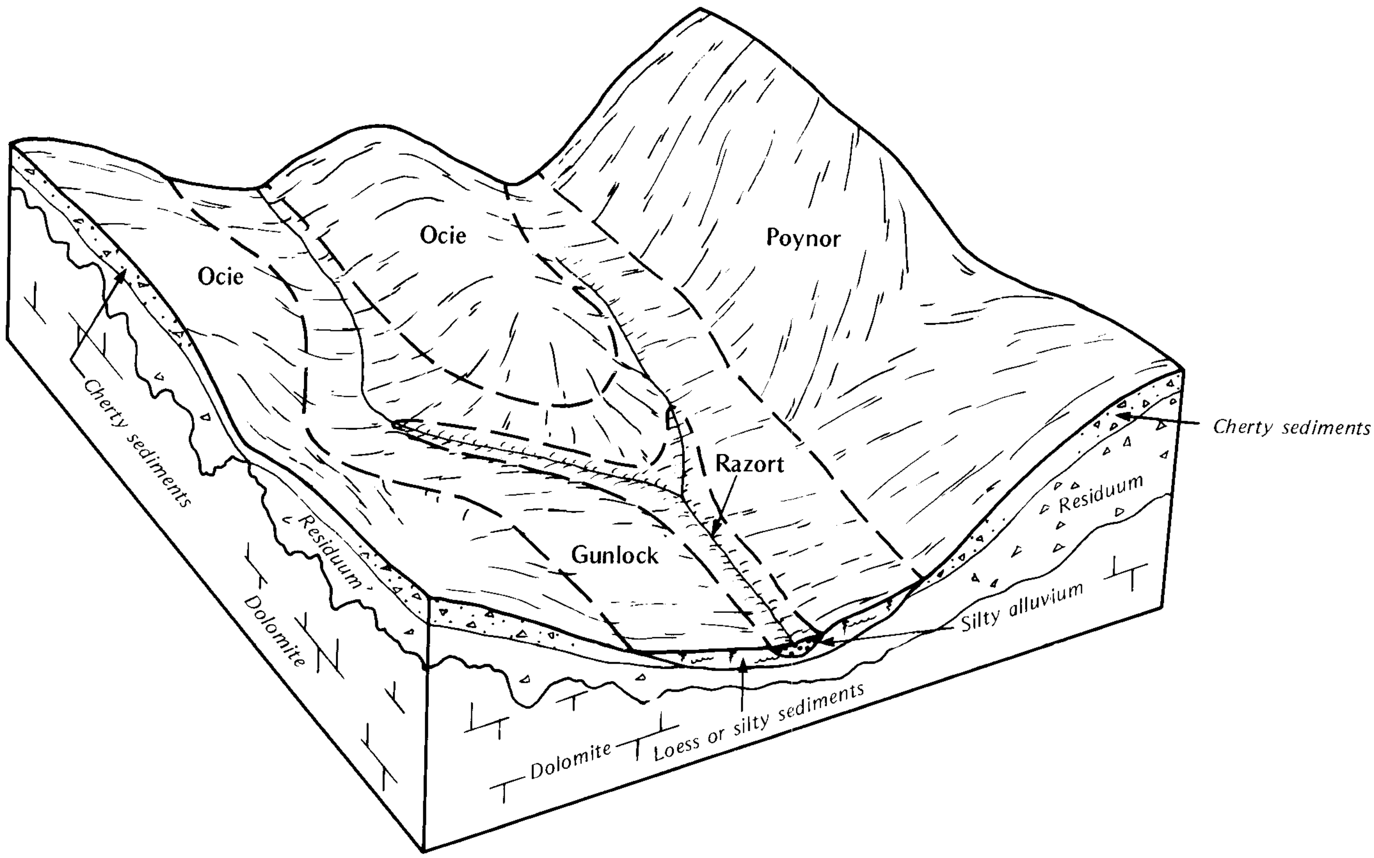


Figure 3.—Pattern of soils and parent material in the Poynor-Ocie-Gunlock association.

side slopes in the higher areas. Razort soils have more silt than the major soils. They are on narrow flood plains. Viraton soils have a fragipan and contain less clay than the major soils. They are on the broader ridgetops.

Most areas of the Poynor soils are used as second-growth woodland. The Gunlock and Ocie soils generally are used for grasses and legumes for hay and pasture.

Most of the major soils are suited to trees. The best sites for trees are the north- and east-facing slopes in areas of the Poynor and Ocie soils and the included flood plains along small streams. The equipment limitation is a problem on the Poynor soils.

The major soils generally are suited to grasses and legumes for hay and pasture. The use of equipment may be limited by the slope of the Poynor soils. Also, a few areas have stones on the surface.

The Poynor and Ocie soils generally are unsuitable for cultivation because of the high content of chert in the surface layer. The Gunlock soils are suited to cultivated crops. The most commonly grown crops are grain sorghum and small grain. The main management concern is the erosion hazard.

The Poynor soils generally are unsuited to building site development and onsite waste disposal because of the slope. The Ocie and Gunlock soils generally are suited to these uses, but wetness, restricted permeability, and the shrink-swell potential are limitations.

5. Lebanon-Plato Association

Deep, gently sloping and moderately sloping, moderately well drained and somewhat poorly drained, silty soils; on uplands

This association consists mainly of soils on broad, loess-covered ridgetops in some of the higher areas of the county. The soils also are on lower lying, narrow ridges.

This association makes up about 15 percent of the county. It is about 85 percent Lebanon and similar soils, 8 percent Plato soils, and 7 percent minor soils.

Lebanon soils are gently sloping and moderately sloping and are moderately well drained. They are on the tops and sides of the ridges. Typically, the surface layer is dark brown silt loam. In sequence downward, the subsoil is yellowish brown silt loam; strong brown, mottled silty clay loam and silty clay; a fragipan of light brownish gray and pale brown, mottled very cherty silt loam and extremely cherty silty clay loam; and reddish brown, mottled clay and cherty clay.

Plato soils are gently sloping and somewhat poorly drained. They generally are on the broader ridgetops. Typically, the surface layer is brown silt loam. In sequence downward, the subsoil is yellowish brown, mottled silty clay loam; light brownish gray and grayish brown, mottled silty clay and silty clay loam; a fragipan of grayish brown, mottled extremely cherty silt loam; and dark red and red cherty and very cherty clay.

The minor soils in this association are the Gatewood, Doniphan, and Ocie soils. Doniphan soils do not have a fragipan. They are on the sides and tops of narrow ridges. Gatewood and Ocie soils have more clay and chert than the major soils. They are on narrow ridgetops, on side slopes, and in saddles.

Most areas of this association are used for grasses and legumes for pasture and hay. A few are used for small grain and row crops, and a few small areas are used as second-growth woodland. The forage and grain crops generally are grown for local farm use.

The major soils generally are suited to grasses, legumes, small grain, and trees. The dense fragipan at a depth of 18 to 36 inches in the major soils limits the root zone. In most years the soils have a perched seasonal high water table during winter and spring. The wetness and the erosion hazard are the main management concerns if row crops are grown. Windthrow is the main concern in managing woodland.

The major soils generally are suitable for building site development and onsite waste disposal. Seasonal wetness, slow or very slow permeability in and below the fragipan, and the shrink-swell potential are the main limitations.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. 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 "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, Clarksville very cherty silt loam, 3 to 9 percent slopes, is a phase in the Clarksville 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. Clarksville-Gepp very cherty silt loams, 14 to 35 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 soils identified on the detailed soil maps of this county do not fully agree with those of the soils identified on the maps 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.

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

12A—Cedargap cherty silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, somewhat excessively drained soil is on flood plains along small streams. It is frequently flooded. Individual areas are long and narrow and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown cherty silt loam about 6 inches thick. The subsurface layer is very dark brown and black very cherty silt loam about 23 inches thick. The substratum to a depth of 60 inches or more is dark brown, mottled extremely cherty silty clay loam. In some areas the dark surface soil is less than 24 inches thick.

Included with this soil in mapping are small areas of the well drained Cedargap and Razort soils, which have a surface layer of silt loam. The areas of Cedargap silt loam are farther from the current stream channels than this Cedargap soil. Razort soils are on the slightly higher stream terraces and alluvial fans. They have less chert than the Cedargap soil. Also included are small areas of gravelly outwash where the streams overflow their banks. Included soils make up about 15 percent of the unit.

Permeability is moderately rapid in the Cedargap soil, and surface runoff is slow. The available water capacity is low. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable, but tillage is difficult because of the content of chert.

Most areas are used for pasture or hay. Some support native hardwoods. Because of the low available water capacity and the flooding, this soil generally is not used for cultivated crops. It is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza, ladino clover, and red clover. Flooding and drought are the main hazards in the areas used for pasture or hay. Flooding during the spring often damages seedlings. As a result, the seedbed should be prepared and the seed planted in the fall. Grasses and legumes respond well to soil amendments. The chert in the surface layer limits the use of equipment. Seedbeds generally are prepared with a heavy disk, and seeds are planted by broadcasting. Dragging the field helps to cover the seed. Carefully operating haying equipment helps to prevent the damage caused by the chert. Overgrazing, especially during dry summer months, deletes the cover of grasses and legumes and increases the extent of weeds.

This soil is suited to trees. Because of the low available water capacity, the seedling mortality rate is a management concern. It can be reduced by planting large nursery stock. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

Because of the flooding, this soil generally is unsuited to building site development, sanitary facilities, and local roads and streets.

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

13A—Cedargap silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on flood plains along small streams. It is frequently flooded. Individual areas are long and narrow and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 12 inches thick. The subsurface layer is black cherty and very cherty silt loam about 14 inches thick. The substratum to a depth of 60 inches or more is extremely cherty silty clay loam. The upper part is very dark grayish brown, and the lower part is dark brown. In some areas the dark surface soil is less than 24 inches thick.

Included with this soil in mapping are small areas of the somewhat excessively drained Cedargap soils, which have a surface layer of cherty silt loam, and small areas of Razort soils. The areas of Cedargap cherty silt loam are adjacent to the stream channels. Razort soils are on the slightly higher stream terraces and alluvial fans. They have less chert in the substratum than the Cedargap soil. Also included are small areas of gravelly outwash where the streams overflow their banks. Included soils make up about 10 percent of the unit.

Permeability is moderately rapid in the Cedargap soil, and surface runoff is slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. Because of the flooding, this soil generally is not used for cultivated crops. It is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza, ladino clover, and red clover. The flooding is the main hazard. It often damages new seedlings in the spring. As a result, the seedbed should be prepared and the seed planted in the fall. Grasses and legumes respond well to soil amendments. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds.

Some areas support native hardwoods. This soil is suited to trees. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil generally is unsuited to building site development, sanitary facilities, and local roads and streets because of the flooding.

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

14B—Claiborne silt loam, 2 to 5 percent slopes. This deep, gently sloping, well drained soil is on foot slopes and stream terraces. Most areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is very dark grayish brown and dark brown silt loam. The next part is reddish brown and yellowish red silty clay loam and cherty silty clay loam. The lower part is dark brown and strong brown, mottled silty clay loam. In eroded areas the surface layer is browner. In some areas the subsoil has a lower content of coarse fragments.

Included with this soil in mapping are small areas of Cedargap and Nolin soils. Cedargap soils have a higher content of coarse fragments than the Claiborne soil. They are adjacent to narrow drainageways. Nolin soils have less chert and clay than the Claiborne soil. They are on flood plains. Included soils make up about 5 to 15 percent of the unit.

Permeability is moderate in the Claiborne soil, and surface runoff is medium. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in areas where it contains subsoil material.

Most areas are used for pasture or hay. A few are used for cultivated crops. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza, red clover, ladino clover, and alfalfa. Erosion is a hazard in newly seeded areas. It can be controlled by a companion crop of small grain or by timely tillage and seeding. Timely renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds. If stock water ponds are constructed on this soil, excessive seepage can occur. As a result, the ponds should be sealed.

This soil generally is suited to soybeans, grain sorghum, and small grain grown in rotation with pasture and hay crops. Erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves a protective cover of crop residue on the surface, stripcropping, winter cover crops, and grassed waterways help to prevent excessive soil loss. A few areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Some type of grade stabilization structure generally should accompany the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Some areas support native hardwoods. This soil is suited to trees. No significant hazards or limitations affect planting or harvesting. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil generally is suitable for building site development and onsite waste disposal. The moderate permeability is a limitation on sites for septic tank absorption fields, but it can be overcome by increasing the size of the absorption area. Sealing the bottom of sewage lagoons helps to prevent seepage. The damage to buildings caused by excessive shrinking and swelling can be minimized by properly designing and reinforcing footings, foundations, and basement walls.

On sites for local roads and streets, crushed rock or other suitable material is needed to strengthen the base. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the road damage caused by shrinking and swelling and by frost action.

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

14C—Claiborne silt loam, 5 to 9 percent slopes. This deep, moderately sloping, well drained soil is on foot slopes and stream terraces. Most areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 61 inches or more. The upper part is strong brown silt loam. The next part is yellowish red cherty silty clay loam. The lower part is yellowish red and strong brown, mottled cherty and very cherty silty clay loam. In eroded areas the surface layer is thinner and lighter in color. In some areas the subsoil has a lower content of coarse fragments.

Included with this soil in mapping are small areas of the somewhat excessively drained Cedargap and Clarksville soils. These soils have more chert than the Claiborne soil. The dark Cedargap soils are along narrow drainageways. Clarksville soils generally are in the higher areas. Included soils make up about 5 to 15 percent of the unit.

Permeability is moderate in the Claiborne soil, and surface runoff is medium. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in areas where it contains subsoil material.

Most areas are used for pasture or hay. A few are used for cultivated crops. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza, red clover, ladino clover, and alfalfa. Erosion is a hazard in newly seeded areas. It can be controlled by a companion crop of small grain or by timely tillage and seeding. Timely renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds. Timely mowing of pastures helps to control the competition from undesirable plants and results in a more uniform distribution of grazing.

This soil generally is suited to soybeans, grain sorghum, and small grain. Erosion is a severe hazard if cultivated crops are grown. A system of conservation tillage that leaves a protective cover of crop residue on the surface, stripcropping, winter cover crops, and grassed waterways help to prevent excess soil loss. A few areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Some type of grade stabilization structure generally should be used in combination with the grassed waterways. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

Some areas support native hardwoods. This soil is suited to trees. No significant hazards or limitations affect planting or harvesting. Selective harvest of mature trees, thinning of second-growth stands, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil generally is suitable for building site development and onsite waste disposal if the design of the structures compensates for the slope. The moderate permeability is a limitation on sites for septic tank absorption fields, but it can be overcome by increasing the size of the absorption area. Leveling may be needed on sites for sewage lagoons. Sealing the bottom of the lagoon helps to prevent seepage. The damage to buildings caused by excessive shrinking and swelling can be minimized by properly designing and reinforcing footings, foundations, and basement walls.

On sites for local roads and streets, crushed rock or other suitable material is needed to strengthen the base. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the road damage caused by shrinking and swelling and by frost action.

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

16C—Clarksville very cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, somewhat excessively drained soil is on narrow ridgetops and around the head of drainageways. Individual areas generally are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is pale brown very cherty silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is light brown extremely cherty silt loam. The next part is strong brown, mottled extremely cherty silty clay loam. The lower part is red and reddish brown extremely cherty silty clay. In some areas, mostly south and east of Fort Leonard Wood, the soil has more sandstone fragments throughout and has stones or boulders of sandstone on the surface.

Included with this soil in mapping are areas of the well drained Doniphan and moderately well drained Viraton soils. Doniphan soils are on shoulder slopes. They have more clay and less chert in the subsoil than the Clarksville soil. Viraton soils are on the broader ridges. They have a fragipan. Included soils make up about 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. Surface runoff is medium. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but it cannot be easily tilled because of the chert content.

Many areas support native hardwoods. Some are used as pasture. Because of the high content of chert and the low available water capacity, this soil generally is not used for cultivated crops. It is suited to trees. Because of the low available moisture capacity, the seedling mortality rate is a management concern. It can be reduced by planting large nursery stock. Selective thinning, removal of undesirable trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for woodland wildlife, especially whitetail deer and wild turkey.

This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to lespedeza. It is moderately suited to ladino clover and red clover. Droughtiness and the cherty surface layer are the main management concerns. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Warm- and cool-season grasses grow well if managed properly. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The cherty surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Proper stocking rates and timely deferment of grazing improve the pasture.

Because of seepage, this soil generally is unsuitable as a site for sewage lagoons. It is suited to building site development and to properly designed and installed septic tank absorption fields. The moderate permeability is a limitation on sites for absorption fields, but it can be overcome by increasing the length of the laterals.

Frost action is a limitation if this soil is used as a site for local roads and streets. Grading the roads and streets so that they shed water and constructing adequate side ditches help to prevent the road damage caused by frost action.

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

16D—Clarksville very cherty silt loam, 9 to 14 percent slopes. This deep, strongly sloping, somewhat excessively drained soil is on side slopes and around the head of drainageways. Individual areas generally are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 15 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown and brown, mottled extremely cherty silty clay loam. The lower part is yellowish red, mottled very cherty silty clay loam. In some areas, mostly south and east of Fort Leonard Wood, the soil has more sandstone fragments throughout and has stones or boulders of sandstone on the surface.

Included with this soil in mapping are areas of the well drained Claiborne and Doniphan soils. Claiborne soils are on foot slopes. They have a surface layer of silt loam and contain less chert in the subsoil than the Clarksville soil. Doniphan soils are on shoulder slopes. They contain more clay and less chert in the subsoil than the Clarksville soil. Included soils make up about 10 percent of the unit.

Permeability is moderately rapid in the Clarksville soil, and surface runoff is medium. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but it cannot be easily tilled because of the chert content.

Most areas support native hardwoods. Some are pastured. Because of the high content of chert, the slope, and the low fertility, this soil generally is unsuitable for cultivation. It is well suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to lespedeza. It is moderately suited to ladino clover and red clover.

Droughtiness, erosion, and the cherty surface layer are the main concerns in managing the pastured areas. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Warm-season grasses grow well if properly managed. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The cherty surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Proper stocking rates and timely deferment of grazing improve the pasture.

This soil is suited to trees. Because of the low available water capacity, the seedling mortality rate is a management concern. It can be reduced by planting large nursery stock. Selective thinning, removal of undesirable trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for woodland wildlife, especially whitetail deer and wild turkey.

Because of the slope and seepage, this soil generally is unsuitable as a site for sewage lagoons. It generally is suitable for building site development and septic tank absorption fields. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Installing the distribution lines in septic tank absorption fields across the slope helps to prevent downhill seepage.

Local roads and streets should be designed so that they conform to the natural slope of the land. Cutting and filling are needed in some areas. Adequate side ditches and culverts help to prevent the road damage caused by frost action.

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

16F—Clarksville very cherty silt loam, 14 to 35 percent slopes. This deep, moderately steep and steep, somewhat excessively drained soil is on convex side slopes. Individual areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark brown very cherty silt loam about 4 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 13 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown, mottled very cherty silt loam. The lower part is strong brown, mottled very cherty and extremely cherty silty clay loam.

Included with this soil in mapping are areas of the well drained Claiborne and Doniphan soils. Claiborne soils are on foot slopes. They have a surface layer of silt loam and contain less chert in the subsoil than the Clarksville soil. Doniphan soils are on shoulder slopes. They contain more clay and less chert in the subsoil than the Clarksville soil. Also included, mostly south and east of Fort Leonard Wood, are some areas where stones or boulders are on the upper part of the slopes. Included areas make up about 10 percent of the unit.

Permeability is moderately rapid in the Clarksville soil, and surface runoff is rapid. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but it cannot be easily tilled because of the chert content.

Most areas support native hardwoods (fig. 4). Some are used as pasture. Because of the high content of chert, the slope, and the low fertility, this soil generally is unsuitable for cultivation. It is suited to trees. The equipment limitation and seedling mortality are the main concerns in managing the woodland. Because of the low available water capacity and the slope, hand planting of large nursery stock may be necessary. The slope limits the use of harvesting equipment. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails. Selective thinning, removal of undesirable trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for woodland wildlife, especially whitetail deer and wild turkey.

Pasture grasses and legumes can be grown in areas that are accessible. This soil is moderately suited to cool- and warm-season grasses, such as tall fescue,

Figure 4.—Young hardwoods on Clarksville very cherty silt loam, 14 to 35 percent slopes.

Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza. Because of the slope, summer droughtiness, and the content of chert, establishing and maintaining a pasture can be difficult. Tillage should be kept to a minimum. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates and timely deferment of grazing improve the pasture. Effective brush control may be a continuing problem because the slope limits the use of equipment. The soil generally is unsuitable as a site for stock water ponds because of excessive seepage. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil generally is unsuited to building site development and onsite waste disposal because of the slope and the chert fragments.

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

17F—Clarksville very cherty silt loam, 14 to 35 percent slopes, stony. This deep, moderately steep and steep, somewhat excessively drained soil is on convex side slopes and shoulder slopes. Chert rocks 10 or more inches in size cover 3 to 10 percent of the surface (fig. 5). Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is brown very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown very cherty silt loam. The next part is strong brown, mottled very cherty and extremely cherty silty clay loam. The lower part is yellowish red and dark brown, mottled very cherty silty clay loam and very cherty silty clay.

Included with this soil in mapping are areas of the well drained Claiborne and Doniphan soils. Claiborne soils are on foot slopes. They have a surface layer of silt loam and contain less chert in the subsoil than the Clarksville soil. Doniphan soils are on shoulder slopes and very narrow ridgetops. They contain more clay and less chert in the subsoil than the Clarksville soil. Included soils make up about 10 percent of the unit.

Figure 5.—An area of Clarksville very cherty silt loam, 14 to 35 percent slopes, stony.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. Surface runoff is rapid. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low.

Most areas support native hardwoods. A few are used as pasture. This soil is unsuitable for cultivation because of the content of chert, the stones on the surface, the slope, and the low fertility. Pasture grasses and legumes can be grown in areas that are accessible. The soil is moderately suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza. Because of the slope, summer droughtiness, and the content of chert, establishing and maintaining a pasture can be difficult. Tillage should be kept to a minimum. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates and timely deferment of grazing improve the pasture. Effective brush control may be a continuing problem because the slope and the chert limit the use of equipment. The soil generally is unsuitable as a site for stock water ponds because of excessive seepage. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to trees. The low fertility and the droughtiness can result in seedling mortality. Hand planting of large nursery stock may be necessary. The slope and the stones limit the use of equipment. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails. Selective thinning, removal of undesirable trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for woodland wildlife, especially whitetail deer and wild turkey.

This soil generally is unsuited to building site development and onsite waste disposal because of the slope.

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

20C—Doniphan very cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on narrow, convex ridgetops and short, uneven shoulder slopes. Individual areas are somewhat narrow and irregularly shaped and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 9 inches thick. The next 4 inches is strong brown silty clay loam mixed with light yellowish brown silt loam. The subsoil to a depth of 60 inches or more is yellowish red, red, and dark red, mottled clay. In places the subsoil is cherty.

Included with this soil in mapping are the somewhat excessively drained Clarksville and moderately well drained Viraton soils. Clarksville soils contain more chert in the subsoil than the Doniphan soil. They generally are on the steeper side slopes. Viraton soils are on the broader ridges. They have a fragipan and contain less chert in the surface layer than the Doniphan soil. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Doniphan soil, and surface runoff is medium or rapid. The available water capacity is low. Natural fertility and the organic matter content also are low.

About two-thirds of the acreage supports native hardwoods. Some areas are pastured. Because of the high content of chert and the low available water capacity, this soil generally is not used for cultivated crops. It is suited to trees. No significant hazards or limitations affect planting or harvesting in the wooded areas. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to lespedeza. It is moderately suited to ladino clover and red clover. Droughtiness and the very cherty surface layer are the main management problems. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Warm- and cool-season grasses grow well if managed properly. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Proper stocking rates and timely deferment of grazing improve the pasture.

This soil is suited to building site development and onsite waste disposal. The moderate permeability is a limitation on sites for septic tank absorption fields, but it can be overcome by increasing the size of the absorption area. Seepage, slope, and large stones are limitations on sites for sewage lagoons. These limitations generally can be overcome by properly designing the lagoon, grading the site, sealing the bottom of the lagoon, and removing the larger stones. Properly designing and reinforcing footings, foundations, and basement walls and backfilling with sand or gravel minimize the damage to buildings caused by shrinking and swelling.

On sites for local roads and streets, providing crushed rock, gravel, or other suitable base material helps to prevent the damage caused by low strength. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent damage caused by frost action and by shrinking and swelling.

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

20D—Doniphan very cherty silt loam, 9 to 14 percent slopes. This deep, strongly sloping, well drained soil is on narrow ridges and convex shoulder slopes. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is pale brown very cherty silt loam about 9 inches thick. The next 4 inches is strong brown cherty silty clay loam mixed with pale brown silt loam. The subsoil extends to a depth of 60 inches or more. It is red, strong brown, and yellowish red and is mottled. It is cherty clay in the upper part and clay in the lower part. In some areas the lower part of the subsoil is cherty.

Included with this soil in mapping are small areas of the somewhat excessively drained Clarksville and moderately well drained Ocie soils. Clarksville soils have less clay in the subsoil than the Doniphan soil. They generally are on the steeper slopes. Ocie soils are 40 to 60 inches deep over bedrock. They are at the head of drainageways. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Doniphan soil, and surface runoff is medium or rapid. The available water capacity is low. The organic matter content and natural fertility also are low.

Most areas are used for native timber or pasture. Because of the high content of chert and the low available water capacity, this soil generally is not used for cultivated crops. It is suited to trees. No significant hazards or limitations affect planting or harvesting in the wooded areas. Selective harvest of mature trees, thinning of second growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is well suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to lespedeza. It is moderately suited to ladino clover and red clover. Droughtiness, erosion, and the cherty surface layer are the main management problems. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Warm-season grasses grow well if properly managed. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Proper stocking rates and timely deferment of grazing improve the pasture.

This soil is suited to building site development and to most kinds of onsite waste disposal. The slope is a limitation, but it can be overcome by land shaping, proper installation procedures, a design that conforms the structures to the natural slope of the land, or a combination of these. The moderate permeability is a limitation on sites for septic tank absorption fields, but it generally can be overcome by increasing the size of the absorption area. Seepage and large stones are limitations on sites for sewage lagoons. Sealing the bottom of the lagoon helps to prevent seepage. The larger stones should be removed. Properly designing and reinforcing footings, foundations, and basement walls and backfilling with sand or gravel minimize the damage to buildings caused by shrinking and swelling.

On sites for local roads and streets, providing crushed rock, gravel, or other suitable base material helps to prevent the damage caused by low strength. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

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

22F—Gasconade-Rock outcrop complex, 2 to 20 percent slopes. This map unit occurs as areas of a shallow, gently sloping to moderately steep, somewhat excessively drained Gasconade soil intermingled with areas of Rock outcrop. The unit is on ridgetops, side slopes, and benches in glade areas. Individual areas are irregular in shape and range from 5 to 150 acres in size. They are about 50 to 65 percent Gasconade soil and 20 to 35 percent Rock outcrop. The Gasconade soil and the Rock outcrop occur as areas so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the Gasconade soil has a surface layer of very dark grayish brown flaggy silty clay loam about 7 inches thick. The subsoil is dark brown, mottled very flaggy silty clay about 11 inches thick. Hard dolomite bedrock is at a depth of about 18 inches.

The Rock outcrop occurs as ledges of exposed dolomite.

Included with this unit in mapping are the moderately deep, moderately well drained Gatewood soils in small areas where less Rock outcrop is exposed. Also included are the deep, moderately well drained Ocie and Clarksville soils at the outer edge of the mapped areas. Included soils make up about 15 percent of the unit.

Permeability is moderately slow in the Gasconade soil, and surface runoff is rapid. The available water capacity is very low. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable, but it cannot be easily tilled because it is flaggy. Root penetration is restricted by the hard bedrock at a depth of about 18 inches.

Most areas support native warm-season grasses and eastern redcedar. This unit generally is unsuited to cultivated crops, to commercial tree production, and to building site development and onsite waste disposal because of the slope, the shallow rooting depth, the coarse fragments in the surface layer, and the Rock outcrop. The eastern redcedar can be used for posts.

The land capability classification is VIIs. The Gasconade soil is assigned to woodland ordination symbol 2D. The Rock outcrop is not assigned to a woodland ordination symbol.

26—Moniteau silt loam. This deep, nearly level, poorly drained soil is on stream terraces. It is subject to rare flooding and receives runoff from the adjacent upland soils. Individual areas range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled, friable silt loam about 12 inches thick. The subsoil is grayish brown and gray, mottled silty clay loam about 40 inches thick. The substratum to a depth of 68 inches or more is grayish brown, mottled silty clay loam. In some areas the surface layer is darker. In other areas the subsoil is not so gray.

Included with this soil in mapping are the well drained Claiborne and Nolin soils and the somewhat poorly drained Hartville soils. Claiborne soils are on foot slopes, and Nolin soils are on flood plains. Hartville soils have more clay than the Moniteau soil. They are in the more sloping areas on the terraces. Also included are a few small areas that are subject to ponding during periods of heavy rainfall. Included soils make up about 5 to 15 percent of the unit.

Permeability is moderately slow in the Moniteau soil, and surface runoff is slow. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. A seasonal high water table is within a depth of 1 foot from November through May in most years.

Most areas are used for pasture or hay (fig. 6). This soil is well suited to shallow-rooted legumes, such as lespedeza, ladino clover, and red clover, and to tall fescue. It is moderately suited to orchardgrass, Caucasian bluestem, and indiangrass. The wetness is a limitation affecting deep-rooted legumes. Diversion terraces are effective in controlling the runoff from the adjacent upland soils. A surface drainage system is needed to prevent ponding in some depressions. Overgrazing or grazing when the soil is wet reduces forage yields and results in surface compaction and poor tilth.

This soil is suited to corn, soybeans, and small grain. The seasonal high water table and the runoff from the adjacent uplands can delay planting and harvesting. Minimizing tillage and returning crop residue to the soil or regularly adding other organic material improve tilth and help to prevent crusting. Diversion terraces are effective in controlling the runoff from the adjacent upland soils. A surface drainage system is needed to prevent ponding in some depressions.

Figure 6.—Hay on Moniteau silt loam in the foreground. The corn is on Nolin silt loam.

This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are management concerns. Equipment should be used only during periods when the soil is dry or frozen. Planting large nursery stock increases the seedling survival rate. Windthrow often occurs after heavy thinning. As a result, less intensive, more frequent thinning is needed.

Because it is subject to rare flooding and has a seasonal high water table, this soil generally is unsuited to building site development and onsite waste disposal. Soils that are better suited to these uses generally are nearby.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

29—Nolin silt loam. This deep, nearly level, well drained soil is on flood plains along the major streams and their larger tributaries. It is occasionally flooded. Individual areas generally are long and narrow and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil to a depth of 63 inches or more is mottled silt loam. The upper part is yellowish brown, and the lower part is dark brown. In some of the lower areas, the surface layer is very dark grayish brown and is more than 10 inches thick.

Included with this soil in mapping are small areas of Cedargap, Claiborne, and Moniteau soils. Cedargap soils are cherty and have a dark surface soil that is thicker than that of the Nolin soil. They are next to the current channel of the smaller streams. Claiborne soils have more chert in the subsoil than the Nolin soil. They are in the more sloping areas adjacent to the uplands. Moniteau soils are poorly drained and are in shallow depressions, generally adjacent to the uplands. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Nolin soil, and surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. A seasonal high water table is at a depth of 3 to 6 feet from November through April in most years.

Most areas are used for pasture or hay. Some are used for cultivated crops. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as alfalfa, ladino clover, and red clover.

The occasional flooding is the main management concern. It can damage seedlings in the spring. As a result, a seedbed should be prepared and seed planted in the fall. Deep-rooted legumes, such as alfalfa, grow well if they are properly managed, especially if supplemental water is provided. Plants on this soil respond well to soil amendments.

This soil is suited to corn, soybeans, and wheat and other small grain crops. The occasional flooding is a hazard. Selecting crops that can be planted later in the growing season reduces the risk of the crop damage caused by floodwater. Some areas receive excessive runoff from the adjacent upland soils. This runoff can damage crops unless it is controlled by diversion terraces. Plants on this soil respond well to applications of fertilizer and lime.

This soil is suited to trees. The limitations and hazards that affect planting and harvesting are slight. Black walnut is a high-value species that can be grown on this soil. Selective thinning of the stands, removal of undesirable trees, and control of fire and grazing improve the woodland.

Because it is occasionally flooded, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIw. The woodland ordination symbol is 11A.

30A—Kickapoo fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on flood plains adjacent to the current channel of large streams and rivers. It is frequently flooded. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The upper substratum is stratified dark brown, yellowish brown, and dark grayish brown fine sandy loam about 23 inches thick. Next is a buried surface layer of very dark grayish brown loam about 9 inches thick. The lower substratum to a depth of 60 inches or more is brown and yellowish brown sand. In some areas the surface layer and substratum contain less sand.

Included with this soil in mapping are small areas of Huntington and Nolin soils and areas of gravelly outwash. Huntington and Nolin soils are silty throughout. They are farther away from the current stream channels than the Kickapoo soil. The gravelly outwash is in areas along the stream channels. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Kickapoo soil, and surface runoff is moderately slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for pasture or hay. Some are used for cultivated crops, dominantly grain sorghum and small grain. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza, red clover, and ladino clover. A cover of grasses is effective in controlling the scouring caused by flooding. Plants on this soil respond well to soil amendments. Flooding can damage seedlings in the spring. As a result, a seedbed should be prepared and seed planted in the fall.

This soil is suited to cultivated crops. Onsite investigation and knowledge of the flooding history of a given area are needed if cultivated crops are grown. Selecting crops that can be planted later in the growing season reduces the risk of flood damage. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to walnut and other high-value trees. The limitations and hazards that affect planting and harvesting are slight. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

Because of the flooding, this soil is unsuitable for building site development and onsite waste disposal.

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

31A—Razort silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on flood plains and low terraces along small streams. It is subject to rare flooding of brief duration. Individual areas are long and narrow and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is dark brown, mottled silt loam. The next part is dark yellowish brown, mottled silt loam. The lower part is dark brown clay loam.

Included with this soil in mapping are small areas of Cedargap and Claiborne soils. Cedargap soils have more chert fragments than the Razort soil. They are adjacent to the stream channels. Claiborne soils have a surface layer that is lighter colored than that of the Razort soil. They are on foot slopes. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderate in the Razort soil, and surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as alfalfa, ladino clover, red clover, and lespedeza. Deep-rooted legumes, such as alfalfa, grow well when properly managed, especially when supplemental water is provided. The grasses and legumes respond well to soil amendments. The hazard of flooding should be considered when a grazing system is designed.

This soil generally is suited to grain sorghum and small grain. Onsite investigation and knowledge of the flooding history of a given area are needed if cultivated crops are grown. Many areas are too small or too narrow for the use of large farm machinery. A system of conservation tillage that leaves a protective cover of crop residue on the surface or regular additions of other organic material help to control erosion, improve fertility, minimize crusting, and increase the rate of water infiltration.

This soil is suited to walnut and other high-value trees. The limitations and hazards that affect planting and harvesting are slight. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

Because of the flooding, this soil generally is unsuited to building site development and onsite waste disposal.

The land capability classification is IIe. The woodland ordination symbol is 10A.

32C—Viraton silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on convex ridgetops. Most areas are irregular in shape and range from 20 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown, mottled silty clay loam and cherty silty clay loam. The next part is a fragipan of pale brown, mottled extremely cherty silty clay loam. The lower part is strong brown, mottled very cherty silty clay.

Included with this soil in mapping are areas of Lebanon soils. These soils contain more clay in the subsoil than the Viraton soil. They are on the broader, less sloping ridgetops. Also included, in areas where the ridgetop narrows and in areas that break to steeper slopes, is a soil that contains more chert above the fragipan than the Viraton soil. Included soils make up about 15 percent of the unit.

Permeability is moderate above the fragipan in the Viraton soil and slow in the fragipan. Surface runoff is medium. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. Root development is restricted to the part of the profile above the fragipan. A perched water table is at a depth of 1.5 to 3.0 feet from November through April in most years.

Most areas are used for pasture or hay (fig. 7). Some are used for cultivated crops, dominantly grain sorghum and small grain. Some areas support native hardwoods. This soil is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover. It is generally unsuited to deep-rooted legumes because of the restricted rooting depth.

Erosion and droughtiness are the major concerns in managing the pastured areas. Erosion is a hazard when the pasture is tilled before it is seeded. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. Renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Timely seeding and a high level of management are needed to establish and maintain a pasture and to prevent excessive erosion. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in summer. Controlled grazing is needed early in spring and late in fall, when the soil is wet.

Suitable sites for stock water ponds generally are available in areas of this soil, but seepage is a problem. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard, and the low available water capacity is a limitation. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, crop rotations that include close-growing pasture or hay crops, and contour stripcropping help to prevent excessive soil loss. Some areas have slopes that are long enough and smooth enough to be terraced. The fragipan is close enough to the surface, however, to hinder both terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to deciduous and coniferous trees. Conifers generally grow better than deciduous trees. The main management concerns are windthrow and seedling mortality. Windthrow is the result of the restricted rooting depth. It often occurs after a heavy thinning, especially of conifers. Less intensive, more frequent thinning reduces the windthrow hazard. Planting large nursery stock increases the seedling survival rate. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and

Figure 7.—Improved pasture in an area of Viraton silt loam, 3 to 9 percent slopes.

grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable for most types of building site development and onsite waste disposal. Seasonal wetness on building sites can be reduced by installing tile drains around basement walls and footings. The slow permeability in the fragipan and the seasonal wetness above the fragipan are severe limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function adequately. A sewage lagoon can function well if it is properly designed and if the site can be leveled to a proper grade.

Wetness and frost action are limitations on sites for local roads and streets. These limitations can be overcome by grading the subgrade so that the roads shed water and by providing adequate side ditches and culverts, which lower the water table.

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

34C—Gatewood cherty silt loam, 5 to 9 percent slopes. This moderately deep, moderately sloping, moderately well drained soil is on side slopes and narrow ridges. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 6 inches thick. The subsoil is yellowish brown, mottled clay about 21 inches thick. The substratum is light brownish gray, mottled cherty clay about 5 inches thick. Hard dolomite bedrock is at a depth of about 35 inches. In some areas the upper part of the subsoil is redder.

Included with this soil in mapping are areas of the somewhat excessively drained Gasconade soils and areas of Ocie soils. Gasconade soils are less than 20 inches over bedrock. They are in glade areas where benches break to steeper slopes. Ocie soils are more than 40 inches over bedrock. They are on the lower side slopes near drainageways. Included soils make up about 10 to 15 percent of the unit.

Permeability is slow in the Gatewood soil, and surface runoff is medium or rapid. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but tillage is difficult because of the coarse fragments. Root development is restricted by the bedrock at a depth of 20 to 40 inches.

Most areas are used for pasture and hay. Some support native timber. Because of the low available water capacity and the low fertility, this soil generally is not used for cultivated crops. It is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover.

Erosion, the content of chert in the surface layer, and droughtiness are the major concerns in managing the pastured areas. Erosion is a hazard when the pasture is tilled before it is seeded. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in summer.

This soil is suited to trees. No significant hazards or limitations affect planting or harvesting. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable as a site for dwellings without basements. The shrink-swell potential is a limitation. Properly designing and reinforcing footings and foundations can help to prevent the damage caused by shrinking and swelling. The soil is better suited to dwellings without basements than to dwellings with basements because of the moderate depth to bedrock.

The depth to bedrock and the slope are severe limitations if this soil is used as a site for sewage lagoons. The slow permeability and the depth to bedrock are severe limitations on sites for septic tank absorption fields. A properly constructed mound of suitable material improves the suitability for absorption fields. Additional soil material is needed on sites for sewage lagoons. Generally, suitable borrow material is available in the adjacent areas.

The shrink-swell potential, frost action, and low strength are limitations if this soil is used as a site for local roads and streets. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the damage caused by shrinking and swelling and by frost action. Providing crushed rock, gravel, or other suitable base material helps to prevent the damage caused by low strength.

The land capability classification is IVs. The woodland ordination symbol is 2A.

34D—Gatewood cherty silt loam, 9 to 14 percent slopes. This moderately deep, strongly sloping, moderately well drained soil is on side slopes and narrow, convex ridgetops. Individual areas are irregular in shape and range from 10 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown cherty silt loam about 4 inches thick. The subsurface layer is brown very cherty silt loam about 6 inches thick. The subsoil is yellowish brown, mottled clay about 17 inches thick. Hard, gray dolomite bedrock is at a depth of about 27 inches. In some areas the upper part of the subsoil is redder.

Included with this soil in mapping are areas of Gasconade and Ocie soils. Gasconade soils are less than 20 inches deep over bedrock. They are in glade areas, generally on south- and west-facing slopes. Ocie soils are more than 40 inches deep over bedrock. They are on the lower side slopes near drainageways. Included soils make up about 10 to 15 percent of the unit.

Permeability is slow in the Gatewood soil, and surface runoff is medium or rapid. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but tillage is difficult because of the content of coarse fragments. Root development is restricted by the bedrock at a depth of 20 to 40 inches.

Most areas are used for timber or pasture. Because of the low available water capacity and the low fertility, this soil generally is not used for cultivated crops. It is well suited to tall fescue, Caucasian bluestem, indiangrass, and shallow-rooted legumes, such as lespedeza. It is moderately suited to orchardgrass.

Erosion, the content of chert in the surface layer, and droughtiness are the major concerns in managing the pastured areas. Erosion is a hazard when the pasture is tilled before it is seeded. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in summer.

This soil is suited to trees. No significant hazards or limitations affect planting or harvesting. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable as a site for dwellings without basements, but the slope and the shrink-swell potential are limitations. The slope can be overcome by land shaping. Also, the dwellings can be designed so that they conform to the natural slope of the land. Properly designing and reinforcing footings and foundations can minimize the damage caused by shrinking and swelling. The soil is better suited to buildings without basements than to buildings with basements because of the moderate depth to bedrock.

The depth to bedrock and the slow permeability are severe limitations on sites for septic tank absorption fields. A properly constructed mound of suitable material improves the suitability for absorption fields. Additional soil material is needed on sites for sewage lagoons because of the depth to bedrock. Generally, suitable borrow material is available in the adjacent areas.

The shrink-swell potential, frost action, and low strength are limitations if this soil is used as a site for local roads and streets. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the damage caused by shrinking and swelling and by frost action. Providing crushed rock, gravel, or other suitable base material helps to prevent the damage caused by low strength.

The land capability classification is VIs. The woodland ordination symbol is 2A.

35B—Lebanon silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on convex ridgetops. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown silt loam and strong brown, mottled silty clay loam and silty clay. The next part is a very dense fragipan of light brownish gray and pale brown, mottled very cherty silt loam and extremely cherty silty clay loam. The lower part to a depth of 72 inches or more is reddish brown, mottled clay and cherty clay. In some areas the depth to the fragipan is more than 24 inches.

Included with this soil in mapping are the somewhat poorly drained Plato soils in the less sloping depressional areas. Also included are some areas of Viraton soils. These soils have less clay than the Lebanon soil. They are in areas that break to steeper slopes. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate above the fragipan in the Lebanon soil and slow in and below the fragipan. Surface runoff is medium. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in eroded areas where it contains subsoil material. Root penetration is restricted by the compact fragipan at a depth of about 21 inches. A perched water table is at a depth of 1 to 2 feet from November through April in most years.

Most areas are used for pasture or hay. Some are used for cultivated crops, dominantly grain sorghum and small grain. Some areas support native hardwoods.

This soil is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover. A cover of these grasses and legumes is effective in controlling erosion. Deep-rooted legumes generally do not grow well because of the restricted rooting depth. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. Timely renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Erosion is a hazard when the pasture is tilled before it is seeded. Because of this hazard, timely tillage and a quickly established ground cover are necessary. Grazing when the soil is wet, especially in early spring and late fall, causes surface compaction, excessive runoff, and poor tilth.

Suitable sites for stock water ponds generally are available in areas of this soil, but seepage is a problem. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard, and an insufficient amount of soil moisture commonly is a limitation affecting summer-grown row crops. Also, spring planting may be delayed by seasonal wetness. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, stripcropping, and contour farming help to prevent excessive soil loss. Some areas have slopes that are long enough and smooth enough to be terraced. The fragipan is close enough to the surface, however, to hinder terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent crusting, and increases the rate of water infiltration.

This soil is suited to trees. Conifers generally grow better than deciduous trees. Seedling mortality and windthrow are the main management concerns. Planting large nursery stock increases the seedling survival rate. Windthrow often occurs after a heavy thinning, especially of conifers. Less intensive, more frequent thinning reduces the windthrow hazard. Thinning of second-growth stands, removal of undesirable trees, and control of fire and grazing improve the woodland.

This soil is suitable for building site development and onsite waste disposal. Excessive wetness in winter and spring is a problem on building sites. Installing tile drains around footings helps to prevent the damage caused by wetness. The slow permeability in the fragipan and seasonal wetness above the fragipan are limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function well. The slope is a limitation on sites for sewage lagoons, but the sites generally can be easily leveled. In residential areas sanitary facilities should be connected to any available commercial sewers.

Wetness and frost action are moderate limitations if this soil is used as a site for local roads and streets. Adequate side ditches and culverts can lower the water table and thus help to prevent the damage caused by frost action and wetness.

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

35C—Lebanon silt loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on convex ridgetops. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. The upper part of the subsoil is strong brown and yellowish brown, mottled silty clay loam and cherty silty clay. The next part is a very dense fragipan of pale brown, mottled very cherty silt loam and very cherty silty clay loam. The lower part to a depth of 60 inches or more is red, mottled extremely cherty clay. In some areas the slope is less than 5 percent.

Included with this soil in mapping are areas of Gunlock soils on foot slopes adjacent to drainageways. These soils do not have a fragipan. Also included are some areas of Viraton soils. These soils have less clay than the Lebanon soil. They are in areas that break to steeper slopes. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate above the fragipan in the Lebanon soil and slow in and below the fragipan. Surface runoff is medium. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in areas where it contains subsoil material. Root penetration is restricted by the compact fragipan at a depth of about 23 inches. A perched water table is at a depth of 1 to 2 feet from November through April in most years.

Most areas are used for pasture or hay (fig. 8). Some are used for cultivated crops, dominantly grain sorghum and small grain. Some areas support native hardwoods.

This soil is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover. A cover of these grasses and legumes is effective in controlling erosion. Deep-rooted legumes generally do not grow well because of the restricted rooting depth. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. Timely renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Erosion is a hazard when the pasture is tilled before it is seeded. Because of this hazard, timely tillage and a quickly established ground cover are necessary. Grazing when the soil is wet, especially in early spring and late fall, causes surface compaction, excessive runoff, and poor tilth.

Suitable sites for stock water ponds generally are available in areas of this soil or in the adjacent areas, but seepage is a problem. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard, and an insufficient amount of soil moisture commonly is a limitation affecting summer-grown row crops. Also, spring planting may be delayed by seasonal wetness. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, stripcropping, and contour farming help to control erosion. Some areas have slopes that are long enough and smooth enough to be terraced. The fragipan is close enough to the surface, however, to hinder terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent crusting, and increases the rate of water infiltration.

This soil is suited to trees. Conifers generally grow better than deciduous trees. Seedling mortality and windthrow are the main management concerns. Planting large nursery stock increases the seedling survival rate. Windthrow often occurs after a heavy thinning, especially of conifers. Less intensive, more frequent thinning reduces the windthrow hazard. Thinning of second-growth stands, removal of undesirable trees, and control of fire and grazing improve the woodland.

This soil is suitable for building site development and onsite waste disposal. Excessive wetness in winter and spring is a problem on building sites. The slope also is a limitation. Installing tile drains around footings helps to prevent the damage caused by wetness. The slope can be overcome by land shaping, grading, or leveling. The slow permeability in the fragipan and seasonal wetness above the fragipan are limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function well. The slope is a limitation on sites for sewage lagoons. It can be overcome by grading and leveling. In residential areas sanitary facilities should be connected to any available commercial sewers.

Figure 8.—Large bales of hay on Lebanon silt loam, 5 to 9 percent slopes.

Wetness and frost action are limitations if this soil is used as a site for local roads and streets. Adequate side ditches and culverts can lower the water table and thus help to prevent the damage caused by wetness and frost action.

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

37B—Hartville silt loam, 2 to 5 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on foot slopes and stream terraces. Individual areas generally are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 70 inches or more. The upper part is brown, mottled silty clay loam. The next part is grayish brown and gray, mottled silty clay. The lower part is yellowish brown, mottled silty clay. In some areas the soil has a darker surface layer more than 5 inches thick.

Included with this soil in mapping are areas of the well drained Cedargap and Claiborne and poorly drained Moniteau soils. Cedargap soils have more chert than the Hartville soil. They are adjacent to the current channel of small streams. Claiborne soils have less clay than the Hartville soil. They are on the higher foot slopes. Moniteau soils have less clay in the upper part of the subsoil than the Hartville soil. They are on the less sloping parts of the terraces. Included soils make up about 10 to 15 percent of the unit.

Permeability is slow in the Hartville soil, and surface runoff is medium. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains. A perched water table is at a depth of 1.5 to 3.0 feet from November through April in most years.

Most areas are used for pasture or hay. Some are used for cultivated crops. This soil is well suited to tall fescue, indiangrass, ladino clover, and lespedeza. It is moderately suited to orchardgrass, Caucasian bluestem, and red clover. Wetness is a limitation affecting deep-rooted legumes. The species that can best withstand the wetness should be selected for planting. Diversion terraces are effective in controlling the runoff from the adjacent upland soils. Erosion is a hazard during seedbed preparation. As a result, timely tillage and a quickly established ground cover are necessary. Overgrazing or grazing when the soil is wet reduces the extent of the grasses and legumes and causes surface compaction and poor tilth.

This soil is suited to corn, soybeans, grain sorghum, and small grain. The seasonal high water table and the runoff from adjacent uplands can delay planting and harvesting. Also, erosion is a hazard. It can be controlled by a system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, stripcropping, and contour farming. A few areas have slopes that are long enough and smooth enough to be terraced. Returning crop residue to the soil or regularly adding other organic material improves tilth and helps to prevent crusting. Diversion terraces are effective in controlling the runoff from adjacent upland soils.

This soil is suited to trees. Seedling mortality and windthrow are the main management concerns. Planting large nursery stock or containerized stock increases the seedling survival rate. Windthrow commonly occurs after a heavy thinning. Less intensive, more frequent thinning reduces the windthrow hazard. Selective thinning, removal of undesirable trees, and control of fire and grazing improve the woodland.

This soil is suitable for building site development and onsite waste disposal. The wetness and the shrink-swell potential of the subsoil are major problems on sites for dwellings with basements. Soils that are better suited to dwellings with basements generally are nearby. Properly designing and reinforcing footings, foundations, and basement walls and backfilling with sand or gravel minimize the damage caused by shrinking and swelling. Installing tile drains around the footings help to prevent the damage caused by excessive wetness. Sewage lagoons can function adequately, but some leveling is needed.

Providing crushed rock, gravel, or other suitable base material helps to prevent the damage to local roads and streets caused by low strength. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

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

38—Riverwash. This map unit occurs as areas of sand and gravel along current stream channels and old stream channels. It is frequently flooded. The floodwater deposits new material and mixes the material already deposited. The drainage class varies. Shallow pools are common. Individual areas range from about 5 to 50 acres in size.

Included with the Riverwash in mapping are small areas of Cedargap and Kickapoo soils. These soils are along the edge of the stream channels and on the higher islands. They make up about 10 to 15 percent of the unit.

The Riverwash generally is sparsely vegetated with willows and a few small sycamore trees. Some included areas support a dense stand of sycamore, elm, and ash. A few areas are mined for sand or gravel, generally by a mechanical loader. The mined material is hauled from the site and used as base material for roads, as fill, or as an ingredient in concrete. These areas commonly are mined for short periods, but some have been mined for several years.

This unit generally is unsuited to any type of development and to grasses and trees because of the frequent flooding. Wetland wildlife habitat can be developed in some areas. Natural travel lanes for wildlife are along the waterways. Canoists and fishermen commonly use the gravel bars as campsites.

No land capability classification or woodland ordination symbol is assigned.

39C—Ocie cherty silt loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on ridges, in saddles, and on head slopes. Individual areas are somewhat narrow and irregularly shaped and range from 20 to 500 acres in size.

Typically, the surface layer is dark grayish brown cherty silt loam about 3 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 6 inches thick. The subsoil is about 35 inches thick. The upper part is light yellowish brown and yellowish brown, mottled very cherty silt loam and very cherty silty clay loam. The lower part is yellowish brown, mottled clay. The substratum is olive brown cherty clay about 5 inches thick. It has soft fragments of dolomite. Hard, gray dolomite bedrock is at a depth of about 49 inches. In places the soil is more than 60 inches deep over bedrock.

Included with this soil in mapping are a few small areas of Gatewood and Viraton soils. Gatewood soils are less than 40 inches over bedrock. They are on narrow ridgetops. Viraton soils have a fragipan. They are on the less sloping, broader ridgetops. Included soils make up about 15 percent of the unit.

Permeability is slow in the Ocie soil, and surface runoff is medium. The available water capacity is low. Natural fertility and the organic matter content also are low. The surface layer is friable, but tillage is difficult because of the chert fragments. A perched water table is at a depth of 3 to 5 feet from November through April in most years.

Most areas are used for timber or pasture. Because of the low available water capacity and the low fertility, this soil generally is not used for cultivated crops. It is suited to trees. No significant hazards or limitations affect planting or harvesting in the wooded areas. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to lespedeza. It is moderately well suited to ladino clover and red clover. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Erosion, the content of chert in the surface layer, and droughtiness are the major management concerns. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Erosion is a hazard when the pasture is tilled. As a result, timely tillage and a quickly established ground cover are necessary. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in summer.

This soil is suited to building site development and onsite waste disposal. The slow permeability, the wetness, and the depth to bedrock are limitations on sites for septic tank absorption fields. These limitations can be overcome by increasing the size of the absorption field and by using a properly constructed mound system. The slope and the depth to bedrock are limitations on sites for sewage lagoons. Some leveling may be needed. Extra soil material from the adjacent areas may be needed to increase the depth to bedrock.

The wetness, the shrink-swell potential, and the depth to bedrock are limitations on sites for dwellings with basements, and the wetness and the shrink-swell potential are limitations on sites for dwellings without basements. Because of the depth to bedrock, the dwellings should be constructed above ground level or only partly below. Otherwise, the bedrock can be blasted and ripped. Properly designing and reinforcing foundations and footings and backfilling with sand or gravel minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness.

If this soil is used as a site for local roads and streets, low strength is a limitation. It can be overcome by strengthening the base with crushed rock, gravel, or other suitable material. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

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

39D—Ocie cherty silt loam, 9 to 14 percent slopes. This deep, strongly sloping, moderately well drained soil is on side slopes and head slopes. Individual areas are irregularly shaped and range from 10 to 400 acres in size.

Typically, the surface layer is dark brown cherty silt loam about 2 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 7 inches thick. The subsoil is about 32 inches thick. It is yellowish brown and mottled. The upper part is very cherty silt loam, and the lower part is clay. The substratum is about 5 inches of olive brown cherty clay that has soft fragments of weathered dolomite. Hard, gray dolomite bedrock is at a depth of about 46 inches. In places the soil is more than 60 inches deep over bedrock.

Included with this soil in mapping are small areas of Gatewood and Gunlock soils. Gatewood soils are less than 40 inches over bedrock. They are on convex ridgetops and shoulder slopes near summits. Gunlock soils are more than 60 inches deep over bedrock and have less chert in the surface layer than the Ocie soil. They are on foot slopes near drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Ocie soil, and surface runoff is medium. The available water capacity is low. Natural fertility and the organic matter content also are low. The surface layer is friable, but tillage is difficult because of the chert fragments. A perched water table is at a depth of 3 to 5 feet from November through April in most years.

Most areas are used for timber. A few are pastured. Because of the low available water capacity, the slope, and the low fertility, this soil is generally unsuitable for cultivated crops. It is suited to trees. No significant hazards or limitations affect planting or harvesting in the wooded areas. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is moderately well suited to most cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass. It is well suited to lespedeza and moderately suited to ladino clover and red clover. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Erosion, the content of chert in the surface layer, and droughtiness are the major management concerns. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. The best method of establishing the grasses and legumes is by tilling with a heavy disk and then broadcast seeding. Erosion is a hazard when the pasture is tilled. As a result, timely tillage and a quickly established ground cover are necessary. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in summer.

This soil is suitable for building site development and for most kinds of onsite waste disposal. The slope is a limitation, but it can be overcome by land shaping, by proper installation procedures, by a design that conforms the structures to the natural slope of the land, or by a combination of these. The slow permeability, the wetness, and the depth to bedrock are limitations on sites for septic tank absorption fields, but they can be overcome by increasing the size of the absorption field and by using a properly constructed mound system. The slope and the depth to bedrock are problems when sewage lagoons are constructed. Some sites can be leveled. Additional soil material from the adjacent areas is needed to increase the depth to bedrock.

The wetness, the shrink-swell potential, and the depth to bedrock are limitations on sites for dwellings. Because of the depth to bedrock, the dwellings should be constructed above ground level or only partly below. Otherwise, the bedrock can be blasted or ripped. Properly designing and reinforcing foundations and footings and backfilling with sand or gravel minimize the structural damage caused by shrinking and swelling. Installing tile drains around footings helps to prevent the damage caused by excessive wetness.

If this soil is used as a site for local roads and streets, low strength is a limitation. It can be overcome by strengthening the base with crushed rock, gravel, or other suitable material. Grading the subgrade so that the roads shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

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

40—Huntington silt loam. This deep, nearly level, well drained soil is on flood plains. It is frequently flooded. Some small areas are dissected by stream channels. Individual areas generally are long and narrow and range from about 10 to more than 200 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer also is very dark grayish brown silt loam. It is about 8 inches thick. The subsoil is dark brown, mottled silt loam about 36 inches thick. The substratum to a depth of about 60 inches is dark brown fine sandy loam. In some areas the surface layer is lighter colored.

Included with this soil in mapping are areas of Cedargap and Kickapoo soils and small areas of sandy and gravelly overwash. Cedargap soils have more chert than the Huntington soil. They are on flood plains along the smaller streams. Kickapoo soils have more sand than the Huntington soil. They are on the lower parts of the flood plains, adjacent to the current stream channels. The overwash is in the low areas adjacent to the stream channels. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Huntington soil, and surface runoff is slow. The available water capacity is high. Natural fertility and the organic matter content also are high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. Some are used for cultivated crops. This soil is well suited to most cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as alfalfa, ladino clover, red clover, and lespedeza. A cover of these plants is effective in controlling the scouring caused by floodwater. The flooding limits the suitability of some species. It can damage seedlings in the spring. As a result, the seedbed should be prepared and the seed planted in the fall. Deep-rooted legumes, such as alfalfa, grow well if properly managed, especially if supplemental water is provided. Plants on this soil respond well to soil amendments.

This soil is suited to corn, soybeans (fig. 9), and wheat and other small grain crops. The flooding is the major hazard. Selecting crops that can be planted later in the growing season reduces the risk of crop damage in areas where flooding is not controlled. Some areas receive excessive runoff from the adjacent soils upslope. This runoff can damage crops unless it is controlled by diversion terraces.

A few isolated areas are wooded. This soil is suited to trees. The hazards and limitations that affect planting and harvesting are slight. Black walnut is a high-value species that can be grown on this soil. Selective thinning of the stands, removal of undesirable trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

Because of the flooding, this soil is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIw. The woodland ordination symbol is 9A.

41B—Plato silt loam, 2 to 5 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on broad, convex ridgetops. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The upper part of the subsoil is yellowish brown, light brownish gray, and grayish brown, mottled silty clay and silty clay loam. The next part is a very dense fragipan of grayish brown, mottled extremely

Figure 9.—Soybeans on Huntington silt loam.

cherty silt loam. The lower part to a depth of 62 inches or more is dark red and red, mottled cherty and very cherty clay. In some areas the surface layer is less than 4 inches thick. In some small depressional areas, the subsoil is grayer.

Included with this soil in mapping are areas of the moderately well drained Ocie and Viraton soils. Ocie soils have a cherty surface layer and do not have a fragipan. They are on the breaks to steeper slopes. Viraton soils have more chert and less clay above the fragipan than the Plato soil. They are in the more sloping areas. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow above the fragipan in the Plato soil and very slow in the fragipan. Surface runoff is slow. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in eroded areas where it contains subsoil material. Root penetration is restricted by the compact fragipan at a depth of about 21 inches. A perched water table is at a depth of 1.5 to 3.0 feet from November through April in most years.

Most areas are used for pasture or hay. Some are used for cultivated crops, dominantly grain sorghum and small grain. A few small areas support native hardwoods.

This soil is well suited to warm-season grasses, such as Caucasian bluestem and indiangrass. It is moderately suited to tall fescue and to shallow-rooted legumes, such as ladino clover. A cover of these grasses and legumes is effective in controlling erosion. Deep-rooted legumes generally do not grow well because of the restricted rooting depth. Rotation grazing of individual pastures of cool-season and warm-season grasses is more effective than season-long grazing of any one grass species. Timely renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth.

Suitable sites for stock water ponds generally are available in areas of this soil, but seepage is a problem. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard, and an insufficient amount of soil moisture commonly is a limitation affecting summer-grown row crops. Also, spring planting may be delayed by seasonal wetness. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, stripcropping, and contour farming help to prevent excessive soil loss. Some areas have slopes that are long enough and smooth enough to be terraced. The fragipan is close enough to the surface, however, to hinder terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent crusting, and increases the rate of water infiltration.

This soil is suited to trees. No significant hazards or limitations affect planting or harvesting. Thinning of second-growth stands, removal of undesirable trees, and control of fire and grazing improve the woodland.

This soil is suited to building site development and onsite waste disposal. Excessive wetness in winter and spring is a problem on building sites. Installing tile drains around footings helps to prevent the damage caused by wetness. Properly designing and reinforcing foundations and footings and backfilling with sand or gravel minimize the structural damage caused by shrinking and swelling. The very slow permeability in the fragipan and seasonal wetness above the fragipan are severe limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function well. The slope is a limitation on sites for sewage lagoons, but most sites can be easily leveled. In residential areas sanitary facilities should be connected to any available commercial sewers.

The wetness, the shrink-swell potential, low strength, and frost action are limitations if this soil is used as a site for local roads and streets. Adequate side ditches and culverts can lower the water table and thus help to prevent the damage caused by wetness, shrinking and swelling, and frost action. Adding crushed rock, gravel, or other suitable base material helps to prevent the damage caused by low strength.

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

42C—Gunlock silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on the lower side slopes, foot slopes, and terraces along drainageways in the uplands. Individual areas range from about 15 to more than 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil extends to a depth of 73 inches or more. In sequence downward, it is yellowish brown, mottled silty clay loam; brown, mottled silty clay; compact, slightly brittle, grayish brown and yellowish brown, mottled cherty silty clay loam and silty clay loam; and yellowish brown, mottled extremely cherty silty clay loam and cherty silty clay. In some of the less sloping areas, the upper part of the subsoil has grayish brown mottles. In places the soil is less than 60 inches deep over bedrock.

Included with this soil in mapping are small areas of Cedargap, Hartville, Lebanon, and Ocie soils. Cedargap soils have a thick, dark surface layer. They are on flood plains. Hartville soils are somewhat poorly drained and are in the lower areas. Lebanon soils have a fragipan. They are in the less sloping areas. Ocie soils are cherty. They are on short slopes in the steeper areas. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderately slow in the Gunlock soil, and surface runoff is medium. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. A perched water table is at a depth of 2 to 3 feet from November through April in most years.

Most areas are used for pasture or hay. A few are used for cultivated crops. This soil is well suited to tall fescue, indiangrass, ladino clover, and lespedeza. It is moderately suited to orchardgrass, Caucasian bluestem, and red clover. A cover of grasses and legumes is effective in controlling erosion. Erosion is a hazard during seedbed preparation. This hazard can be reduced by timely seeding and by a companion crop of small grain. Timely renovation of grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Timely mowing of pastures helps to control the competition from undesirable plants and results in a more uniform distribution of grazing.

This soil generally is suited to soybeans, grain sorghum, and small grain. Erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, stripcropping, winter cover crops, and grassed waterways help to prevent excessive soil loss. Some areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. No significant hazards or limitations affect planting or harvesting. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

If the design of the structures compensates for the slope, this soil is suitable for building site development and onsite waste disposal. The moderately slow permeability and excessive wetness are limitations on sites for septic tank absorption fields, but they generally can be overcome by a properly constructed mound system. Sealing the bottom of sewage lagoons with slowly permeable material helps to prevent the contamination of ground water. Properly designing and reinforcing footings and basement walls and backfilling with sand or gravel minimize the damage to buildings caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness.

This soil is suitable as a site for local roads and streets. Low strength, the shrink-swell potential, frost action, and wetness are limitations. Strengthening the subgrade with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by shrinking and swelling, frost action, and wetness.

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

43F—Poynor very cherty silt loam, 14 to 35 percent slopes. This deep, moderately steep and steep, well drained soil is on uneven side slopes and on head slopes. Individual areas are irregularly shaped and range from 20 to 500 acres in size.

Typically, the surface layer is grayish brown very cherty silt loam about 5 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 14 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown, mottled very cherty silty clay loam. The lower part is red and strong brown, mottled clay. In places the upper part of the subsoil has more clay and less chert.

Included with this soil in mapping are areas of the moderately well drained Gunlock and Ocie soils. Gunlock soils have a surface layer of silt loam and are browner in the subsoil than the Poynor soil. They are on foot slopes near drainageways. Ocie soils are 40 to 60 inches deep over bedrock. They are on nose slopes and side slopes. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Poynor soil, and surface runoff is rapid. The available water capacity is low. Natural fertility and the organic matter content also are low.

Because of the slope, the low available moisture capacity, and the content of coarse fragments, this soil is unsuited to cultivated crops. It is moderately suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza. Establishing and maintaining a pasture can be difficult. Erosion, the chert fragments in the surface layer, and droughtiness are the main management problems. A crawler type of tractor and a heavy disk may be needed for seedbed preparation. Tillage generally should be avoided. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates, pasture rotation, and timely deferment of grazing improve the pasture. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds. Effective brush control may be a continuing problem because the slope limits the use of equipment.

This soil generally is unsuitable as a site for stock water ponds because of seepage. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

Most areas support native hardwoods. This soil is suited to trees. The equipment limitation is the main management concern. It can be minimized by carefully selecting and managing sites for logging roads and skid trails. Because of the chert, hand planting of seedlings or direct seeding may be necessary. North- and east-facing slopes are the best sites for seedlings. Selective harvest of mature trees, thinning of second-growth stands, removal of cull trees, and control of fire and grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

Because of the slope, this soil generally is unsuitable as a site for sanitary facilities and buildings.

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

46F—Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes. These deep, moderately steep and steep soils are on uneven side slopes. The well drained Gepp soil is on benches, generally on the lower part of the side slopes. The somewhat excessively drained Clarksville soil is in the steeper areas above the benches. Individual areas are irregular in shape and range from 20 to more than 200 acres in size. They are about 50 to 60 percent Clarksville soil and 30 to 40 percent Gepp soil. The two soils occur as areas so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the surface of the Clarksville soil is covered with partially decomposed forest litter from pine or deciduous trees. The surface layer is brown very cherty silt loam about 3 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown very cherty silt loam, and the lower part is strong brown and yellowish red, mottled extremely cherty silty clay loam and extremely cherty silty clay.

Typically, the surface layer of the Gepp soil is dark grayish brown very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish red, mottled cherty silty clay loam, and the lower part is red, mottled clay and cherty clay. In some areas on the lower part of the landscape, the slope is more than 35 percent.

Included with these soils in mapping are small areas of Doniphan and Claiborne soils. Doniphan soils are on the shoulder slopes of ridges. They have more clay and less chert in the upper part of the subsoil than the Clarksville soil and have a surface layer that is thicker than that of the Gepp soil. Claiborne soils are less cherty than the Clarksville soil and less clayey than the Gepp soil. They are on foot slopes. Also included, where the hillside benches break to steeper slopes, are some small stony areas and some small areas where the depth to bedrock is less than 60 inches. Included soils make up about 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. It is moderate in the Gepp soil. Surface runoff is rapid on both soils. The available water capacity is low in the Clarksville soil and moderate in the Gepp soil. Natural fertility is low in both soils. The organic matter content is moderately low in the Clarksville soil and moderate in the Gepp soil.

Because of the slope, the high content of chert, the low fertility, and the hazard of erosion, these soils are generally unsuited to cultivated crops. They are moderately suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza. Accessible areas can be used as pasture, but droughtiness, the slope, erosion, and the chert fragments in the surface layer are problems. A crawler type of tractor and a heavy disk may be needed for seedbed preparation. Tillage should be avoided where possible. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates, pasture rotation, and timely deferment of grazing improve the pasture. Effective brush control may be a continuing problem because the slope limits the use of equipment.

These soils generally are unsuitable as sites for stock water ponds because of excessive seepage. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

Most areas support second-growth stands of black oak and post oak. Some small stands of white oak are on the north- and east-facing slopes. These soils are suited to trees. The main management concerns are the equipment limitation and seedling mortality rate on both soils and the erosion hazard on the Gepp soil. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails. Some disturbed areas should be seeded after the trees are harvested. Because of the chert, hand planting of seedlings may be necessary. Planting large nursery stock or container-grown stock increases the seedling survival rate. Selective thinning of the stands, removal of undesirable trees and other competing vegetation, and control of fire and grazing improve the woodland.

These soils generally are unsuitable for building site development and onsite waste disposal because of the slope.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Clarksville soil is 3R, and that assigned to the Gepp soil is 4R.

47F—Gepp-Bardley-Clarksville very cherty silt loams, 14 to 35 percent slopes. These moderately steep and steep soils are on uneven side slopes and benches. The deep, well drained Gepp soil and the moderately deep, well drained Bardley soil are on the lower part of the side slopes and on the benches. The deep, somewhat excessively drained Clarksville soil generally is on the steeper side slopes above the benches. Individual areas are irregular in shape and range from 20 to more than 100 acres in size. They are about 45 percent Gepp soil, 25 percent Bardley soil, and 20 percent Clarksville soil. The three soils occur as areas so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Gepp soil is dark brown very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is red and yellowish red, mottled clay, and the lower part is strong brown, mottled cherty clay. In some areas the soil has a thicker cherty subsurface layer. In other areas the upper part of the subsoil has more chert.

Typically, the surface layer of the Bardley soil is brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam about 3 inches thick. The subsoil is about 26 inches of red, mottled silty clay and clay. The substratum is strong brown, mottled clay loam about 3 inches thick. Hard dolomite bedrock is at a depth of about 36 inches. In some areas the soil is shallower over bedrock.

Typically, the surface layer of the Clarksville soil is brown very cherty silt loam about 3 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown and light brown, mottled very cherty silt loam, and the lower part is strong brown, mottled extremely cherty silty clay loam.

Included with these soils in mapping are areas of Doniphan soils. These included soils have a very cherty surface soil as much as 20 inches thick and are underlain by red clay. They are on shoulder slopes on the higher parts of the landscape. Also included are small areas of the shallow Gasconade soils and narrow bands where bedrock crops out, generally on south- and west-facing slopes. Included areas make up about 5 to 10 percent of the unit.

Permeability is moderate in the Gepp and Bardley soils and moderately rapid in the Clarksville soil. Surface runoff is rapid on all three soils. The available water capacity is low in the Bardley and Clarksville soils and moderate in the Gepp soil. Natural fertility is low in all three soils. The organic matter content is moderately low in the Clarksville soil, moderate in the Gepp soil, and low in the Bardley soil. Root penetration is restricted by the dolomite bedrock at a depth of about 36 inches in the Bardley soil.

Because of the slope, the high content of chert, the low fertility, and the hazard of erosion, these soils are generally unsuited to cultivated crops. They are moderately suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza. Accessible areas can be used as pasture, but droughtiness, erosion, and the chert fragments in the surface layer are problems. A crawler type of tractor and a heavy disk may be needed for seedbed preparation. Tillage should be avoided where possible. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates, pasture rotation, and timely deferment of grazing improve the pasture. Effective brush control may be a continuing problem because the slope limits the use of equipment.

These soils generally are unsuitable as sites for stock water ponds because of excessive seepage. The pond should be sealed, or alternative water supplies, such as pipelines, should be considered.

These soils are suited to trees. Most areas are wooded with black oak and post oak. Some small stands of white oak are on north- and east-facing slopes. Also, native grasses and eastern redcedar grow in isolated glades, mainly on south- and west-facing slopes. The main management concerns are seedling mortality on the Gepp and Clarksville soils, erosion on the Gepp and Bardley soils, and the equipment limitation on all three soils. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails. Some disturbed areas should be seeded after the trees are harvested. Because of the chert, hand planting of seedlings may be necessary. Planting container-grown stock increases the seedling survival rate. Selective thinning, removal of undesirable trees, and control of fire and grazing improve the woodland.

These soils generally are unsuitable for building site development and onsite waste disposal, mainly because of the slope and the chert fragments in the surface layer.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Gepp soil is 4R, that assigned to the Bardley soil is 2R, and that assigned to the Clarksville soil is 3R.

47G—Gepp-Rock outcrop complex, 35 to 60 percent slopes. This map unit occurs as areas of a deep, very steep, well drained Gepp soil intermingled with areas of Rock outcrop. The unit is on ledges and bluffs on side slopes along rivers and streams. Individual areas are long and narrow and range from about 10 to more than 100 acres in size. They are about 60 percent Gepp soil and 30 percent Rock outcrop. The Gepp soil and the Rock outcrop occur as areas so intermingled that they could not be shown separately at the scale selected for mapping.

Typically, the surface layer of the Gepp soil is dark grayish brown cherty silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown, mottled cherty silty clay loam. The next part is red, mottled clay. The lower part is yellowish red, mottled very cherty clay. In some areas the soil has a thicker cherty subsurface layer. In other areas the upper part of the subsoil has more chert.

The Rock outcrop includes ledges, vertical bluff faces, and talus consisting of gravel, stones, and boulders intermixed with soil particles that have sloughed off of the higher lying adjacent hillsides.

Included with this unit in mapping are the moderately deep Bardley and shallow Gasconade soils on the side slopes directly above the rock bluffs. These included soils make up about 10 percent of the unit.

Permeability is moderate in the Gepp soil, and surface runoff is rapid. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderate.

Most areas are vegetated with oak, except for the bluff faces. Some small glades support native grasses and eastern redcedar. Because of the slope, this unit is unsuited to pasture and to cultivation. It generally is not used for commercial tree production, but selected trees occasionally are harvested along with the trees on the adjacent soils. The best trees are on the highest part of the side slopes and on the talus below.

Because of caves, scenic views, and hiking trails, this unit has esthetic qualities. Also, it provides habitat for woodland wildlife, particularly birds and small game.

The Gepp soil generally is unsuitable for building site development and onsite waste disposal because of the slope.

The land capability classification is VIIe. The Gepp soil is assigned to woodland ordination symbol 4R. The Rock outcrop is not assigned to a woodland ordination symbol.

98—Pits, quarries. This map unit occurs as areas that are or have been quarried for dolomitic limestone. It generally includes the quarry pits, stockpiles of lime and crushed rock, piles of overburden or spoil, equipment areas, and transport areas. Individual areas range from 5 to about 70 acres in size.

The active quarry pits are dry, but some of the abandoned ones contain water. Soil areas vary in composition. A few support a small amount of vegetation, primarily small hardwoods, annual weeds, and perennial grasses. Detailed onsite investigation is needed to determine the suitability of specific areas for any proposed uses.

No land capability classification or woodland ordination symbol is assigned.

99—Udorthents, clayey. These nearly level to steep soils are in open excavations from which soil material is or has been removed for use as fill on roads, railroads, or other construction sites. In places the excavations have nearly vertical faces. A few areas have no outlet and contain water, especially during wet periods. Most areas are 5 to 30 acres in size.

Typically, these soils are silty clay, clay, or the cherty or very cherty analogs of these textures.

Permeability generally is moderate to slow, but areas that have been compacted by machinery are very slowly permeable or impermeable. Surface runoff is medium in most areas, but it ranges from slow to rapid. Erosion is a moderate hazard in bare areas. In most places the available water capacity is low or very low because of the high content of coarse fragments and clay.

Most areas have reverted to natural vegetation, which consists of brush, weeds, and native grasses. A few areas have been seeded to cool-season grasses. Because of the high content of clay and coarse fragments, these soils generally are not suited to cultivated crops. They are moderately well suited to hay and pasture. The areas should be reshaped and seeded to drought-tolerant grasses. Because of the low fertility, applications of lime and fertilizer are needed.

These soils generally are unsuited to trees. The seedling mortality rate is high because of the low or very low available water capacity and low fertility.

These soils generally are unsuited to building site development. The limitations that affect urban uses can be overcome only by major reclamation measures.

No land capability classification or woodland ordination symbol is assigned.

Prime Farmland

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 and 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 inputs 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 Soil Conservation Service or the Cooperative Extension Service.

About 67,500 acres in Pulaski County, or 19 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in soil associations 1 and 5, which are described under the heading "General Soil Map Units." Most of the prime farmland is used for pasture and hay.

The map units in the survey area 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."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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 avoid 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 behavior 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 recreation 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

Robert T. Hagedorn, district conservationist, Soil Conservation Service, helped prepare this section.

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 Soil 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 "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Most of the soils in the survey area are used as pasture, hayland, or woodland. Row crops and small grain crops, mainly wheat, corn, soybeans, and grain sorghum, are regularly grown on only a few thousand acres.

The potential of the soils in Pulaski County for increased production of forage is good. The soils generally are suited to limited row cropping and are suitable as grazing land for beef and dairy cattle. This soil survey provides information that can greatly facilitate forage production and the selection of species that are suited to the various soils in the county.

Good management can greatly increase crop and pasture yields. The major hazards or limitations affecting the use of the soils for field crops or pasture are erosion, wetness, and droughtiness. On all of the soils, measures that conserve water, maintain or increase the organic matter content and fertility level, and preserve good tilth are needed.

High fertility levels increase the yields of grain and forage. The kind and amount of soil amendments needed to maintain or increase fertility levels can be determined by a soil test. A complete record of the kind and amount of fertilizer applied, the time of application, and the yields obtained is desirable.

Close-grown crops reduce the destructive impact of falling raindrops on the soil. Leaving large amounts of crop residue on the surface after harvest can increase the organic matter content and keep the soil porous, thereby increasing the water intake rate and the available water capacity. Leaving crop residue on or near the surface also helps to control runoff and erosion. The effectiveness of this measure depends on the amount of crop residue and the length of time that it is left on the surface. Thus, spring plowing, which allows residue to remain on the surface throughout the winter, is more effective than fall plowing, which leaves the surface bare. The use of tillage implements that leave the residue on the surface during the growing season is desirable.

A system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year helps to maintain good tilth, increases the rate of water infiltration, and reduces the susceptibility to erosion. Examples are chisel plowing and no-till planting.

If special management is applied, some soils can be intertilled year after year without excessive erosion. These include soils on bottom land and some nearly level soils on uplands. The special management needed in these intensively cropped areas generally involves maintaining fertility, managing crop residue, and applying a system of conservation tillage. This management is used in combination with grassed waterways, terraces, diversions, stripcropping, contour farming, or drainage systems on bottom land.

Many good stands of grass-legume pasture have been established in the survey area. Pasture renovation and improved management are needed to control erosion and to increase forage production. A good pasture generally can be established if lime and fertilizer are applied according to the results of a current soil test; a firm seedbed is prepared; the recommended amount of pure, live seed is planted and the seed is covered with 0.25 to 0.5 inch of soil; all legume seeds are inoculated with proper bacteria within 24 hours of planting; weeds are controlled until seedlings are well established; and newly seeded areas are not grazed until the root systems are well established. Only the adapted species of grasses and legumes should be planted. Seeding dates for the different species may vary.

Good pasture management results in the maximum production of forage, a good seasonal distribution of plant growth, and stands that are productive for long periods. It includes rotation grazing, restricted grazing during wet periods, measures that prevent overgrazing, selection of suitable forage species, measures that control brush and weeds, and applications of lime and fertilizer. If grazing is rotated, crossfencing and an adequate supply of water in each field are needed. If the plants are grazed too close to the ground, the stand is depleted and the extent of weeds is increased. Brush and weeds compete with the grasses and legumes for moisture, sunlight, and plant nutrients. As a result, they reduce the amount of available forage. They can be controlled by mowing or cutting and by spraying with chemicals.

Well managed pastures generally include mixtures of cool-season grasses and legumes, which are grazed during spring and fall. Seeding the legumes with the grasses increases the amount, palatability, and nutritional value of the forage. Tall fescue can be stockpiled for use by beef herds and nonproducing dairy cows in winter. Surplus spring growth of grasses and legumes can be baled and left in the field. This procedure extends the grazing season and helps to maintain the quality of the feed.

Native, warm-season grasses grow well in the county. Big bluestem, switchgrass, and indiangrass are tall grasses that formerly grew on small, isolated prairies throughout the county. Warm-season grasses can meet the need for good-quality summer forage when cool-season plants are dormant. Fields of warm-season grasses should be separated from fields of cool-season grasses. Prescribed burning can help to control undesirable vegetation and improve the quality and quantity of warm-season grasses, but it generally is not necessary more often than once every 3 to 5 years. The pasture should be burned only when a specific management objective is to be met.

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 of each map unit 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 are also 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 Soil 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 and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*10*). 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 that restrict their use.

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

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

Class IV soils have very severe limitations 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 that make them generally unsuitable for cultivation.

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

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

There are no class I, class V, or class VIII soils in Pulaski 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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); 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 subclass indicated by *w* 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 each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Woodland is one of the dominant land uses in Pulaski County. It is important to the local economy.

The primary cover type is the oak-hickory forest, but the county has some areas of oak-pine or pine forest and some areas of hardwoods on bottom land. The major tree species are white oak, post oak, black oak, blackjack oak, and hickories. The oak-pine cover type has the same species as the oak-hickory forest, but it also includes shortleaf pine.

The Clarksville-Gepp, Viraton-Clarksville-Doniphan, Poynor-Ocie-Gunlock, and Lebanon-Plato soil associations, which are on uplands, are dominated by the oak-hickory forest. Shortleaf pine has been planted in areas of the Clarksville-Gepp, Viraton-Clarksville-Doniphan, and Lebanon-Plato associations.

The more productive upland sites tend to be areas of moist, deep soils at the base of north- and east-facing slopes. White oak, northern red oak, and scattered black walnut are more dominant on these sites than on other sites. The less productive upland sites generally are on ridgetops, in areas where a fragipan or bedrock restricts the rooting depth, and on south- and west-facing slopes. Post oak, black oak, blackjack oak, and hickories are more dominant on these sites than on other sites. Lebanon, Plato, and Viraton soils have a fragipan. In areas where they are on south- and west-facing slopes, these soils are well suited to shortleaf pine (fig. 10).

Eastern redcedar is a common species on the shallow Gasconade soils in glades. Other species on these sites are chinkapin oak, blackjack oak, post oak, winged elm, and white ash. The stands commonly are thin, and the openings support many native grasses, such as little bluestem, sideoats grama, and indiangrass, and many wild flowers, such as eveningprimrose, prairie dock, and pricklypear.

Some areas of the Nolin-Huntington-Kickapoo association support the timber species that typically grow on bottom land. These are highly productive sites for such species as black walnut, white ash, eastern cottonwood, sycamore, hackberry, and soft maple.

Much of the woodland in Pulaski County has been subject to frequent fires and to grazing by livestock. This past treatment seriously hindered the establishment of the better quality species, such as white oak and northern red oak, and increased the extent of the lower quality species that could withstand this treatment. Thus, on many of the sites, post oak, blackjack oak, and hickories are more extensive than they would be on well managed sites. The forest is recovering, and such

Figure 10.—Pine trees on Lebanon silt loam, 2 to 5 percent slopes.

management as timber stand improvement and proper harvesting can decrease the time required to make the forest productive.

Table 7 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. The table 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, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also 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 or season of use is 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 on 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 is the dominant species on the soil and the one that determines the ordination class.

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

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 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 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 Soil Conservation Service, the Missouri Department of Conservation, or the Cooperative Extension Service or from a commercial nursery.

Recreation

Edward A. Gaskins, biologist, Soil Conservation Service, helped prepare this section.

A total of 115,044 acres in Pulaski County is used for recreational development (*8*). Ownership of this land is 99 percent federal and 1 percent private, municipal, county, and school. The recreational areas occur as swimming and canoeing areas (fig. 11), hunting and fishing areas, camping areas, trails, game courts, ball fields, picnic areas, play areas, a historical site, and wildlife-viewing areas.

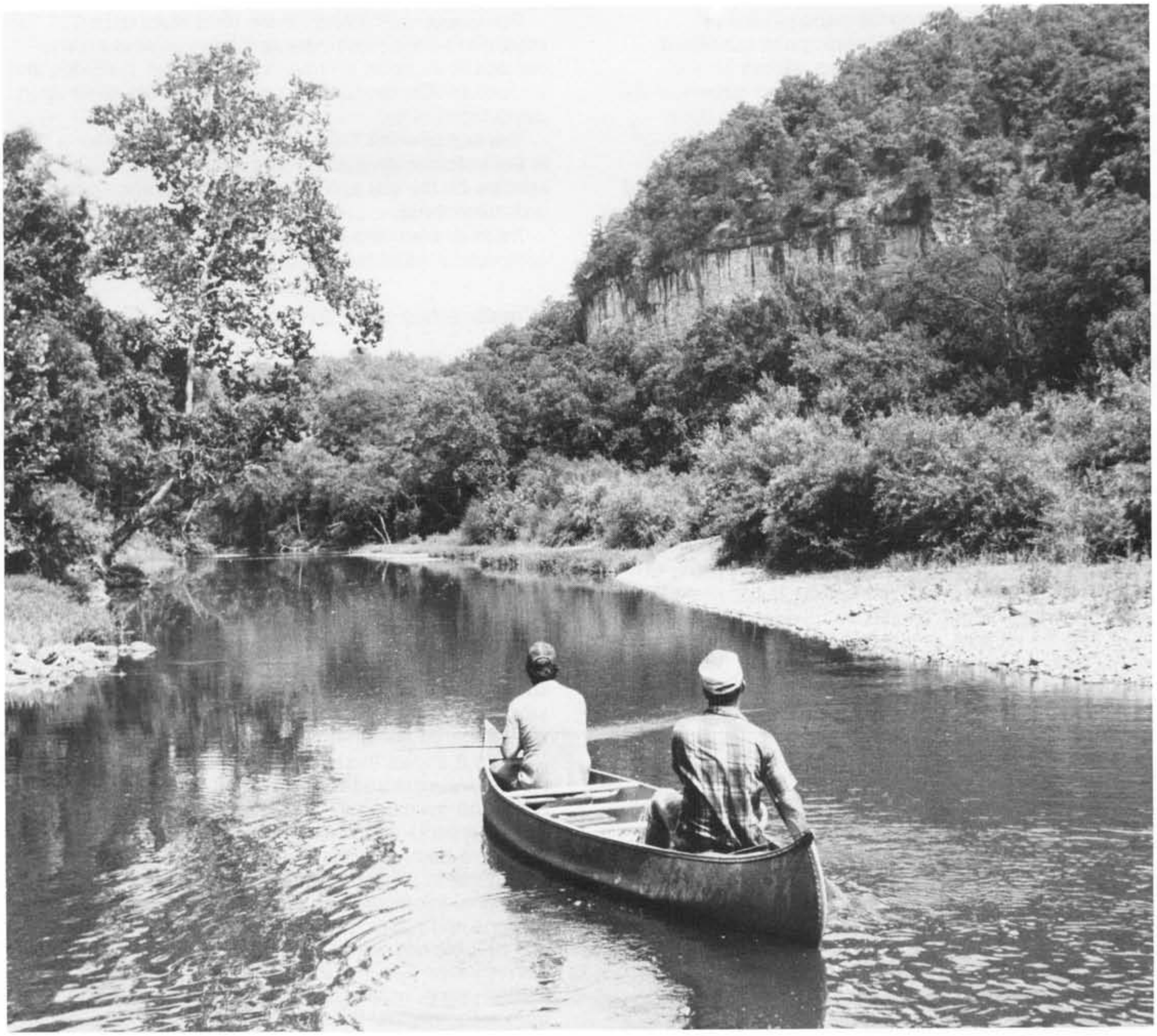


Figure 11.—Canoeing is a popular recreational activity in Pulaski County.

The county has only two recreational areas that are more than 100 acres in size. These are the Mark Twain National Forest, which is more than 44,000 acres, and Fort Leonard Wood, which is more than 60,000 acres. Most of the land available for recreational uses in the county is in these areas. There are 10 state-owned recreational areas, which range from stream access sites to natural history areas. The county has five small city parks.

The county has 14 private and semiprivate commercial recreation enterprises (*7*). They include a golf course, church camps, trail rides, a racetrack, campgrounds, and pay fishing lakes. Additional campgrounds and fishing lakes are the kinds of recreation areas most needed in the county.

The soils of the survey area are rated in table 9 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 sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, 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 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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 have gentle slopes 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

Edward A. Gaskins, biologist, Soil Conservation Service, helped prepare this section.

Pulaski County is one of 24 counties that make up the Ozark Plateau Zoogeographic Region in Missouri (*6*). The distribution of habitat elements generally favors woodland wildlife, but habitat for openland species also is available in the county. About 2 percent of the county is cultivated cropland, 35 percent is permanent grassland, and 57 percent is woodland, which includes areas that support shrubs and brush. The rest of the county is urban land or other land. The population of nongame wildlife, such as songbirds, is good to excellent throughout the county.

Grazing of woodland is the major problem affecting the wildlife resource. Though currently less common than it was in the past, the traditional practice of burning woodland in the spring still adversely affects the quality of the habitat.

Most of the woodland is in areas of the Clarksville-Gepp, Poynor-Ocie-Gunlock, and Viraton-Clarksville-Doniphan soil associations, which are described under the heading "General Soil Map Units." Parts of the other associations in the county also provide habitat for woodland wildlife. The deer population is good, and the carrying capacity for this big game animal has not yet been reached. The turkey population is good to excellent. It is increasing as this species is expanding into the available range. Depending on the amount of available mast, the squirrel population usually is excellent. Hunting pressure on this animal is light to moderate. The county has a good resident population of woodcock in special habitats. There are excellent spring and fall migratory flights of this species into the county.

The overall furbearer population is good throughout much of the county. Because of a decline in fur prices, trapping pressure has been somewhat reduced, but it is still strong. The most frequently harvested furbearers are raccoon, muskrat, opossum, fox, beaver, coyote, mink, and striped skunk. The population of bobcat is fair. An experimental stocking of ruffed grouse is planned for the future in the Fort Leonard Wood area.

Most of the openland habitat in the county is in areas of the Nolin-Huntington-Kickapoo and Lebanon-Plato associations. The chief grain crops are corn, grain sorghum, soybeans, and wheat. A reduction in the extent of fall plowing on cropland is needed. A system of conservation tillage leaves a protective cover of crop residue and waste grain on the surface after harvest. As a result, it provides additional winter food and limited cover for wildlife.

The population of bobwhite quail currently is poor or fair because of the scarcity of cultivated cropland. Some good habitat for this species is available in the Nolin-Huntington-Kickapoo association and in a few other areas. The rabbit population is good to excellent, and hunting pressure on this popular game animal is heavy. A fair population of mourning doves inhabits the bottom land in the county. A lack of migratory flights helps to keep hunting pressure on this game bird very light.

The county has virtually no wetland habitat. Certain rivers and streams, such as the Big Piney River and the upper reaches of Roubidoux Creek, provide some habitat for wood ducks and blue-winged teal. A few Canada geese frequent the bottom land along certain rivers each year. The Nolin-Huntington-Kickapoo association is the only association that has some small areas of wetland. The county has several rookeries for great blue heron.

Fishing opportunities are provided by rivers, streams, lakes, and farm ponds. The county has 123 miles of permanent streams (*5*). The most important public fishing areas are the Gasconade and Big Piney Rivers and Roubidoux Creek. These waters contain largemouth and smallmouth bass, channel catfish, bullheads, paddlefish, crappie, carp, suckers, walleye, and sunfish. Trout are released at two locations near the Big Piney River and Roubidoux Creek.

Opportunities for lake fishing are limited. Two small impoundments in the Fort Leonard Wood area and Manning's Lake are the primary lakes available to the general public. Several small abandoned gravel pits in the Mark Twain National Forest also are used for fishing. The county has about 250 private farm ponds and small lakes, which have been stocked with largemouth bass, channel catfish, and bluegill.

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 10, 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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, soybeans, and grain sorghum.

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 soil, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bluegrass, switchgrass, orchardgrass, clover, alfalfa, indiangrass, trefoil, and crownvetch.

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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, ragweed, beggarweed, foxtail, croton, 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 hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, sumac, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, persimmon, and sassafras. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are wild plum, Amur honeysuckle, hazelnut, autumn-olive, and crabapple.

Coniferous plants furnish winter cover, 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 pine, spruce, fir, cedar, 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, wildrice, cutgrass, cattail, rushes, sedges, and reeds.

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. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, mourning dove, 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, and deer.

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, 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. The ratings are given in the following tables: 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 need to 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, soil reaction, depth to bedrock, hardness of bedrock within 5 to 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 absorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) 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 11 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 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 the 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, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 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, 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), shrink-swell potential, frost action potential, 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, 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 12 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 12 also shows the suitability of the soils for use as daily cover for landfills. 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, and flooding affect absorption of the effluent. Large stones and bedrock 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 12 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, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of 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. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock 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 needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, soil reaction, and content of salts and sodium affect trench type 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 type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse 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 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.

Construction Materials

Table 13 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 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 shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, 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 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 the depth to the water table is 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. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, 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 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 14 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 of 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 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; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. 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 reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock 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 affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

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 classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

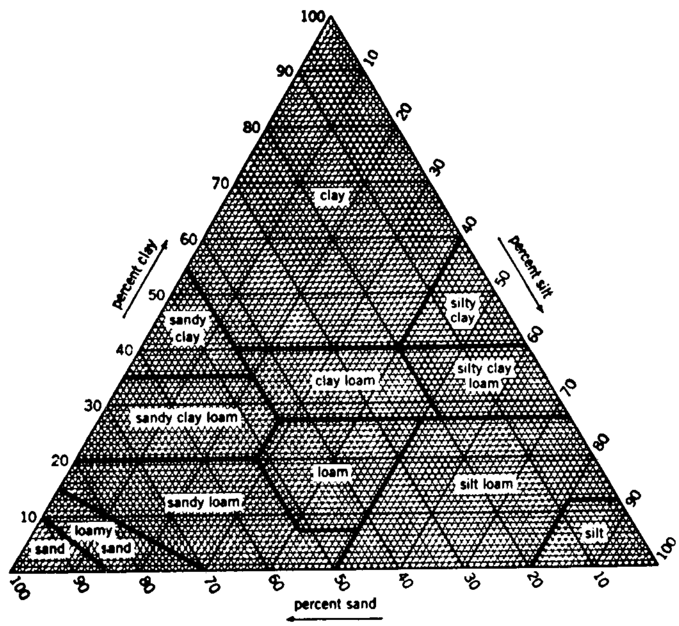


Figure 12.—Percentages of sand, clay, and silt in the basic USDA soil textural classes.

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, "cherty." Textural terms are defined in the Glossary.

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 absorb 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 1/3 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.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

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 of 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 intake 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.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. 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.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

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 is also 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

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). 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 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten 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 Alfisol.

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 Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

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 Fragiudalf (*Fragi*, meaning fragipan, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

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. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fragiudalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly 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 fine-loamy, siliceous, mesic Typic Fragiudalfs.

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

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* (*9*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*11*). 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."

Bardley Series

The Bardley series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 14 to 35 percent.

Typical pedon of Bardley very cherty silt loam, in an area of Gepp-Bardley-Clarksville very cherty silt loams, 14 to 35 percent slopes; 2,500 feet south and 2,900 feet west of the northeast corner of sec. 1, T. 36 N., R. 11 W.

A—0 to 4 inches; brown (10YR 4/3) very cherty silt loam, very pale brown (10YR 7/3) dry; weak very fine granular structure; very friable; many fine and few coarse roots; about 40 percent chert fragments; slightly acid; clear smooth boundary.

E—4 to 7 inches; pale brown (10YR 6/3) very cherty silt loam; weak very fine granular structure; very friable; many fine and few coarse roots; about 40 percent chert fragments; slightly acid; clear smooth boundary.

2Bt1—7 to 11 inches; red (2.5YR 4/6) silty clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine and medium roots; common distinct clay films on faces of peds; about 5 percent chert fragments; strongly acid; clear smooth boundary.

2Bt2—11 to 23 inches; red (2.5YR 4/6) clay; common medium distinct red (2.5YR 4/8) mottles; moderate fine subangular blocky structure; firm; common fine and medium roots; common distinct clay films on faces of peds; about 5 percent chert fragments; strongly acid; gradual smooth boundary.

2Bt3—23 to 33 inches; red (2.5YR 4/6) clay; common medium prominent strong brown (7.5YR 5/6) and common fine distinct red (2.5YR 4/8) mottles; weak very fine and fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; about 12 percent chert fragments; medium acid; clear smooth boundary.

2C—33 to 36 inches; strong brown (7.5YR 5/6) clay loam; common medium distinct yellowish red (5YR 4/6) mottles; massive; very firm; few coarse roots; common fine stains of manganese oxide; few fine dolomite fragments; moderately alkaline; abrupt smooth boundary.

2R—36 inches; hard dolomite limestone.

The depth to bedrock ranges from 20 to 40 inches. The content of chert ranges from 35 to 70 percent in the A and E horizons. It averages less than 35 percent in the B horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It dominantly is very cherty silt loam, but the range includes extremely cherty silt loam.

The Bt horizon has hue of dominantly 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Directly above the lithic contact, this horizon has hue of 7.5YR or redder. It is silty clay, clay, or the cherty analogs of these textures.

The C horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 6. It ranges from sand to clay loam. It commonly is 2 to 4 inches thick. Some pedons do not have a C horizon.

Cedargap Series

The Cedargap series consists of deep, well drained or somewhat excessively drained soils on narrow flood plains along small streams. These soils formed in silty alluvium that has a high content of chert fragments. Permeability is moderately rapid. Slopes range from 0 to 3 percent.

Typical pedon of Cedargap cherty silt loam, 0 to 3 percent slopes, 10 feet south and 2,200 feet east of the northwest corner of sec. 36, T. 37 N., R. 13 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) cherty silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; many fine roots; about 20 percent chert fragments; neutral; clear smooth boundary.

A2—6 to 16 inches; very dark brown (10YR 2/2) very cherty silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; many fine roots; about 55 percent chert fragments; neutral; clear smooth boundary.

A3—16 to 29 inches; black (10YR 2/1) very cherty silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; about 40 percent chert fragments; slightly acid; gradual smooth boundary.

C1—29 to 42 inches; dark brown (7.5YR 4/4) extremely cherty silty clay loam; common fine distinct dark brown (10YR 4/3) mottles; moderate fine subangular blocky structure; friable; few fine roots; about 65 percent chert fragments; slightly acid; gradual smooth boundary.

C2—42 to 60 inches; dark brown (7.5YR 4/4) extremely cherty silty clay loam; common fine distinct dark brown (7.5YR 4/2) and few fine distinct strong brown (7.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; firm; about 65 percent chert fragments; slightly acid.

The thickness of the solum and of the mollic epipedon ranges from 24 to 44 inches. The depth to bedrock is more than 60 inches. The content of chert between depths of 10 and 40 inches is 35 to 85 percent.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. It is the cherty to extremely cherty analogs of silt loam or loam.

The C horizon has hue of 10YR or 7.5YR, value of 2 to 5, and chroma of 1 to 4. It is the cherty to extremely cherty analogs of silt loam, loam, silty clay loam, or clay loam.

Claiborne Series

The Claiborne series consists of deep, well drained, moderately permeable soils on foot slopes and stream terraces. These soils formed in local alluvium or in cherty dolomite and sandstone residuum. Slopes range from 2 to 9 percent.

Typical pedon of Claiborne silt loam, 5 to 9 percent slopes, 1,800 feet north and 1,850 feet east of the southwest corner of sec. 13, T. 37 N., R. 12 W.

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; many very fine roots; strongly acid; clear smooth boundary.

BA—6 to 10 inches; strong brown (7.5YR 5/6) silt loam; weak very fine subangular blocky structure; friable; common very fine roots; common very fine vesicular pores; very strongly acid; clear smooth boundary.

Bt1—10 to 21 inches; yellowish red (5YR 4/6) cherty silty clay loam; moderate fine and very fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few stains and fine concretions of manganese oxide; about 20 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt2—21 to 37 inches; yellowish red (5YR 4/6) cherty silty clay loam; common fine faint yellowish red (5YR 5/8) mottles; moderate fine and very fine subangular blocky structure; firm; few distinct clay films on faces of peds; few stains and fine concretions of manganese oxide; about 15 percent chert fragments; very strongly acid; clear smooth boundary.

Bt3—37 to 52 inches; yellowish red (5YR 4/6) cherty silty clay loam; few fine distinct dark red (2.5YR 3/6) and few fine prominent pale brown (10YR 6/3) mottles; moderate fine subangular blocky structure; firm; few distinct clay films on faces of peds; about 30 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt4—52 to 60 inches; strong brown (7.5YR 4/6) and yellowish red (5YR 4/6) very cherty silty clay loam; common fine prominent gray (10YR 6/1) mottles; weak fine subangular blocky structure; firm; few distinct clay films on faces of peds; about 45 percent chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A horizon has chroma of 3 or 4. The BA horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The Bt horizon also has value of 4 or 5 and chroma of 4 to 6. It is silty clay loam, cherty silty clay loam, or very cherty silty clay loam.

Clarksville Series

The Clarksville series consists of deep, somewhat excessively drained soils on uplands. These soils formed in cherty dolomite residuum. Permeability is moderately rapid throughout the profile or moderately rapid in the upper part of the profile and moderate in the lower part. Slopes range from 3 to 35 percent.

Typical pedon of Clarksville very cherty silt loam, 3 to 9 percent slopes, 1,700 feet west and 1,000 feet south of the northeast corner of sec. 19, T. 37 N., R. 11 W.

A—0 to 2 inches; grayish brown (10YR 5/2) very cherty silt loam, light gray (10YR 7/2) dry; weak very fine granular structure; very friable; common very fine roots; about 45 percent chert fragments; very strongly acid; abrupt smooth boundary.

E—2 to 13 inches; pale brown (10YR 6/3) very cherty silt loam; weak very fine subangular blocky structure; friable; common very fine, fine, and coarse roots; about 55 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt1—13 to 22 inches; light brown (7.5YR 6/4) extremely cherty silt loam; weak fine and very fine subangular blocky structure; friable; few very fine and medium roots; common very fine pores; few distinct clay films in pores; common distinct silt coatings on faces of peds and in pores; about 70 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—22 to 35 inches; strong brown (7.5YR 5/6) extremely cherty silty clay loam; common medium prominent red (2.5YR 4/6) and common fine distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; firm; few very fine and medium roots; common very fine pores; few distinct clay films on faces of peds; about 75 percent chert fragments; very strongly acid; clear smooth boundary.

Bt3—35 to 47 inches; red (2.5YR 4/6) and reddish brown (5YR 5/4) extremely cherty silty clay; moderate fine subangular blocky structure; firm; few very fine and medium roots; common fine pores; common distinct clay films on faces of peds and in pores; few fine stains of manganese oxide; about 65 percent chert fragments; very strongly acid; gradual wavy boundary.

Bt4—47 to 60 inches; red (2.5YR 5/6) extremely cherty silty clay; mottled in shades of red and reddish brown; moderate fine subangular blocky structure; firm; few very fine and medium roots; common fine pores; common distinct clay films on faces of peds and in pores; few stains of manganese oxide; about 65 percent chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The coarse fragments mainly are chert, but some are sandstone. They generally range from 2 millimeters to about 4 inches in size, but some are larger. In some small areas, stones cover 3 to 10 percent of the surface.

The A horizon has value of 2 to 6 and chroma of 1 to 3. The E horizon has value of 4 to 7 and chroma of 2 or 3. The A and E horizons are dominantly very cherty or extremely cherty silt loam, but coarse cherty silt loam is within the range.

The Bt horizon has hue of 7.5YR to 2.5YR and value and chroma of 4 to 6. It is the very cherty or extremely cherty analogs of silt loam, silty clay loam, and silty clay.

Doniphan Series

The Doniphan series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and in dolomite residuum. Slopes range from 3 to 14 percent.

Typical pedon of Doniphan very cherty silt loam, 3 to 9 percent slopes, 900 feet north and 1,490 feet east of the southwest corner of sec. 23, T. 35 N., R. 13 W.

A—0 to 2 inches; dark grayish brown (10YR 4/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; many fine roots; about 40 percent chert fragments; very strongly acid; clear smooth boundary.

E—2 to 11 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak very fine granular structure; friable; common fine roots; about 55 percent chert fragments; very strongly acid; clear smooth boundary.

B/E—11 to 15 inches; strong brown (7.5YR 5/6) silty clay loam (Bt); about 10 percent light yellowish brown (10YR 6/4) silt loam (E); weak fine subangular blocky structure; firm; few fine roots; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt1—15 to 22 inches; yellowish red (5YR 4/6) clay; common fine faint yellowish red (5YR 5/6) and common fine distinct dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; very firm; few fine roots; few distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Bt2—22 to 41 inches; red (2.5YR 4/6) clay; common fine distinct yellowish red (5YR 5/6) and few fine prominent light brown (7.5YR 6/4) mottles; moderate fine and medium subangular blocky structure; very firm; few fine roots; few distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt3—41 to 60 inches; dark red (2.5YR 3/6) clay; common fine prominent yellowish red (5YR 5/8) and gray (10YR 6/1) mottles; moderate fine subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert is 35 to 75 percent in the A and E horizons and 0 to about 30 percent in the Bt horizon. The upper 20 inches of the argillic horizon has a clay content of 48 to 70 percent.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 3 or 4.

The Bt part of the B/E horizon and the 2Bt horizon have hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 4 to 8. The lower part of the 2Bt horizon commonly has mottles in shades of gray. It is silty clay, clay, or the cherty analogs of these textures. Some pedons do not have a B/E horizon.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in dolomite residuum. Permeability is moderately slow. Slopes range from 2 to 20 percent.

Typical pedon of Gasconade flaggy silty clay loam, in an area of Gasconade-Rock outcrop complex, 2 to 20 percent slopes, 1,000 feet north and 600 feet east of the southwest corner of sec. 31, T. 38 N., R. 13 W.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; many fine roots; about 30 percent chert and dolomite fragments; neutral; clear smooth boundary.

Bw—7 to 18 inches; dark brown (7.5YR 4/4) very flaggy silty clay; common fine distinct dark yellowish brown (10YR 3/4) and common fine distinct dark brown (7.5YR 4/2) mottles; weak fine subangular blocky structure; firm; common fine roots; few stains and fine concretions of manganese oxide; about 40 percent chert and dolomite fragments; mildly alkaline; abrupt smooth boundary.

R—18 inches; hard cherty dolomite bedrock.

The thickness of the solum and the depth to bedrock are about 4 to 20 inches. The content of dolomite and chert fragments is 35 to 60 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is the flaggy or cherty analogs of silty clay loam or clay loam.

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is the very flaggy or very cherty analogs of silty clay, clay, or clay loam.

Gatewood Series

The Gatewood series consists of moderately deep, moderately well drained, slowly permeable soils on uplands. These soils formed in cherty sediments and in dolomite residuum. Slopes range from 5 to 14 percent.

Typical pedon of Gatewood cherty silt loam, 5 to 9 percent slopes, 2,640 feet north and 600 feet east of the southwest corner of sec. 26, T. 38 N., R. 12 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) cherty silt loam, gray (10YR 6/1) dry; weak very fine granular structure; very friable; many fine and medium roots; about 30 percent chert fragments; medium acid; clear smooth boundary.

E—3 to 9 inches; pale brown (10YR 6/3) very cherty silt loam; weak fine granular structure; very friable; many fine and medium roots; about 45 percent chert fragments; strongly acid; clear smooth boundary.

2Bt1—9 to 16 inches; yellowish brown (10YR 5/6) clay; common fine prominent red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; few distinct clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt2—16 to 22 inches; yellowish brown (10YR 5/4) clay; common fine prominent yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; very firm; common fine roots; many fine clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt3—22 to 30 inches; yellowish brown (10YR 5/4) clay; common fine faint yellowish brown (10YR 5/6) and common fine prominent yellowish red (5YR 4/6) mottles; weak fine and medium subangular blocky structure; very firm; few fine roots; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

2C—30 to 35 inches; light brownish gray (2.5Y 6/2) cherty clay; many medium prominent brownish yellow (10YR 6/6) and common fine prominent strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; very firm; few fine roots; about 15 percent weathered dolomite fragments; neutral; abrupt smooth boundary.

2R—35 inches; hard dolomite bedrock.

The depth to bedrock is 20 to 40 inches. The content of chert is 15 to 75 percent in the A and E horizons. The content of chert and dolomite fragments commonly is 5 to 30 percent in the subsoil. Mottles with high chroma are common in the lower part of the subsoil.

The A and E horizons have value of 2 to 6 and chroma of 1 to 4. They are cherty or very cherty silt loam. The 2Bt horizon has hue of 10YR to 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is silty clay, clay, or the cherty analogs of these textures. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is clay or cherty clay.

Gepp Series

The Gepp series consists of deep, well drained, moderately permeable soils on side slopes and benches in the uplands. These soils formed in cherty sediments and in dolomite residuum. Slopes range from 14 to 60 percent.

Typical pedon of Gepp very cherty silt loam, in an area of Gepp-Bardley-Clarksville very cherty silt loams, 14 to 35 percent slopes, 2,450 feet south and 2,750 feet west of the northeast corner of sec. 1, T. 36 N., R. 11 W.

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

E—3 to 10 inches; pale brown (10YR 6/3) very cherty silt loam; weak very fine granular structure; friable; few fine and medium roots; about 45 percent chert fragments; strongly acid; clear smooth boundary.

2Bt1—10 to 15 inches; yellowish red (5YR 5/6) clay; many medium distinct red (2.5YR 4/6) and few fine distinct strong brown (7.5YR 4/6) mottles; weak 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 fragments; very strongly acid; clear smooth boundary.

2Bt2—15 to 25 inches; yellowish red (5YR 5/6) clay; many medium distinct red (2.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; firm; few fine and medium roots; common distinct clay films on faces of peds; about 5 percent chert fragments; strongly acid; clear smooth boundary.

2Bt3—25 to 34 inches; red (2.5YR 4/6) and yellowish red (5YR 5/6) clay; moderate fine and medium subangular blocky structure; firm; few fine and medium roots; common distinct clay films on faces of peds; about 12 percent chert fragments; strongly acid; clear smooth boundary.

2Bt4—34 to 47 inches; red (2.5YR 4/8) clay; common fine distinct yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; about 10 percent chert fragments; strongly acid; clear smooth boundary.

2Bt5—47 to 60 inches; strong brown (7.5YR 5/6) cherty clay; few medium faint strong brown (7.5YR 4/6) and common fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; few faint clay films on faces of peds; about 30 percent chert fragments; an extremely cherty lens in the top part; strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The content of chert is 20 to 65 percent in the A and E horizons and 0 to 35 percent in the 2B horizon. It averages less than 35 percent in the control section. In some pedons the lower part of the B horizon has lenses that are more than 60 percent chert.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 2 to 4. The A and E horizons are very cherty silt loam.

The upper part of the 2Bt horizon has hue of 5YR or 7.5YR and chroma of 6 to 8. The lower part has hue of 7.5YR, value of 5, and chroma of 6 or hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 6 to 8.

Gunlock Series

The Gunlock series consists of deep, moderately well drained soils on uplands and terraces. These soils formed in a thin mantle of loess or silty sediments and in the underlying dolomite residuum. Permeability is moderately slow. Slopes range from 3 to 9 percent.

Typical pedon of Gunlock silt loam, 3 to 9 percent slopes, 1,015 feet north and 1,220 feet east of the southwest corner of sec. 23, T. 37 N., R. 13 W.

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

Bt1—5 to 13 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; many fine and medium roots; few faint clay films on faces of peds; few fine dark soft masses of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—13 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; few medium dark soft masses of iron and manganese oxide; medium acid; clear smooth boundary.

Bt3—18 to 25 inches; brown (10YR 5/3) silty clay; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; about 10 percent chert fragments; medium dark soft masses of iron and manganese oxide; slightly acid; gradual smooth boundary.

2Btx1—25 to 32 inches; grayish brown (10YR 5/2) cherty silty clay loam; many medium prominent yellowish brown (10YR 5/8) and common fine prominent strong brown (7.5YR 4/6) mottles; weak thick platy structure parting to weak fine subangular blocky; firm and very firm; compact and moderately brittle; few fine roots; few faint clay films on faces of peds; common medium dark soft masses of iron and manganese oxide; about 15 percent chert fragments; medium acid; clear smooth boundary.

2Btx2—32 to 43 inches; yellowish brown (10YR 5/6) silty clay loam; many medium prominent grayish brown (10YR 5/2) mottles; weak thick platy structure parting to weak fine subangular blocky; firm and very firm; compact and moderately brittle; few fine roots; few distinct clay films on faces of peds; common medium black soft masses of iron and manganese oxide; about 10 percent chert fragments; medium acid; gradual smooth boundary.

3Bt1—43 to 55 inches; yellowish brown (10YR 5/6) extremely cherty silty clay loam; many medium prominent light gray (10YR 6/1) mottles; moderate fine subangular blocky structure; firm; few distinct clay films on faces of peds; common medium black soft masses of iron and manganese oxide; about 70 percent chert fragments; very strongly acid; gradual smooth boundary.

3Bt2—55 to 73 inches; yellowish brown (10YR 5/8) cherty silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; common faint clay films on faces of peds; common fine black soft masses of iron and manganese oxide; about 30 percent chert fragments; very strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to bedrock is more than 60 inches but commonly less than 100 inches. The depth to the 2Bx horizon ranges from 20 to 34 inches.

The Ap or A horizon has value of 4 to 6 and chroma of 2 to 5. The content of coarse fragments in these horizons is less than 10 percent. The E horizon, if it occurs, has value of 5 or 6 and chroma of 3 to 6. It has a content of coarse fragments similar to that of the A horizon.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. In some pedons it has mottles with value of 4 or more and chroma of 2 or less in the lower part. It is silty clay or silty clay loam. The content of coarse fragments in this horizon is 0 to 15 percent.

The 2Btx horizon is mottled. Its brittleness ranges from moderate to weak. This horizon is silt loam, silty clay loam, or the cherty or very cherty analogs of these textures. The content of coarse fragments is 10 to 50 percent.

The 3Bt horizon has mottles with hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam, silty clay, clay, or the cherty to extremely cherty analogs of these textures. The content of coarse fragments is 15 to 75 percent.

Hartville Series

The Hartville series consists of deep, somewhat poorly drained, slowly permeable soils on foot slopes and stream terraces. These soils formed in silty and clayey alluvium. Slopes range from 3 to 5 percent.

Typical pedon of Hartville silt loam, 2 to 5 percent slopes, 1,200 feet north and 200 feet east of the southwest corner of sec. 14, T. 37 N., R. 13 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; common fine prominent dark brown (7.5YR 4/4) mottles; weak very fine subangular blocky structure parting to weak fine granular; friable; common very fine roots; few very fine pores; few worm channels; common stains and fine concretions of manganese oxide; neutral; clear smooth boundary.

Bt1—7 to 13 inches; brown (10YR 5/3) silty clay loam; common fine prominent strong brown (7.5YR 5/6) and common medium distinct dark grayish brown (10YR 4/2) mottles; weak very fine subangular blocky structure; firm; common very fine roots; few faint clay films on faces of peds; few very fine pores; few worm casts; common stains and fine concretions of manganese oxide; medium acid; clear smooth boundary.

Bt2—13 to 22 inches; grayish brown (10YR 5/2) silty clay; common fine prominent red (2.5YR 4/8) and very fine prominent yellowish brown (10YR 5/8) mottles; moderate very fine subangular blocky structure; firm; few very fine roots; common faint clay films on faces of peds; few stains and fine concretions of manganese oxide; very strongly acid; clear smooth boundary.

Btg1—22 to 28 inches; gray (10YR 5/1) silty clay; common fine prominent red (2.5YR 4/8) mottles; moderate very fine subangular blocky structure; firm; few very fine roots; common faint clay films on faces of peds; few stains and fine concretions of manganese oxide; very strongly acid; clear smooth boundary.

Btg2—28 to 36 inches; gray (10YR 5/1) silty clay; many fine prominent yellowish red (5YR 5/8) and common fine prominent strong brown (7.5YR 5/8) mottles; moderate very fine subangular blocky structure; firm; common faint clay films on faces of peds; few fine stains and concretions of manganese oxide; about 10 percent fine chert fragments; medium acid; clear smooth boundary.

Btg3—36 to 50 inches; gray (10YR 5/1) silty clay; many fine prominent yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; few stains and fine concretions of manganese oxide; about 10 percent fine chert fragments; medium acid; clear smooth boundary.

BC—50 to 70 inches; yellowish brown (10YR 5/8) silty clay; many medium prominent grayish brown (10YR 5/2) and common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate very fine subangular blocky structure; firm; common stains and medium and coarse concretions of manganese oxide; about 10 percent fine chert fragments; medium acid.

The depth to bedrock is more than 60 inches. The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt1 horizon has value of 4 or 5 and chroma of 3 or 4. The Btg horizon has value of 4 to 6 and chroma of 1 or 2. It has mottles with hue of 10YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay loam or silty clay. The BC horizon has value of 4 to 6 and chroma of 3 to 8. It is silty clay, silty clay loam, clay, the cherty analogs of these textures.

Huntington Series

The Huntington series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Huntington silt loam, 500 feet east and 2,400 feet north of the southwest corner of sec. 14, T. 36 N., R. 12 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; many very fine and fine roots; many very fine pores and fine worm channels; medium acid; clear smooth boundary.

A—7 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; many very fine and fine roots; many very fine pores and many fine worm channels; slightly acid; clear smooth boundary.

Bw1—15 to 27 inches; dark brown (10YR 4/3) silt loam; dark brown (10YR 3/3) exteriors of peds; weak fine and medium subangular blocky structure; friable; common fine roots; many very fine pores and many fine worm channels; slightly acid; clear smooth boundary.

Bw2—27 to 51 inches; dark brown (10YR 4/3) silt loam; common fine faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; common fine roots; many very fine pores and many fine worm channels; slightly acid; clear smooth boundary.

2C—51 to 60 inches; dark brown (10YR 4/3) fine sandy loam; common fine faint yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; slightly acid.

The solum is more than 40 inches thick. The depth to bedrock is more than 60 inches. The thickness of the mollic epipedon is 10 to 24 inches.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It dominantly is silt loam, but the range includes loam. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The C horizon has colors similar to those of the B horizon. It is fine sandy loam, sandy loam, loam, or fine sand.

Kickapoo Series

The Kickapoo series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Kickapoo fine sandy loam, 0 to 3 percent slopes, 350 feet south and 575 feet east of the northwest corner of sec. 17, T. 35 N., R. 10 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; common fine faint dark brown (10YR 3/3) mottles; weak fine granular structure; friable; many very fine and fine roots; neutral; clear smooth boundary.

C1—4 to 18 inches; stratified dark brown (10YR 4/3) and yellowish brown (10YR 5/4) fine sandy loam; weak very thick platy structure parting to weak fine and medium granular; some evidence of horizontal cleavage; friable; few very fine and fine roots; slightly acid; clear smooth boundary.

C2—18 to 27 inches; stratified dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) fine sandy loam; weak very thick platy structure parting to weak fine granular; friable; few very fine and fine roots; slightly acid; gradual smooth boundary.

Ab—27 to 36 inches; very dark grayish brown (10YR 3/2) loam; common fine faint dark brown (10YR 4/3) mottles; weak fine subangular blocky structure; friable; few very fine roots; slightly acid; clear smooth boundary.

C3—36 to 60 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) sand; single grain; loose; slightly acid.

The depth to bedrock is more than 60 inches. The depth to the Ab horizon is 20 to 40 inches.

The A horizon has chroma of 1 or 2. It is fine sandy loam or loam. Some pedons have an Ap horizon. This horizon has value of 4 and chroma of 2 or 3.

The C horizon has value of 3 to 5 and chroma of 2 to 4. It is rather uniform fine sandy loam or loam or occurs as alternating layers or bands of silt, sandy loam, loamy sand, sand, and loam. In the control section, the content of clay is 12 to 18 percent and the content of fine sand or coarser sand is 40 to 70 percent.

The Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam, loam, or fine sandy loam. Some pedons do not have an Ab horizon.

Lebanon Series

The Lebanon series consists of deep, moderately well drained soils on uplands. These soils formed in a thin mantle of loess or silty sediments and in the underlying cherty dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in and below the fragipan. Slopes range from 2 to 9 percent.

Typical pedon of Lebanon silt loam, 2 to 5 percent slopes, 800 feet south and 2,800 feet west of the northeast corner of sec. 25, T. 35 N., R. 12 W.

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

BE—4 to 7 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure parting to weak fine granular; friable; few fine and common medium roots; very strongly acid; clear smooth boundary.

Bt1—7 to 14 inches; strong brown (7.5YR 4/6) silty clay loam; few fine prominent yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; firm; few fine and medium roots; very strongly acid; clear smooth boundary.

Bt2—14 to 21 inches; strong brown (7.5YR 5/6) silty clay; many fine prominent pale brown (10YR 6/3) mottles; moderate fine subangular blocky structure; firm; few fine and common medium roots; about 5 percent chert fragments; very strongly acid; clear smooth boundary.

2Ex—21 to 31 inches; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) very cherty silt loam; common medium faint gray (10YR 6/1) mottles; massive; very firm; brittle; few fine roots; about 55 percent chert fragments; very strongly acid; clear wavy boundary.

2Bx—31 to 39 inches; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) extremely cherty silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; about 70 percent chert fragments; very strongly acid; clear wavy boundary.

3Bt1—39 to 58 inches; reddish brown (5YR 4/4) clay; many medium prominent red (2.5YR 4/6) and common fine prominent dark red (2.5YR 3/6) mottles; moderate fine angular blocky structure; firm; about 5 percent chert fragments; very strongly acid; gradual wavy boundary.

3Bt2—58 to 72 inches; reddish brown (5YR 4/4) cherty clay; common fine prominent gray (10YR 6/1) and common fine prominent dark red (2.5YR 3/6) mottles; moderate fine angular blocky structure; firm; about 25 percent chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The depth to the fragipan is 20 to 24 inches. The content of chert ranges from 0 to 20 percent above the fragipan, from 10 to 70 percent in the fragipan, and from 5 to 30 percent below the fragipan.

The A horizon generally has value of 4 or 5 and chroma of 3 or 4. In undisturbed areas, however, it has value of 3 or 4 and chroma of 2 or 3. Some pedons have an E horizon. The BE horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam or silty clay.

The 2Ex and 2Bx horizons have value of 5 or 6 and chroma of 2 or 3. They have mottles with hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. They are the cherty to extremely cherty analogs of silt loam or silty clay loam.

The 3Bt horizon has hue of 10YR to 2.5YR, value of 3 to 5, and chroma of 4 to 8. It is silty clay, clay, or the cherty to extremely cherty analogs of these textures.

Moniteau Series

The Moniteau series consists of deep, poorly drained soils on low stream terraces. These soils formed in silty alluvium. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Moniteau silt loam, 1,600 feet north and 1,900 feet east of the southwest corner of sec. 31, T. 36 N., R. 11 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak very fine granular structure; friable; many fine roots; common stains and fine concretions of manganese oxide; strongly acid; clear smooth boundary.

E—8 to 20 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak very fine subangular blocky; friable; common very fine and fine roots; common vesicular pores; common stains and fine concretions of manganese oxide; strongly acid; clear smooth boundary.

Btg1—20 to 25 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent dark yellowish brown (10YR 4/6) mottles; weak very fine and fine subangular blocky structure; firm; few very fine and fine roots; few faint clay films on faces of peds and in root channels; light brownish gray (10YR 6/2) silt coatings on peds; common stains and fine concretions of manganese oxide; very strongly acid; clear smooth boundary.

Btg2—25 to 35 inches; grayish brown (10YR 5/2) silty clay loam; common medium faint gray (10YR 5/1) and common medium prominent dark yellowish brown (10YR 4/6) mottles; weak very fine and fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds and in root channels; light brownish gray (10YR 6/2) silt coatings on peds; common stains and fine concretions of manganese oxide; very strongly acid; gradual smooth boundary.

Btg3—35 to 45 inches; grayish brown (10YR 5/2) silty clay loam; common medium faint gray (10YR 5/1) and common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate very fine and fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds and in root channels; light brownish gray (10YR 6/2) silt coatings on peds; common stains and fine concretions of manganese oxide; strongly acid; clear smooth boundary.

Btg4—45 to 60 inches; gray (10YR 5/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak very fine subangular blocky structure; firm; common faint clay films on faces of peds; common stains and fine concretions of manganese oxide; slightly acid; clear smooth boundary.

Cg—60 to 68 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; common stains and fine concretions of manganese oxide; slightly acid.

The solum is commonly more than 60 inches thick. The upper 20 inches of the argillic horizon has a clay content of 27 to 35 percent. The content of sand ranges from 5 to 15 percent throughout the Bt horizon.

The Ap horizon has value of 4 or 5 and chroma of 2. The E horizon has value of 5 or 6. The Bt and C horizons have value of 4 or 5 and chroma of 1 or 2. The Bt horizon has mottles with higher chroma. The C horizon is silt loam or silty clay loam.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Nolin silt loam, 2,000 feet north and 500 feet west of the southeast corner of sec. 15, T. 36 N., R. 12 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak very fine and fine granular structure; very friable; many fine and medium roots; common very fine pores; few fine worm casts; slightly acid; gradual smooth boundary.

Bw1—9 to 28 inches; yellowish brown (10YR 5/4) silt loam; many fine distinct dark brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; friable; common fine roots; common very fine pores; few fine worm casts; medium acid; gradual smooth boundary.

Bw2—28 to 39 inches; dark brown (7.5YR 4/4) silt loam; many fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; few very fine roots; common very fine pores; few fine worm casts; common distinct silt coatings on faces of peds; medium acid; gradual smooth boundary.

Bw3—39 to 63 inches; dark brown (7.5YR 4/4) silt loam; common fine distinct strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; friable; few very fine roots; common very fine pores; common distinct silt coatings on faces of peds; common stains and fine concretions of manganese oxide; medium acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam.

Ocie Series

The Ocie series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 5 to 14 percent.

Typical pedon of Ocie cherty silt loam, 9 to 14 percent slopes, 2,620 feet east and 1,000 feet south of the northwest corner of sec. 27, T. 35 N., R. 13 W.

A--0 to 2 inches; dark brown (10YR 4/3) cherty silt loam, light brownish gray (10YR 6/2) dry; weak very fine and fine granular structure; very friable; many very fine and fine roots; about 25 percent chert fragments; strongly acid; clear smooth boundary.

E—2 to 9 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak thin platy structure parting to weak fine granular; friable; many very fine and fine roots; about 40 percent chert fragments; strongly acid; clear smooth boundary.

Bt1—9 to 17 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak fine subangular blocky structure; firm; few faint clay films on faces of peds; many very fine and fine roots; common distinct silt coatings on chert fragments and faces of peds; about 55 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt2—17 to 29 inches; yellowish brown (10YR 5/8) clay; common fine prominent strong brown (7.5YR 5/6) and common fine prominent yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very firm; few very fine and fine roots; common distinct clay films on faces of peds; few stains and fine concretions of manganese oxide; strongly acid; gradual smooth boundary.

2Bt3—29 to 41 inches; yellowish brown (10YR 5/6) clay; common fine faint yellowish brown (10YR 5/8 and 5/4) mottles; weak medium subangular blocky structure; very firm; few very fine and fine roots; common distinct clay films on faces of peds; few stains and fine concretions of manganese oxide; medium acid; gradual smooth boundary.

2C—41 to 46 inches; olive brown (2.5Y 4/4) clay; about 20 percent white (10YR 8/2) soft weathered dolomite; very firm; few fine roots; neutral; abrupt smooth boundary.

2R—46 inches; hard dolomite bedrock.

The depth to bedrock is 40 to 60 inches. The A horizon has value of 3 to 5 and chroma of 2 to 4. The E horizon has value of 4 to 6 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is the very cherty analogs of silt loam or silty clay loam.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 4 to 8. It is cherty clay or clay. The 2C horizon has hue of 10YR or 2.5YR, value of 4 or 5, and chroma of 4 to 8.

Plato Series

The Plato series consists of deep, somewhat poorly drained soils on uplands. These soils formed in about 24 to 36 inches of loess or silty sediments and in the underlying cherty dolomite residuum. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 2 to 5 percent.

Typical pedon of Plato silt loam, 2 to 5 percent slopes, about 2,030 feet south and 1,015 feet west of the northeast corner of sec. 29, T. 38 N., R. 10 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common coarse roots; neutral; clear smooth boundary.

Bt1—6 to 12 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular structure; friable; common medium roots; few distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—12 to 17 inches; yellowish brown (10YR 5/6) silty clay loam; common fine prominent light brownish gray (10YR 6/2) and strong brown (7.5YR 4/6) mottles; moderate fine and medium subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; few fine dark brown soft masses of manganese oxide; very strongly acid; clear smooth boundary.

Bt3—17 to 21 inches; light brownish gray (10YR 6/2) silty clay; many fine prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt4—21 to 29 inches; grayish brown (10YR 5/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Btx—29 to 46 inches; grayish brown (10YR 5/2) extremely cherty silt loam; common medium distinct dark yellowish brown (10YR 4/6) mottles; massive; very firm; few faint clay films on faces of peds; about 70 percent chert fragments; strongly acid; gradual smooth boundary.

2Bt1—46 to 56 inches; dark red (10R 3/6) very cherty clay; common medium prominent reddish yellow (7.5YR 6/6) and few fine prominent gray (10YR 5/1) mottles; weak medium subangular blocky structure; very firm; few distinct clay films on faces of peds; about 50 percent chert fragments; strongly acid; gradual smooth boundary.

2Bt2—56 to 62 inches; red (10R 4/6) cherty clay; common medium prominent light brownish gray (10YR 6/2) and few fine prominent reddish yellow (7.5YR 6/6) mottles; weak medium subangular blocky structure; very firm; few distinct clay films on faces of peds; about 20 percent chert fragments; strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The depth to the fragipan is 25 to 36 inches. The content of coarse fragments ranges from 0 to 5 percent in the A horizon, from 0 to 15 percent in the part of the B horizon above the fragipan, and from 15 to 70 percent in the fragipan.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The upper part of the Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. The lower part has chroma of 1 or 2. The Bt horizon is silty clay loam, silty clay, or clay.

The 2Btx horizon is mottled. It is the cherty, very cherty, or extremely cherty analogs of silt loam or silty clay loam. The 2Bt horizon is the cherty or very cherty analogs of silty clay loam, silty clay, or clay.

Poynor Series

The Poynor series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 14 to 35 percent.

Typical pedon of Poynor very cherty silt loam, 14 to 35 percent slopes, 400 feet south and 1,250 feet west of the northeast corner of sec. 4, T. 37 N., R. 12 W.

A—0 to 5 inches; grayish brown (10YR 5/2) very cherty silt loam, light gray (10YR 7/2) dry; weak very fine granular structure; very friable; very fine and fine roots; about 40 percent chert fragments; extremely acid; clear smooth boundary.

E—5 to 19 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak fine granular structure; friable; many very fine and fine roots; about 55 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt1—19 to 27 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; many fine distinct yellowish brown (10YR 5/6) and common fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; common fine and medium roots; few distinct clay films; pale brown (10YR 6/3) silt coatings; about 50 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt2—27 to 41 inches; red (2.5YR 4/6) clay; many fine prominent strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; very firm; common fine and medium roots; few distinct clay films on faces of peds; few stains of manganese oxide; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt3—41 to 60 inches; strong brown (7.5YR 5/8) clay; few fine prominent red (2.5YR 4/6) and common fine prominent light gray (10YR 7/2) mottles; weak fine subangular blocky structure; very firm; few fine and medium roots; few distinct clay films on faces of peds; few stains of manganese oxide; about 13 percent chert fragments; extremely acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A and E horizons have value of 2 to 6 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8. It is the very cherty analogs of silt loam or silty clay loam. The 2Bt horizon has hue of 10YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay or clay.

Razort Series

The Razort series consists of deep, well drained, moderately permeable soils on flood plains and low terraces. These soils formed in silty and loamy alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Razort silt loam, 0 to 3 percent slopes, 1,900 feet south and 1,750 feet east of the northwest corner of sec. 12, T. 37 N., R. 13 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine and very fine granular structure; very friable; many very fine and fine roots; neutral; clear smooth boundary.

BA—7 to 16 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; weak very fine subangular blocky structure; very friable; many fine roots; few very fine vesicular pores; common worm casts; about 5 percent chert fragments; medium acid; clear smooth boundary.

Bt1—16 to 27 inches; dark brown (10YR 4/3) silt loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; friable;

common fine roots; few faint clay films on faces of peds; common worm casts; about 15 percent chert fragments; medium acid; gradual smooth boundary.

Bt2—27 to 38 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct dark brown (7.5YR 3/4) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few very fine vesicular pores; few faint clay films on faces of peds; about 10 percent chert fragments; medium acid; gradual wavy boundary.

Bt3—38 to 60 inches; dark brown (7.5YR 3/4) clay loam; common fine faint dark brown (7.5YR 4/4) and common fine distinct dark brown (10YR 4/3) mottles; weak medium subangular blocky structure; firm; few fine roots; few very fine vesicular pores; few distinct clay films on faces of peds; about 10 percent chert fragments; medium acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A horizon is neutral or slightly acid. It has value of 2 or 3 and chroma of 2 to 4. It typically is silt loam, but the range includes loam. The Bt horizon has value and chroma of 3 or 4. In some pedons it has hue of 7.5YR, value of 3 or 4, and chroma of 4. It is silt loam, loam, or clay loam. The content of clay in this horizon ranges from 18 to 30 percent. Some pedons have a 2C horizon. This horizon varies in texture and is mottled with shades of brown and gray.

Viraton Series

The Viraton series consists of deep, moderately well drained soils on uplands. These soils formed in 20 or more inches of loess or loamy sediments and in the underlying cherty dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 3 to 9 percent.

Typical pedon of Viraton silt loam, 3 to 9 percent slopes, 850 feet north and 10 feet west of the southeast corner of sec. 31, T. 38 N., R. 10 W.

Ap—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 very fine and fine roots; about 5 percent chert fragments; very strongly acid; clear smooth boundary.

Bt1—6 to 11 inches; strong brown (7.5YR 5/6) silty clay loam; few fine prominent dark brown (10YR 4/3) and yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; many very fine and fine roots; few distinct clay films on faces of peds; about 5 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—11 to 18 inches; strong brown (7.5YR 5/6) silty clay loam; few fine distinct brown (7.5YR 5/4) mottles; weak fine subangular blocky structure; firm; many fine roots; common distinct clay films on faces of peds; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

Bt3—18 to 24 inches; strong brown (7.5YR 5/6) cherty silty clay loam; few fine faint strong brown (7.5YR 4/6) and few fine prominent light yellowish brown (10YR 6/4) mottles; weak fine subangular blocky structure; firm; many fine roots; common distinct clay films on faces of peds; about 30 percent chert fragments; very strongly acid; clear smooth boundary.

2Bx—24 to 48 inches; pale brown (10YR 6/3) extremely cherty silty clay loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; weak thin platy structure parting to weak fine subangular blocky; very firm; brittle; common faint silt coatings; about 70 percent chert fragments; extremely acid; clear smooth boundary.

2Bt—48 to 60 inches; strong brown (7.5YR 5/6) very cherty silty clay; many fine prominent light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; common distinct clay films; about 50 percent chert fragments; very strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The depth to the fragipan is 16 to 33 inches.

The A horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma dominantly of 4 to 6. In some pedons, however, it has chroma of 3 in the lower part. It is silty clay loam or cherty silty clay loam.

The 2Bx horizon is mottled with shades of red, gray, and brown. Any one of these shades may dominate. This horizon has hue of 10YR or 5YR, value of 4 to 6, and chroma of 2 to 6. The 2Bt horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 3 to 8. It is very cherty or extremely cherty silty clay.

Factors of Soil Formation

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 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.

The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Living organisms, chiefly plants, are active factors of soil formation. The climate determines the amount of water available for leaching and the amount of heat available for physical and chemical changes. Together, climate and plant and animal life act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. Relief commonly modifies the effects of the other factors. Finally, time is required for the transformation of the parent material into a soil. Generally, a long time is required for the development of distinct soil horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made about the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The soils in Pulaski County formed in alluvium, residuum, cherty, silty, or loamy sediments, loess, or a combination of these.

Alluvium is soil material that was transported by water and deposited on the nearly level or very gently sloping flood plains along streams. The major streams in Pulaski County are the Gasconade and Big Piney Rivers and Roubidoux Creek. The alluvial material was washed from the watersheds of these streams and their tributaries. It ranges from silt to sand and gravel. Kickapoo soils formed in the sandy and loamy material, Huntington and Nolin soils in the silty material, and Cedargap soils in the silty material that has a high content of chert.

Stream terraces are former flood plains that have been abandoned because of downcutting of the streams to a lower elevation. The alluvial material on these terraces is clayey, silty, or loamy. Hartville, Moniteau, and Razort soils formed on these stream terraces.

The residuum in Pulaski County is mainly material that weathered from cherty dolomite, dolomite, or sandstone. Bardley, Clarksville, Doniphan, Gasconade, Gatewood, Gepp, Ocie, and Poynor soils formed in residuum.

Cherty sediments occur as a lag concentrate of chert and finer textured sediments associated with an erosional surface. On the steeper slopes, this concentrate is the surface layer of the modern soil. In some areas where the land surface is stable, the cherty layers are overlain by loess or other silty or loamy sediments.

Loess is silty material deposited by the wind. Most of the uplands in the county have or have had deposits of loess. Erosion has removed the material from the steeper side slopes. Only the more stable ridgetops and a few areas of gently sloping to moderately sloping head slopes have a loess mantle ranging from about 18 to 30 inches in thickness. Gunlock, Lebanon, Plato, and Viraton soils formed in a thin layer of loess and in the underlying cherty dolomite residuum.

Living Organisms

Living organisms on and in the soil have helped to alter the parent material and the properties of the soil. Plants, bacteria and fungi, burrowing animals, and human activities have affected soil formation in various ways. They have influenced the content of organic matter and nitrogen, reaction, color, thickness and kinds of horizons, structure, aeration, and other soil properties.

Plants greatly influence soil formation. Plant communities have varied at different times, depending on the climate and the fertility, available water capacity, drainage class, and depth of the soil. Most of the soils in the county formed under forest vegetation. They had a high content of organic matter on or near the surface. When the soils were cleared for farming, this organic layer was mixed with the plow layer and was soon oxidized. Therefore, these soils have a gray or light brown surface layer and a very low organic matter content.

Worms, insects, burrowing animals, and large animals affect soil formation. Bacteria and fungi cause the decay of organic material, improve tilth, and fix nitrogen in the soil. The population of soil organisms is directly related to the rate at which organic material decomposes in the soil. The kinds of organisms in a given area and their activity are determined by the vegetation.

Intensive cultivation, clearing of trees, and other human activities also influence soil formation. In places cultivation has mixed the surface layer with the subsurface layer, lowered the organic matter content, reduced the extent of biological activity in the soil, and decreased the stability of soil structure. In many areas it has increased the runoff rate and the susceptibility to erosion. Erosion has removed the original surface layer in some areas, thereby lowering the fertility and productivity of the soil. The introduction of new crops and the addition of chemicals, such as fertilizer and lime, may alter soil formation in the future.

Climate

Climate has significantly affected soil formation in Pulaski County. Rainfall and temperature continue to affect soil formation. The rate of geologic erosion varies with the climate. It influences the shape and character of the landforms that make up an area. Changes in the relative abundance and composition of plant and animal life are determined by climatic changes.

High temperatures and large amounts of rainfall accelerate chemical changes and physical disintegration in the soil. When calcium carbonate and other soluble salts are removed by leaching, soil fertility declines. This kind of climate also is conducive to the rapid breakdown of clay minerals within the soil. The clay is moved downward from the surface soil to the subsoil. This process is known as illuviation. Nearly all of the soils in the uplands, such as Clarksville and Poynor soils, show the effects of this process.

Local conditions can modify the influence of the general climate in a region. Variations in temperature from high to low elevations have had only a slight influence on soil formation in the county. The effects of temperature variations on different aspects are more strongly expressed. For example, south- and west-facing slopes are warmer and drier than north- and east-facing slopes. The less desirable tree species grow on the warmer and drier slopes. Also, the trees grow more slowly.

Relief

Relief refers to the gradient, length, shape, aspect, and uniformity of the slopes that make up a landscape. It influences soil formation mainly through its effects on drainage, runoff, and erosion.

Relief results from natural forces that create inequalities in the land surface. The steep, dissected topography of the southern part of Pulaski County is a result of the deep entrenchment of the meandering Gasconade River and its tributaries into the Ozark Peneplain. The divide between the valley of the Gasconade River and the valley of the Osage River follows a course running southwest to northeast from Richland, through Crocker, and through Dixon. The strongly sloping to steep area north of the divide is becoming entrenched by tributaries of the Osage River.

The amount of water that percolates through the soil depends on the steepness of the slope, the permeability of the soil, and the amount and intensity of rainfall. Because runoff is rapid on the steeper soils, very little water percolates through the profile. As a result, these soils show little evidence of profile development. Runoff is slow on the gently sloping or nearly level soils. Most of the water percolates through the profile. As a result, these soils show the maximum profile development. Rapidly permeable soils form more slowly than slowly permeable soils on similar slopes.

Time

Time is an important factor of soil formation only because it allows living organisms, climate, and relief to exert their influence on the parent material. The degree to which the soil-forming processes have changed the parent material determines the age of a soil. Thus, the age reflects the degree of profile development in a given soil rather than the number of years that the soil material has existed.

Kickapoo and Huntington soils, which formed in alluvium deposited by floodwater receding from the Gasconade River, are some of the youngest soils in the county. The oldest soils formed in the nearly level or gently sloping areas at the highest elevations in the county. Lebanon and Plato soils are examples. They have a well expressed profile. They are dominantly acid throughout because the carbonates that were originally in the parent material have been leached to a great depth. Clay has been translocated by water and has accumulated in distinct subsoil horizons, and the soils have a distinct fragipan. Some time was required for the formation of this fragipan.

Most of the soils in Pulaski County are intermediate in age. Clarksville and Gepp soils formed in cherty dolomite or limestone residuum on the steeper side slopes in the uplands. They have an illuviated subsurface layer and have translocated clay in the subsoil.

Physiography and Geology

John W. Whitefield, geologist, Engineering Geology Section, Geology and Land Survey, Missouri Department of Natural Resources, prepared this section.

Pulaski County is situated on the Salem Plateau part of the Ozark Plateau Province.

The bedrock in the county consists of sedimentary rocks ranging in age from Ordovician cherty dolomite to Pennsylvanian sandstone and clay. A layer of loess, generally 1 foot thick or less, covers the bedrock or the stony residual material. On the broad upland divides in the northern part of the county, the loess is generally 2 to 3 feet thick but in local areas is as much as 4 feet thick.

The bedrock has a northwest regional dip of approximately 6 feet to the mile. The county has no known major fault systems, although several smaller faults cross the county from the northwest to the southeast. These faults are geologically old and are inactive.

The exposed bedrock in Pulaski County is cherty dolomite and sandstone. The subsurface bedrock formations consist of cherty dolomite, dolomite, and sandstone. These sediments rest on Precambrian igneous bedrock. In this county, the Precambrian rock is approximately 1,400 feet below the surface.

Cherty dolomite and sandstone have played a significant role in the formation of residual soils in the county. The effects of physical and chemical weathering have caused a slow disintegration of bedrock to the least soluble components of sandstone fragments, chert, and clay. Weathering has altered the soluble carbonate portion of the bedrock, such as dolomite, into a reddish silty clay. Chert and sandstone are made up of silica oxide, which is more resistant to weathering than dolomite. The chert and sandstone in the residual soils are in the form of angular fragments in the silty clay matrix, wavy horizontal beds between the layers of silty clay, or both of these. Where there has been no significant movement of soil, the sequence of silty clay, chert, and sandstone retain the relict structure of the bedrock.

Because of the effects of weathering, the bedrock surface is quite uneven. A relatively thin soil layer gives way to a thick layer of stony soil and deeply weathered bedrock. The thickness of the residual soil ranges from less than 1 foot to more than 100 feet. Hilltops and broad upland divides generally have the thickest layers of soil, whereas steep hillsides may have little, if any, soil material.

Several areas of gently rolling uplands are on the divides that separate the watersheds of the major rivers and creeks. Many sinkholes have formed on the broad upland divides in the central and southern parts of the county. The sinkholes indicate that the underlying bedrock is weathered and has enlarged joints and caves. Surface water that enters the sinkholes percolates downward through openings in the soil and bedrock and eventually recharges the underground aquifer.

Large areas in the county consist of wooded, stony, narrow hills that have steep slopes. High, vertical bluffs of massive bedrock are exposed along the Gasconade and Big Piney Rivers and Roubidoux Creek.

From the oldest to the youngest, the bedrock formations exposed in the county are Gasconade Dolomite, the Roubidoux Formation, Jefferson City Dolomite, and Pennsylvanian deposits. Several small outcrops of Mississippian limestone are on the hilltops in the western part of the county.

Gasconade Dolomite is 250 to 300 feet thick. It is gray to light brown dolomite that has thin to massive layers of chert. Some of the cherty layers are more than 5 feet thick. Outcrops of Gasconade Dolomite form the high bluffs along the major stream valleys in the county. Most of the steep hillsides in areas of the Gasconade Dolomite have a very thin layer of cherty soil.

The Roubidoux Formation is 100 to 150 feet thick. It is brown to brownish red, sandy dolomite, cherty dolomite, and sandstone. It commonly crops out as sandstone and sandy dolomite bluffs on the hillsides along small stream valleys and in road cuts. The surface is generally covered by an abundance of chert and sandstone boulders. The formation has less sandstone in the northern part of the county than in the southern part. As a result, fewer sandstone fragments are on the surface. Weathering of the bedrock results in residual soil laden with chert and sandstone fragments of various sizes. Generally, the surficial material is 5 to 10 feet thick. It may be more than 35 feet thick, however, in areas of strongly weathered bedrock.

Jefferson City Dolomite is 5 to 70 feet thick. It is gray to brown dolomite that commonly is interbedded with chert and that has thin layers of sandstone and shale. The formation underlies most of the broad upland divides in the county. It generally is in gently rolling areas covered by soil. Outcrops are not common. In places, however, a massive layer of brown, crystalline dolomite, called the "Quarry Ledge" crops out as small bluffs on upland hillsides. Also, small glades have no soil or have a very thin soil layer because of the resistance of this dolomite to weathering. Many of the quarries in this area obtain stone from the "Quarry Ledge." A light brown or brown cherty silty clay forms as the Jefferson City Dolomite weathers. The soil generally is 5 to 10 feet thick.

Pennsylvanian clay or sandstone occurs only in filled sinkholes on the broad upland divides in the northeastern part of the county. The clay deposits are mostly white to purple. They are commonly mined. They have a high content of alumina and thus are of value in the manufacture of refractory products. The sandstone borders the rim of the filled sinkholes. It commonly crops out as an isolated amorphous mass that projects 10 to 15 feet above the land surface. The residual soil in these areas is cherty clay to dark red clay containing sandstone fragments. It is 1 to 10 feet thick.

Mississippian cherty limestone crops out in many small areas on the higher hilltops in the western part of the county. This bedrock is so limited in extent that it does not exert a noticeable influence on the properties of the residual soils.

The bedrock formations exposed in Pulaski County produce small amounts of ground water. Jefferson City Dolomite yields 1 to 10 gallons per minute, and the Roubidoux Formation yields 5 to 10 gallons per minute. Water from these two formations commonly is contaminated because of surface pollution and the poorly constructed and cased wells nearby. The Gasconade Dolomite is a more reliable source of water. It yields 10 to 30 gallons per minute.

The major sources of ground water in the county are the Cambrian formations. Wells drilled to a depth of more than 800 feet in these formations provide water to Waynesville and St. Roberts. They yield more than 300 gallons per minute.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Goodspeed Publishing Co. 1889. History of Laclede, Camden, Dallas, Webster, Wright, Texas, Pulaski, Phelps, and Dent Counties, Missouri. 1,219 pp., illus. (Reprinted in 1974)

(4) Missouri Crop and Livestock Reporting Service. 1980. Pulaski County agri-facts. U.S. Dep. Agric., Econ. and Stat. Serv., 4 pp.

(5) Missouri Department of Natural Resources, Division of Parks and Recreation. 1976. Missouri statewide comprehensive outdoor recreation plan.

(6) Nagel, Werner, ed. and comp. 1970. Conservation contrasts. Mo. Dep. of Conserv., 453 pp., illus.

(7) National Association of Conservation Districts. NACD nationwide outdoor recreation inventory—Missouri. (Unpublished data assembled in 1974; available in field offices of the Soil Conservation Service)

(8) State Interagency Council for Outdoor Recreation. 1970. Missouri statewide comprehensive recreation plan. 127 pp., illus.

(9) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(10) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(11) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

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.

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—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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.

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.

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, 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.

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 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.

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.

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.

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.

Glade. A nearly level area of bare or nearly bare limestone.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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.

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:

O 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 O, 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

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 soil 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 or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

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.

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).

Munsell notation. A designation of color by degrees of the 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.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

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 the 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.

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 inch 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.

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.

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 soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
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.

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-size particles.

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.

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.

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.

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.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the 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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

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 amendment. Any substance added to the soil for the purpose of promoting plant growth. Examples are agricultural lime, ground rock phosphate, and chemical fertilizer.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
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 if rounded and 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind 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.

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.

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.

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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along 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.

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.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Waynesville, Missouri)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	45.6	18.9	32.3	74	-11	13	1.93	0.86	2.84	5	3.0
February---	50.6	23.1	30.9	76	-6	21	2.37	1.39	3.23	5	3.3
March------	59.5	31.0	45.3	86	3	164	3.67	2.05	5.10	7	3.0
April------	71.8	42.3	57.1	91	19	240	3.67	2.27	4.92	8	0.2
May--------	78.7	50.8	64.8	91	27	459	4.78	2.76	6.57	8	.0
June-------	85.4	59.4	72.4	97	40	672	3.80	1.95	5.42	7	.0
July-------	90.7	63.8	77.3	103	46	846	3.82	1.54	5.74	6	.0
August-----	89.5	61.8	75.7	101	44	797	3.33	1.44	4.94	5	.0
September--	83.1	54.1	66.6	98	33	558	3.57	1.43	5.35	6	.0
October----	73.6	42.2	57.9	91	21	269	3.39	1.76	4.81	6	.0
November---	59.6	31.7	45.7	81	6	52	2.83	1.27	4.15	5	1.5
December---	49.7	24.0	36.9	75	-5	8	2.68	1.15	3.97	5	2.4
Yearly:											
Average--	69.8	41.9	55.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	-13	---	---	---	---	---	---
Total----	---	---	---	---	---	4,039	39.84	32.51	46.79	73	13.3

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Waynesville, Missouri)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 21	May 9	May 17
2 years in 10 later than--	Apr. 16	May 3	May 12
5 years in 10 later than--	Apr. 7	Apr. 22	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 15	Oct. 2	Sept. 27
2 years in 10 earlier than--	Oct. 21	Oct. 7	Oct. 1
5 years in 10 earlier than--	Oct. 31	Oct. 17	Oct. 8

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Waynesville, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	184	156	139
8 years in 10	192	163	145
5 years in 10	206	177	157
2 years in 10	220	192	168
1 year in 10	228	199	174

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
12A	Cedargap cherty silt loam, 0 to 3 percent slopes	10,450	3.0
13A	Cedargap silt loam, 0 to 3 percent slopes	2,550	0.7
14B	Claiborne silt loam, 2 to 5 percent slopes	872	0.2
14C	Claiborne silt loam, 5 to 9 percent slopes	5,950	1.7
16C	Clarksville very cherty silt loam, 3 to 9 percent slopes	2,525	0.7
16D	Clarksville very cherty silt loam, 9 to 14 percent slopes	4,515	1.3
16F	Clarksville very cherty silt loam, 14 to 35 percent slopes	21,050	6.0
17F	Clarksville very cherty silt loam, 14 to 35 percent slopes, stony	1,690	0.5
20C	Doniphan very cherty silt loam, 3 to 9 percent slopes	26,200	7.5
20D	Doniphan very cherty silt loam, 9 to 14 percent slopes	2,165	0.6
22F	Gasconade-Rock outcrop complex, 2 to 20 percent slopes	2,350	0.7
26	Moniteau silt loam	2,135	0.6
29	Nolin silt loam	8,250	2.3
30A	Kickapoo fine sandy loam, 0 to 3 percent slopes	3,850	1.1
31A	Razort silt loam, 0 to 3 percent slopes	1,800	0.5
32C	Viraton silt loam, 3 to 9 percent slopes	47,300	13.4
34C	Gatewood cherty silt loam, 5 to 9 percent slopes	1,775	0.5
34D	Gatewood cherty silt loam, 9 to 14 percent slopes	3,820	1.1
35B	Lebanon silt loam, 2 to 5 percent slopes	38,200	10.9
35C	Lebanon silt loam, 5 to 9 percent slopes	10,775	3.1
37B	Hartville silt loam, 2 to 5 percent slopes	1,250	0.4
38	Riverwash	1,200	0.3
39C	Ocie cherty silt loam, 5 to 9 percent slopes	2,425	0.7
39D	Ocie cherty silt loam, 9 to 14 percent slopes	17,700	5.0
40	Huntington silt loam	5,375	1.5
41B	Plato silt loam, 2 to 5 percent slopes	4,100	1.2
42C	Gunlock silt loam, 3 to 9 percent slopes	9,125	2.6
43F	Poynor very cherty silt loam, 14 to 35 percent slopes	23,500	6.7
46F	Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes	65,850	18.7
47F	Gepp-Bardley-Clarksville very cherty silt loams, 14 to 35 percent slopes	17,000	4.8
47G	Gepp-Rock outcrop complex, 35 to 60 percent slopes	4,675	1.3
98	Pits, quarries	101	*
99	Udorthents, clayey	1,400	0.4
	Total land area	351,923	100.0
	Water areas more than 40 acres in size	960	
	Total area	352,883	

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
13A	Cedargap silt loam, 0 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
14B	Claiborne silt loam, 2 to 5 percent slopes
26	Moniteau silt loam (where drained)
29	Nolin silt loam
30A	Kickapoo fine sandy loam, 0 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
31A	Razort silt loam, 0 to 3 percent slopes
35B	Lebanon silt loam, 2 to 5 percent slopes
37B	Hartville silt loam, 2 to 5 percent slopes
40	Huntington silt loam (where protected from flooding or not frequently flooded during the growing season)
41B	Plato silt loam, 2 to 5 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
12A------------- Cedargap	IIIw	50	25	50	30	2.5	5.0
13A------------- Cedargap	IIIw	60	30	60	35	3.0	6.0
14B------------- Claiborne	IIe	85	35	70	40	3.5	6.0
14C------------- Claiborne	IIIe	80	30	60	35	3.0	6.0
16C------------- Clarksville	IVs	---	---	---	---	2.1	4.2
16D------------- Clarksville	VIs	---	---	---	---	1.7	3.4
16F, 17F-------- Clarksville	VIIs	---	---	---	---	---	2.6
20C------------- Doniphan	IIIs	---	---	---	25	2.5	5.0
20D------------- Doniphan	IVs	---	---	---	---	2.1	4.2
22F**----------- Gasconade-Rock outcrop	VIIs	---	---	---	---	---	---
26-------------- Moniteau	IIIw	80	30	72	35	3.7	7.0
29-------------- Nolin	IIw	105	40	95	40	4.5	8.0
30A------------- Kickapoo	IIIw	70	30	70	35	3.0	6.0
31A------------- Razort	IIe	75	35	70	35	3.0	6.0
32C------------- Viraton	IIIe	40	20	40	25	2.3	4.6
34C------------- Gatewood	IVs	---	---	---	18	2.1	4.2
34D------------- Gatewood	VIs	---	---	---	---	1.8	3.6
35B------------- Lebanon	IIe	55	28	60	35	3.5	7.0
35C------------- Lebanon	IIIe	50	24	60	32	3.2	6.4

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
37B------------- Hartville	IIe	70	35	70	25	2.7	5.0
38**. Riverwash							
39C------------- Ocie	IVs	---	---	---	20	2.2	4.5
39D------------- Ocie	VIs	---	---	---	---	2.0	3.7
40-------------- Huntington	IIw	110	45	110	45	3.0	8.0
41B------------- Plato	IIe	55	28	60	35	3.5	7.0
42C------------- Gunlock	IIIe	45	25	50	30	3.2	6.4
43F------------- Poynor	VIIs	---	---	---	---	1.6	3.2
46F------------- Clarksville-Gepp	VIIe	---	---	---	---	---	3.2
47F------------- Gepp-Bardley-Clarksville	VIIe	---	---	---	---	---	3.4
47G**----------- Gepp-Rock outcrop	VIIe	---	---	---	---	---	---
98**. Pits							
99. Udorthents							

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
12A------------- Cedargap	3F	Slight	Slight	Moderate	Slight	Black oak-----------	66	48	Black oak, shortleaf pine.
13A------------- Cedargap	3A	Slight	Slight	Slight	Slight	Black oak-----------	66	48	Black oak, shortleaf pine.
14B, 14C-------- Claiborne	4A	Slight	Slight	Slight	Slight	Northern red oak---- Shortleaf pine------ White oak----------- Black oak-----------	70 66 70 70	52 101 52 52	Yellow-poplar, black walnut, shortleaf pine, loblolly pine.
16C, 16D-------- Clarksville	3F	Slight	Slight	Moderate	Slight	White oak----------- Shortleaf pine------ Black oak----------- Northern red oak----	58 61 61 61	41 90 44 44	Shortleaf pine, northern red oak, white oak.
16F------------- Clarksville	3R	Slight	Moderate	Moderate	Slight	White oak----------- Shortleaf pine------ Black oak----------- Northern red oak----	58 61 61 61	41 90 44 44	Shortleaf pine, northern red oak, white oak.
17F------------- Clarksville	3R	Moderate	Severe	Moderate	Slight	White oak----------- Shortleaf pine------ Black oak----------- Northern red oak----	58 61 61 61	41 90 44 44	Shortleaf pine, northern red oak, white oak.
20C, 20D-------- Doniphan	3A	Slight	Slight	Slight	Slight	Black oak----------- White oak----------- Shortleaf pine------ Northern red oak----	63 59 63 61	46 42 --- 44	Shortleaf pine, white oak, northern red oak, black oak.
22F**: Gasconade------	2D	Slight	Moderate	Moderate	Moderate	Chinkapin oak------- Eastern redcedar---- White ash----------- Sugar maple--------- Mockernut hickory--- Post oak------------ Blackjack oak-------	40 30 --- --- --- --- ---	26 --- --- --- --- --- ---	Eastern redcedar.
Rock outcrop.									
26-------------- Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak-------------	70	52	White oak, pin oak, green ash, eastern cottonwood, silver maple.
29-------------- Nolin	11A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- River birch---------	108 --- ---	150 --- ---	Black walnut, eastern white pine, eastern cottonwood, white ash.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
30A Kickapoo	3A	Slight	Slight	Slight	Slight	Northern red oak Sugar maple	66 ---	48 ---	Shortleaf pine, white ash, silver maple, black walnut, eastern white pine.
31A Razort	10A	Slight	Slight	Slight	Slight	Eastern cottonwood American sycamore White oak	103 85 75	135 --- 57	Shortleaf pine, white oak, black walnut, American sycamore, eastern cottonwood.
32C Viraton	3D	Slight	Slight	Moderate	Moderate	White oak Black oak Post oak	55 60 ---	38 43 ---	White oak, black oak, shortleaf pine.
34C, 34D Gatewood	2A	Slight	Slight	Slight	Slight	White oak Eastern redcedar Post oak Black oak	45 --- --- ---	30 --- --- ---	Eastern redcedar, shortleaf pine.
35B, 35C Lebanon	3D	Slight	Slight	Moderate	Moderate	White oak Black oak Shortleaf pine Post oak	55 60 --- ---	38 43 --- ---	Shortleaf pine, white oak, black oak.
37B Hartville	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern cottonwood, white oak, pin oak.
39C, 39D Ocie	3A	Slight	Slight	Slight	Slight	White oak Black oak Northern red oak	57 58 ---	40 41 ---	Shortleaf pine, northern red oak.
40 Huntington	9A	Slight	Slight	Slight	Slight	Eastern cottonwood Northern red oak Black walnut Silver maple	100 85 --- ---	128 67 --- ---	Black walnut, eastern white pine, eastern cottonwood, silver maple.
41B Plato	3A	Slight	Slight	Slight	Slight	White oak Black oak Shortleaf pine Post oak	55 60 --- ---	38 43 --- ---	Shortleaf pine, black oak.
42C Gunlock	3A	Slight	Slight	Slight	Slight	Northern red oak White oak Black oak	60 57 60	43 40 43	Northern red oak, white oak, black oak, shortleaf pine.
43F Poynor	3R	Slight	Moderate	Slight	Slight	White oak	58	41	Shortleaf pine, white oak, green ash, black oak.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
46F**:									
Clarksville----	3R	Slight	Moderate	Moderate	Slight	White oak-----------	58	41	Shortleaf pine, white oak.
						Shortleaf pine------	61	90	
						Black oak-----------	61	44	
						Northern red oak----	61	44	
Gepp-----------	4R	Moderate	Moderate	Moderate	Slight	White oak-----------	70	52	Shortleaf pine.
						Shortleaf pine------	75	120	
						Black oak-----------	70	52	
						Northern red oak----	70	52	
						Post oak------------	---	---	
47F**:									
Gepp-----------	4R	Moderate	Moderate	Moderate	Slight	White oak-----------	70	52	Shortleaf pine.
						Shortleaf pine------	75	120	
						Black oak-----------	70	52	
						Northern red oak----	70	52	
						Post oak------------	---	---	
Bardley--------	2R	Moderate	Moderate	Slight	Slight	Post oak------------	45	30	Shortleaf pine, eastern redcedar.
Clarksville----	3R	Slight	Moderate	Moderate	Slight	White oak-----------	58	41	Shortleaf pine, white oak.
						Shortleaf pine------	61	90	
						Black oak-----------	61	44	
						Northern red oak----	61	44	
47G**:									
Gepp-----------	4R	Moderate	Moderate	Moderate	Slight	White oak-----------	70	52	Shortleaf pine.
						Shortleaf pine------	75	120	
						Black oak-----------	70	52	
						Northern red oak----	70	52	
						Post oak------------	---	---	
Rock outcrop.									

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
12A, 13A Cedargap	---	Amur maple, Amur honeysuckle, autumn-olive, lilac.	Eastern redcedar	Hackberry, Austrian pine, eastern white pine, green ash, honeylocust, pin oak.	Eastern cottonwood.
14B, 14C Claiborne	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar, Russian-olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---
16C, 16D, 16F, 17F Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
20C, 20D Doniphan	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Austrian pine, honeylocust, eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
22F*:					
Gasconade.					
Rock outcrop.					
26 Moniteau	Silky dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Norway spruce, green ash, golden willow, honeylocust, northern red oak, silver maple.	Eastern cottonwood.
29 Nolin	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern white-cedar, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine.
30A Kickapoo	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Eastern redcedar	Austrian pine, eastern white pine, hackberry, green ash, honeylocust, pin oak.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
31A Razort	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Austrian pine, pin oak, green ash, hackberry, honeylocust, eastern white pine.	Eastern cottonwood.
32C Viraton	Lilac	Manchurian crabapple, Amur honeysuckle, Amur maple, autumn-olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust	---
34C, 34D Gatewood	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Russian-olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
35B, 35C Lebanon	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Austrian pine, eastern redcedar, jack pine, green ash, Russian-olive, hackberry.	Honeylocust	---
37B Hartville	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Austrian pine, hackberry, green ash, jack pine, Russian-olive, eastern redcedar.	Honeylocust	---
38*. Riverwash					
39C, 39D Ocie	Lilac, Amur honeysuckle, fragrant sumac.	Autumn-olive	Russian-olive, green ash, honeylocust, bur oak, eastern redcedar, hackberry, Austrian pine.	Siberian elm	---
40 Huntington	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Austrian pine, hackberry, green ash, pin oak, honeylocust, eastern white pine.	Eastern cottonwood.
41B Plato	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---
42C Gunlock	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Eastern redcedar, hackberry, Russian-olive.	Eastern white pine, Norway spruce, green ash, honeylocust, pin oak.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
43F: Poynor	Siberian peashrub	Tatarian honeysuckle, Amur honeysuckle, eastern redcedar, autumn-olive, radiant crabapple, Washington hawthorn, lilac.	Eastern white pine, jack pine, Austrian pine, red pine.	---	---
46F*:					
Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
Gepp	Lilac	Amur honeysuckle, Manchurian crabapple, autumn-olive, Amur maple.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust	---
47F*:					
Gepp	Lilac	Amur honeysuckle, Manchurian crabapple, autumn-olive, Amur maple.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust	---
Bardley	Lilac, fragrant sumac, Amur honeysuckle.	Autumn-olive	Russian-olive, hackberry, eastern redcedar, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---
Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
47G*:					
Gepp	Lilac	Amur honeysuckle, Manchurian crabapple, autumn-olive, Amur maple.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust	---
Rock outcrop.					
98*. Pits					
99. Udorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Only the soils rated for recreational uses are listed. Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
12A------------------- Cedargap	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones, flooding.	Severe: small stones.	Severe: small stones, flooding.
13A------------------- Cedargap	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
14B------------------- Claiborne	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: small stones.
14C------------------- Claiborne	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: small stones.
16C, 16D-------------- Clarksville	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
16F, 17F-------------- Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
20C, 20D-------------- Doniphan	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: large stones.	Severe: small stones.
22F*:					
Gasconade------------	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, small stones.	Moderate: large stones.	Severe: large stones, depth to rock.
Rock outcrop.					
26-------------------- Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
29-------------------- Nolin	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
30A------------------- Kickapoo	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
31A------------------- Razort	Severe: flooding.	Slight----------	Moderate: small stones.	Slight----------	Slight.
32C------------------- Viraton	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Slight----------	Moderate: wetness.
34C, 34D-------------- Gatewood	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight----------	Severe: small stones.
35B------------------- Lebanon	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
35C: Lebanon	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
37B: Hartville	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
39C: Ocie	Moderate: small stones, percs slowly.	Moderate: small stones, percs slowly.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones.
39D: Ocie	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones.
40: Huntington	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
41B: Plato	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
42C: Gunlock	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Slight.
43F: Poynor	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
46F*:					
Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
Gepp	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
47F*:					
Gepp	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
Bardley	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, slope.
Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
47G*:					
Gepp	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Rock outcrop.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
12A, 13A----------- Cedargap	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
14B---------------- Claiborne	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
14C---------------- Claiborne	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
16C, 16D, 16F, 17F- Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
20C, 20D----------- Doniphan	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
22F*:										
Gasconade---------	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
26----------------- Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
29----------------- Nolin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
30A---------------- Kickapoo	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
31A---------------- Razort	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
32C---------------- Viraton	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
34C, 34D----------- Gatewood	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
35B, 35C----------- Lebanon	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
37B---------------- Hartville	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
38*. Riverwash										
39C---------------- Ocie	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
39D---------------- Ocie	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
40----------------- Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
41B Plato	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
42C Gunlock	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
43F Poynor	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
46F*:										
Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Gepp	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47F*:										
Gepp	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bardley	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
47G*:										
Gepp	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
98*. Pits										
99. Udorthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12A Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, flooding.
13A Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
14B Claiborne	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: small stones.
14C Claiborne	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: small stones.
16C Clarksville	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Severe: small stones.
16D Clarksville	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Severe: small stones.
16F, 17F Clarksville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
20C Doniphan	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: small stones.
20D Doniphan	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Severe: small stones.
22F*:						
Gasconade	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, depth to rock.
Rock outcrop.						
26 Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
29 Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
30A Kickapoo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
31A Razort	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
32C--------------- Viraton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: wetness.
34C--------------- Gatewood	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: small stones.
34D--------------- Gatewood	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: small stones.
35B, 35C---------- Lebanon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness.
37B--------------- Hartville	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
38*. Riverwash						
39C--------------- Ocie	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: small stones, large stones.
39D--------------- Ocie	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: small stones, large stones.
40---------------- Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
41B--------------- Plato	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
42C--------------- Gunlock	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
43F--------------- Poynor	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.
46F*: Clarksville------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Gepp-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47F*:						
Gepp-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.
Bardley----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.
Clarksville------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
47G*:						
Gepp-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.
Rock outcrop.						
98*. Pits						
99. Udorthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12A, 13A Cedargap	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
14B Claiborne	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
14C Claiborne	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
16C Clarksville	Slight	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Poor: small stones.
16D Clarksville	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too clayey.	Severe: seepage.	Poor: small stones.
16F, 17F Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
20C Doniphan	Moderate: percs slowly.	Moderate: seepage, slope, large stones.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
20D Doniphan	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
22F*: Gasconade	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, large stones.
Rock outcrop.					
26 Moniteau	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
29 Nolin	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey.
30A Kickapoo	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
31A Razort	Moderate: flooding, percs slowly.	Severe: seepage, flooding.	Severe: seepage.	Moderate: flooding.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
32C Viraton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
34C, 34D Gatewood	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
35B Lebanon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, small stones.
35C Lebanon	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, small stones.
37B Hartville	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
38*. Riverwash					
39C Ocie	Severe: wetness, percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
39D Ocie	Severe: wetness, percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
40 Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
41B Plato	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey.
42C Gunlock	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: small stones.
43F Poynor	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, hard to pack, slope.
46F*:					
Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
Gepp	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47F*:					
Gepp	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Bardley	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
47G*:					
Gepp	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Rock outcrop.					
98*. Pits					
99. Udorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12A, 13A: Cedargap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
14B, 14C: Claiborne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
16C, 16D: Clarksville	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
16F: Clarksville	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
17F: Clarksville	Fair: slope.	Improbable: small stones.	Probable	Poor: small stones, area reclaim, slope.
20C, 20D: Doniphan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
22F*:				
Gasconade	Poor: depth to rock, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: depth to rock, large stones.
Rock outcrop.				
26: Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
29: Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
30A: Kickapoo	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
31A: Razort	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
32C: Viraton	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
34C, 34D: Gatewood	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
35B, 35C: Lebanon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
37B------------------- Hartville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones, thin layer.
38*. Riverwash				
39C, 39D-------------- Ocie	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
40-------------------- Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41B------------------- Plato	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
42C------------------- Gunlock	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
43F------------------- Poynor	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
46F*:				
Clarksville-----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Gepp------------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
47F*:				
Gepp------------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Bardley---------------	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Clarksville-----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
47G*:				
Gepp------------------	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Rock outcrop.				
98*. Pits				
99. Udorthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
12A Cedargap	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, flooding.	Large stones	Large stones.
13A Cedargap	Severe: seepage.	Severe: seepage.	Deep to water	Flooding	Large stones	Favorable.
14B, 14C Claiborne	Moderate: seepage, slope.	Moderate: piping, thin layer.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
16C Clarksville	Severe: seepage.	Moderate: large stones.	Deep to water	Droughty, slope.	Large stones	Large stones, droughty.
16D, 16F Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
17F Clarksville	Severe: seepage, slope.	Moderate: thin layer, large stones.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
20C Doniphan	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Droughty, slope.	Favorable	Droughty.
20D Doniphan	Severe: slope.	Moderate: hard to pack.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
22F*:						
Gasconade	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
26 Moniteau	Slight	Severe: wetness.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
29 Nolin	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
30A Kickapoo	Moderate: seepage.	Slight	Deep to water	Soil blowing, flooding.	Too sandy, soil blowing.	Favorable.
31A Razort	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
32C Viraton	Moderate: slope.	Moderate: piping, wetness.	Percs slowly, slope.	Wetness, droughty, percs slowly.	Erodes easily, wetness.	Erodes easily, droughty.
34C Gatewood	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Large stones, depth to rock.	Large stones.
34D Gatewood	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
35B, 35C: Lebanon	Moderate: seepage, slope.	Severe: hard to pack.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Wetness, erodes easily.
37B: Hartville	Moderate: slope.	Moderate: hard to pack, wetness.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
38*. Riverwash						
39C: Ocie	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, slope.	Large stones	Large stones.
39D: Ocie	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, slope.	Slope, large stones.	Large stones, slope.
40: Huntington	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
41B: Plato	Moderate: slope.	Severe: thin layer.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth, percs slowly.
42C: Gunlock	Moderate: slope.	Moderate: piping, wetness.	Slope	Wetness, slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
43F: Poynor	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope	Large stones, slope, droughty.
46F*: Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Gepp	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
47F*: Gepp	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Droughty, depth to rock.	Slope, depth to rock.	Slope, droughty.
Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
47G*: Gepp	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Rock outcrop.						
98*. Pits						
99. Udorthents						

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
12A---------------- Cedargap	0-6	Cherty silt loam	SM, GM	A-1, A-2-4, A-4	2-15	40-85	30-75	20-60	15-50	25-35	3-9
	6-29	Cherty silt loam, cherty loam, very cherty silt loam.	SM, GM	A-1, A-2, A-4	2-15	40-85	20-65	15-45	15-40	25-35	3-9
	29-60	Extremely cherty silty clay loam, extremely cherty clay loam, extremely cherty loam.	GC	A-2-6, A-6	5-20	25-50	20-50	15-45	15-40	30-40	15-25
13A---------------- Cedargap	0-12	Silt loam--------	ML	A-4	0-5	90-100	85-95	75-95	70-95	25-35	3-9
	12-26	Cherty silt loam, cherty loam, very cherty silt loam.	SM, GM	A-1, A-2, A-4	2-15	40-85	20-65	15-45	15-40	25-35	3-9
	26-60	Extremely cherty silty clay loam, extremely cherty clay loam, extremely cherty loam.	GC	A-2-6, A-6	5-20	25-50	20-50	15-45	15-40	30-40	15-25
14B, 14C--------- Claiborne	0-10	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	70-100	65-90	55-80	24-35	4-10
	10-52	Silty clay loam, cherty silty clay loam.	CL	A-4, A-6	0-5	75-95	55-75	55-90	55-80	28-40	8-20
	52-60	Very cherty silty clay loam.	MH, CH, CL, SC, GC	A-7, A-6	0-10	50-90	30-40	40-85	40-75	35-65	13-35
16C---------------- Clarksville	0-13	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	13-35	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	35-60	Very cherty silty clay, very cherty clay, extremely cherty silty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55
16D, 16F--------- Clarksville	0-18	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	18-60	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
17F-------------- Clarksville	0-17	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1	10-30	30-70	10-60	5-50	5-35	20-40	5-15
	17-45	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	45-60	Very cherty silty clay, very cherty clay, extremely cherty silty clay.	GC, SC, GP, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55
20C, 20D--------- Doniphan	0-11	Very cherty silt loam.	CL-ML, GM, GM-GC, SM-SC	A-4	5-30	50-80	30-70	30-65	30-60	20-30	2-8
	11-15	Cherty silty clay loam, silty clay loam.	CL	A-6	5-30	85-100	60-85	50-80	50-70	30-40	15-25
	15-60	Clay-------------	CH, MH	A-7	0-5	90-100	90-100	85-100	70-95	51-70	25-35
22F*:											
Gasconade-------	0-7	Flaggy silty clay loam.	CL	A-6	20-50	75-90	70-85	60-75	55-65	30-40	15-25
	7-18	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
26--------------- Moniteau	0-20	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	20-60	Silty clay loam	CL	A-6, A-7	0	100	100	85-100	80-95	30-45	15-25
	60-68	Silt loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	85-100	75-100	25-40	5-15
29--------------- Nolin	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	9-63	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
30A-------------- Kickapoo	0-4	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	100	70-85	40-55	<26	3-8
	4-60	Stratified loam to sand.	SM-SC, SC	A-4	0	100	100	65-75	35-45	<28	6-9
31A-------------- Razort	0-7	Silt loam--------	ML, CL-ML	A-4	0	80-100	80-100	65-90	65-90	<25	NP-7
	7-60	Silt loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	60-100	60-100	55-85	50-80	25-40	7-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
32C-------------- Viraton	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	90-100	75-100	70-95	60-75	20-30	5-11
	6-24	Silt loam, silty clay loam, cherty silty clay loam.	CL, SC	A-4, A-6	0-5	85-100	50-100	50-95	45-75	25-35	8-15
	24-48	Very cherty silt loam, extremely cherty silt loam.	SC, CL, GC	A-2-4, A-2-6, A-4, A-6	0-15	50-85	20-65	20-55	20-55	25-35	8-15
	48-60	Cherty silt loam, cherty silty clay loam, very cherty silty clay.	SC, CL, GC	A-2-6, A-2-7, A-6, A-7	0-15	40-100	20-100	20-90	20-80	30-48	11-25
34C, 34D--------- Gatewood	0-9	Cherty silt loam very cherty silt loam.	CL, SC, SP-SC	A-4, A-6, A-2	10-30	70-90	20-75	15-70	10-65	25-35	7-15
	9-30	Cherty silty clay, cherty clay, clay.	CH, SC	A-7	5-15	80-100	50-100	40-85	40-85	55-75	30-45
	30-35	Cherty silty clay, cherty clay, clay.	CH, SC	A-7	15-30	75-90	50-85	40-80	40-65	55-75	30-45
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
35B, 35C--------- Lebanon	0-4	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	85-100	85-100	80-95	60-75	22-35	5-15
	4-7	Silt loam, silty clay loam.	CL	A-6	0-5	85-100	80-100	75-95	60-75	30-40	11-20
	7-21	Silty clay loam, silty clay.	CL	A-7	0-5	85-95	70-95	65-90	55-75	40-50	20-30
	21-39	Very cherty silt loam, extremely cherty silty clay loam, cherty loam.	CL, SC, GC	A-7, A-2, A-6	0-10	55-90	20-85	20-65	20-60	35-45	15-20
	39-72	Cherty silty clay, clay, cherty clay.	CL, CH, SC, GC	A-7	0-10	65-95	50-90	45-65	40-60	45-80	25-45
37B-------------- Hartville	0-7	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	95-100	80-95	70-90	30-40	7-15
	7-13	Silt loam, silty clay loam.	CL	A-6, A-7	0-10	95-100	95-100	90-98	85-95	35-45	20-25
	13-70	Silty clay, clay, silty clay loam.	CH	A-7	0-10	95-100	80-100	80-98	80-95	50-60	30-40
38*. Riverwash											
39C, 39D--------- Ocie	0-2	Cherty silt loam	CL-ML, CL, SC, SM-SC	A-4	0-15	70-85	60-80	55-70	35-55	<25	4-10
	2-17	Very cherty silt loam, very cherty loam, cherty silt loam.	GM, GC, GM-GC	A-2-4, A-2-6	5-20	40-55	30-50	30-45	25-35	20-30	5-15
	17-46	Cherty clay, clay	CH	A-7	0-15	70-95	65-90	65-90	60-80	50-70	30-40
	46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
40---------------- Huntington	0-15	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	15-51	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	51-60	Stratified fine sand to silty clay loam.	SM, SC, ML, CL	A-2, A-4	0-10	95-100	60-100	50-90	30-75	<30	NP-10
41B--------------- Plato	0-6	Silt loam--------	CL-ML, ML	A-4	0-5	100	95-100	90-100	70-90	<25	NP-6
	6-29	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	80-100	75-95	65-85	40-55	20-35
	29-46	Extremely cherty silt loam, very cherty silt loam.	CL-ML, CL, GC, GM-GC	A-4, A-6, A-2, A-1	0-10	25-70	20-65	15-65	15-60	25-40	5-20
	46-62	Very cherty clay, cherty clay, cherty silty clay loam.	CL, CH, GC	A-7	0-5	40-75	35-70	35-70	35-65	45-60	30-45
42C--------------- Gunlock	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	100	95-100	90-100	70-90	20-30	5-15
	5-25	Silty clay loam, silty clay.	CL	A-6, A-7	0-5	85-100	85-100	80-100	80-90	35-50	15-30
	25-43	Silty clay loam, cherty silty clay loam, very cherty silt loam.	CL, GC, SC	A-4, A-6, A-7	0-10	40-85	40-85	35-85	35-70	25-45	8-25
	43-73	Extremely cherty silty clay loam, cherty silty clay, cherty clay.	GC, CL, CH, SC	A-7, A-2-7	0-10	40-80	20-75	20-75	20-70	45-70	25-40
43F--------------- Poynor	0-19	Very cherty silt loam.	GM, GM-GC, SM-SC, SM	A-1, A-4, A-2-4	5-20	35-70	15-65	10-60	10-45	20-30	2-8
	19-27	Very cherty silty clay loam, cherty silty clay loam.	GC, GP-GC, SC, SP-SC	A-6, A-2-6	5-20	30-70	10-60	10-50	5-45	25-40	10-20
	27-60	Silty clay, clay	CH, MH	A-7	0-10	90-100	80-100	80-95	70-90	51-70	25-35
46F*: Clarksville-----	0-17	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	17-35	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	35-60	Very cherty silty clay, very cherty clay, extremely cherty silty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
46F*:											
Gepp------------	0-11	Very cherty silt loam.	GM, GC, SM-SC, SM	A-1, A-2	10-30	30-70	20-50	10-40	5-20	<30	NP-10
	11-15	Cherty silty clay loam, cherty silt loam, silty clay loam.	CL	A-6, A-4	0-15	65-100	65-100	55-95	51-90	25-40	8-20
	15-47	Clay-------------	MH, CH	A-7	0-5	90-100	90-100	85-100	80-95	51-75	25-40
	47-60	Clay, cherty clay	MH, CH	A-7	0-15	70-100	70-100	65-100	60-95	51-75	25-40
47F*:											
Gepp------------	0-10	Very cherty silt loam.	GM, GC, SM-SC, SM	A-1, A-2	10-30	30-70	20-50	10-40	5-20	<30	NP-10
	10-47	Clay-------------	MH, CH	A-7	0-5	90-100	90-100	85-100	80-95	51-75	25-40
	47-60	Clay, cherty clay	MH, CH	A-7	0-15	70-100	55-100	55-100	55-95	51-75	25-40
Bardley---------	0-7	Very cherty silt loam.	GC, CL, SC	A-6, A-2	0-15	40-90	30-80	30-70	25-65	30-40	10-20
	7-36	Silty clay, clay, cherty clay.	MH, GM, SM	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Clarksville-----	0-17	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	17-60	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
47G*:											
Gepp------------	0-4	Cherty silt loam	GM, GC, ML, CL	A-2, A-4	10-25	45-75	45-75	35-65	25-55	<30	NP-10
	4-15	Cherty silty clay loam, cherty silt loam, silty clay loam.	CL	A-6, A-4	0-15	65-100	65-100	55-95	51-90	25-40	8-20
	15-47	Clay-------------	MH, CH	A-7	0-5	90-100	90-100	85-100	80-95	51-75	25-40
	47-60	Clay, cherty clay	MH, CH	A-7	0-15	70-100	70-100	65-100	60-95	51-75	25-40
Rock outcrop.											
98*. Pits											
99. Udorthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
12A---------------Cedargap	0-6	12-25	1.20-1.45	2.0-6.0	0.11-0.18	5.6-7.3	Low-----------	0.24	5	8	1-4
	6-29	12-27	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	Low-----------	0.24			
	29-60	25-35	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low-----------	0.10			
13A---------------Cedargap	0-12	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	6	1-4
	12-26	12-27	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	Low-----------	0.24			
	26-60	25-35	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low-----------	0.10			
14B, 14C---------Claiborne	0-10	20-27	1.30-1.50	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37	4	6	1-3
	10-52	27-35	1.35-1.55	0.6-2.0	0.17-0.20	4.5-5.5	Moderate-----	0.32			
	52-60	27-40	1.35-1.55	0.6-2.0	0.14-0.17	4.5-5.5	Moderate-----	0.24			
16C---------------Clarksville	0-13	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	13-35	27-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
	35-60	40-75	1.40-1.80	0.6-2.0	0.05-0.08	3.6-5.5	Low-----------	0.10			
16D, 16F---------Clarksville	0-18	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	18-60	27-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
17F---------------Clarksville	0-17	15-27	1.30-1.50	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	17-45	27-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
	45-60	40-75	1.40-1.70	0.6-2.0	0.05-0.08	3.6-5.5	Low-----------	0.10			
20C, 20D---------Doniphan	0-11	18-27	1.10-1.30	2.0-6.0	0.08-0.15	4.5-6.5	Low-----------	0.15	2	8	.5-2
	11-15	27-35	1.20-1.40	0.6-2.0	0.10-0.14	3.6-5.5	Moderate-----	0.20			
	15-60	48-70	1.20-1.40	0.6-2.0	0.08-0.10	3.6-5.5	Moderate-----	0.20			
22F*:											
Gasconade--------	0-7	30-40	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	8	2-4
	7-18	40-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20			
	18	---	---	---	---	---	-------------	----			
Rock outcrop.											
26----------------Moniteau	0-20	18-27	1.20-1.40	0.6-2.0	0.21-0.23	5.1-6.5	Low-----------	0.43	3	6	1-2
	20-60	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.43			
	60-68	18-30	1.25-1.45	0.2-0.6	0.20-0.22	4.5-6.5	Low-----------	0.43			
29----------------Nolin	0-9	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43	5	6	2-4
	9-63	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43			
30A---------------Kickapoo	0-4	8-16	1.20-1.55	0.6-2.0	0.16-0.18	5.1-7.8	Low-----------	0.24	5	3	2-4
	4-60	12-18	1.50-1.60	0.6-2.0	0.12-0.16	5.1-7.8	Low-----------	0.24			
31A---------------Razort	0-7	10-25	1.25-1.60	0.6-2.0	0.10-0.22	6.1-7.3	Low-----------	0.37	5	6	1-3
	7-60	18-30	1.25-1.60	0.6-2.0	0.13-0.22	5.6-7.3	Low-----------	0.37			
32C---------------Viraton	0-6	15-25	1.30-1.50	0.6-2.0	0.15-0.18	4.5-6.0	Low-----------	0.43	4	6	.5-2
	6-24	18-35	1.30-1.50	0.6-2.0	0.08-0.16	4.5-6.0	Low-----------	0.43			
	24-48	20-27	1.60-1.80	0.06-0.2	0.01-0.05	3.6-5.5	Low-----------	0.43			
	48-60	25-45	1.10-1.40	0.2-0.6	0.02-0.06	4.5-7.3	Moderate-----	0.28			
34C, 34D---------Gatewood	0-9	15-25	1.10-1.40	0.6-2.0	0.12-0.17	5.1-6.5	Low-----------	0.32	2	8	.5-2
	9-30	60-85	1.10-1.30	0.06-0.2	0.09-0.12	5.1-6.5	High----------	0.32			
	30-35	60-85	1.10-1.30	0.06-0.2	0.07-0.10	6.1-7.3	High----------	0.32			
	35	---	---	---	---	---	-------------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
35B, 35C--------- Lebanon	0-4	10-20	1.20-1.50	0.6-2.0	0.20-0.22	5.6-6.5	Low-----------	0.43	3	5	1-3
	4-7	20-30	1.30-1.50	0.6-2.0	0.14-0.19	4.5-5.5	Low-----------	0.43			
	7-21	35-45	1.30-1.50	0.6-2.0	0.10-0.16	4.5-5.5	Moderate-----	0.32			
	21-39	25-40	1.60-1.80	0.06-0.2	0.08-0.14	4.5-5.5	Low-----------	0.32			
	39-72	40-80	1.40-1.60	0.06-0.2	0.06-0.12	4.5-5.5	Moderate-----	0.32			
37B-------------- Hartville	0-7	20-27	1.10-1.30	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	6	1-3
	7-13	24-40	1.20-1.40	0.06-0.2	0.18-0.21	4.5-6.0	Moderate-----	0.43			
	13-70	35-60	1.20-1.50	0.06-0.2	0.10-0.12	4.5-6.5	High----------	0.32			
38*. Riverwash											
39C, 39D--------- Ocie	0-2	10-20	1.10-1.40	0.6-2.0	0.12-0.17	4.5-6.5	Low-----------	0.32	4	8	.5-2
	2-17	15-27	1.10-1.35	0.6-2.0	0.12-0.15	4.5-6.0	Low-----------	0.32			
	17-46	55-80	1.10-1.30	0.06-0.2	0.07-0.10	5.1-7.3	High----------	0.32			
	46	---	---	---	---	---	-------------	----			
40--------------- Huntington	0-15	18-27	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low-----------	0.28	5	6	3-6
	15-51	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low-----------	0.32			
	51-60	15-30	1.30-1.50	0.6-2.0	0.10-0.16	5.6-7.8	Low-----------	0.28			
41B-------------- Plato	0-6	12-20	1.20-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43	3	5	1-2
	6-29	27-45	1.30-1.50	0.2-0.6	0.10-0.18	3.6-5.5	Moderate-----	0.32			
	29-46	20-27	1.60-1.90	<0.06	0.04-0.10	3.6-5.5	Low-----------	0.24			
	46-62	35-45	1.40-1.60	0.6-2.0	0.06-0.12	4.5-6.0	Moderate-----	0.24			
42C-------------- Gunlock	0-5	15-25	1.20-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	4	5	1-2
	5-25	35-45	1.30-1.50	0.2-0.6	0.12-0.18	4.5-6.5	Moderate-----	0.37			
	25-43	20-35	1.50-1.70	0.2-0.6	0.08-0.14	5.1-6.5	Low-----------	0.37			
	43-73	35-65	1.30-1.50	0.2-0.6	0.06-0.13	4.5-6.5	Moderate-----	0.37			
43F-------------- Poynor	0-19	15-22	1.20-1.45	2.0-6.0	0.04-0.12	3.6-6.5	Low-----------	0.28	2	8	.5-1
	19-27	27-32	1.40-1.55	0.6-2.0	0.02-0.09	3.6-5.5	Low-----------	0.28			
	27-60	42-50	1.50-1.65	0.6-2.0	0.08-0.12	3.6-5.5	Moderate-----	0.28			
46F*:											
Clarksville-----	0-17	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	17-35	27-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			
	35-60	40-75	1.40-1.80	0.6-2.0	0.05-0.08	3.6-5.5	Low-----------	0.10			
Gepp------------	0-11	10-25	1.25-1.45	0.6-2.0	0.06-0.12	5.1-6.5	Low-----------	0.24	4	8	2-4
	11-15	25-40	1.20-1.40	0.6-2.0	0.10-0.22	4.5-6.0	Low-----------	0.28			
	15-47	65-85	1.15-1.30	0.6-2.0	0.10-0.18	4.5-6.0	Moderate-----	0.28			
	47-60	65-85	1.15-1.30	0.6-2.0	0.08-0.18	5.1-6.5	Moderate-----	0.28			
47F*:											
Gepp------------	0-10	10-25	1.25-1.45	0.6-2.0	0.06-0.12	5.1-6.5	Low-----------	0.24	4	8	2-4
	10-47	65-85	1.15-1.30	0.6-2.0	0.10-0.18	4.5-6.0	Moderate-----	0.28			
	47-60	65-85	1.15-1.30	0.6-2.0	0.08-0.18	5.1-6.5	Moderate-----	0.28			
Bardley---------	0-7	20-27	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Moderate-----	0.28	3	8	.5-2
	7-36	60-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-8.4	Moderate-----	0.28			
	36	---	---	---	---	---	-------------	----			
Clarksville-----	0-17	14-20	1.30-1.60	2.0-6.0	0.07-0.12	3.6-6.0	Low-----------	0.15	2	8	1-2
	17-60	27-35	1.40-1.65	2.0-6.0	0.06-0.10	3.6-5.5	Low-----------	0.20			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
47G*:											
Gepp------------	0-4	10-25	1.25-1.45	0.6-2.0	0.08-0.18	5.1-6.5	Low-----------	0.28	4	8	2-4
	4-15	25-40	1.20-1.40	0.6-2.0	0.10-0.22	4.5-6.0	Low-----------	0.28			
	15-47	65-85	1.15-1.30	0.6-2.0	0.10-0.18	4.5-6.0	Moderate-----	0.28			
	47-60	65-85	1.15-1.30	0.6-2.0	0.08-0.18	5.1-6.5	Moderate-----	0.28			
Rock outcrop.											
98*. Pits											
99. Udorthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
12A, 13A---------- Cedargap	B	Frequent----	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low-------	Low.
14B, 14C---------- Claiborne	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
16C, 16D, 16F, 17F-------------- Clarksville	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	High.
20C, 20D---------- Doniphan	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
22F*:												
Gasconade---------	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	High------	Low.
Rock outcrop.												
26---------------- Moniteau	C/D	Rare---------	---	---	0-1.0	Apparent	Nov-May	>60	---	High------	High------	High.
29---------------- Nolin	B	Occasional	Brief to long.	Nov-May	3.0-6.0	Apparent	Nov-Apr	>60	---	---	Low-------	Moderate.
30A--------------- Kickapoo	B	Frequent----	Brief-----	Nov-May	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
31A--------------- Razort	B	Rare---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low.
32C--------------- Viraton	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	Moderate	High.
34C, 34D---------- Gatewood	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High------	Moderate.
35B, 35C---------- Lebanon	C	None---------	---	---	1.0-2.0	Perched	Nov-Apr	>60	---	Moderate	Moderate	High.
37B--------------- Hartville	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High------	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
38*. Riverwash												
39C, 39D: Ocie	C	None	---	---	3.0-5.0	Perched	Nov-Apr	40-60	Hard	Moderate	High	Moderate.
40: Huntington	B	Frequent	Brief	Nov-May	>6.0	---	---	>60	---	High	Low	Moderate.
41B: Plato	C	None	---	---	1.5-2.5	Perched	Nov-Apr	>60	---	Moderate	High	High.
42C: Gunlock	C	None	---	---	2.0-3.0	Perched	Nov-Apr	>60	---	Moderate	Moderate	High.
43F: Poynor	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
46F*:												
Clarksville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
Gepp	B	None	---	---	>6.0	---	---	>60	---	---	High	High.
47F*:												
Gepp	B	None	---	---	>6.0	---	---	>60	---	---	High	High.
Bardley	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Clarksville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
47G*:												
Gepp	B	None	---	---	>6.0	---	---	>60	---	---	High	High.
Rock outcrop.												
98*. Pits												
99. Udorthents												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bardley	Very fine, mixed, mesic Typic Hapludalfs
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Claiborne	Fine-loamy, siliceous, mesic Typic Paleudults
Clarksville	Loamy-skeletal, siliceous, mesic Typic Paleudults
Doniphan	Clayey, mixed, mesic Typic Paleudults
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Gatewood	Very fine, mixed, mesic Typic Hapludalfs
Gepp	Very fine, mixed, mesic Typic Paleudalfs
Gunlock	Fine, mixed, mesic Typic Hapludalfs
Hartville	Fine, mixed, mesic Aquic Hapludalfs
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Kickapoo	Coarse-loamy, mixed, nonacid, mesic Typic Udifluvents
Lebanon	Fine, mixed, mesic Typic Fragiudalfs
Moniteau	Fine-silty, mixed, mesic Typic Ochraqualfs
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Ocie	Loamy-skeletal over clayey, mixed, mesic Typic Hapludalfs
Plato	Fine, mixed, mesic Aquic Fragiudalfs
Poynor	Loamy-skeletal over clayey, siliceous, mesic Typic Paleudults
Razort	Fine-loamy, mixed, mesic Mollic Hapludalfs
Udorthents	Mixed, mesic Udorthents
Viraton	Fine-loamy, siliceous, mesic Typic Fragiudalfs

☆ U.S. GOVERNMENT PRINTING OFFICE : 1989 O - 183-519 : QL 3

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.