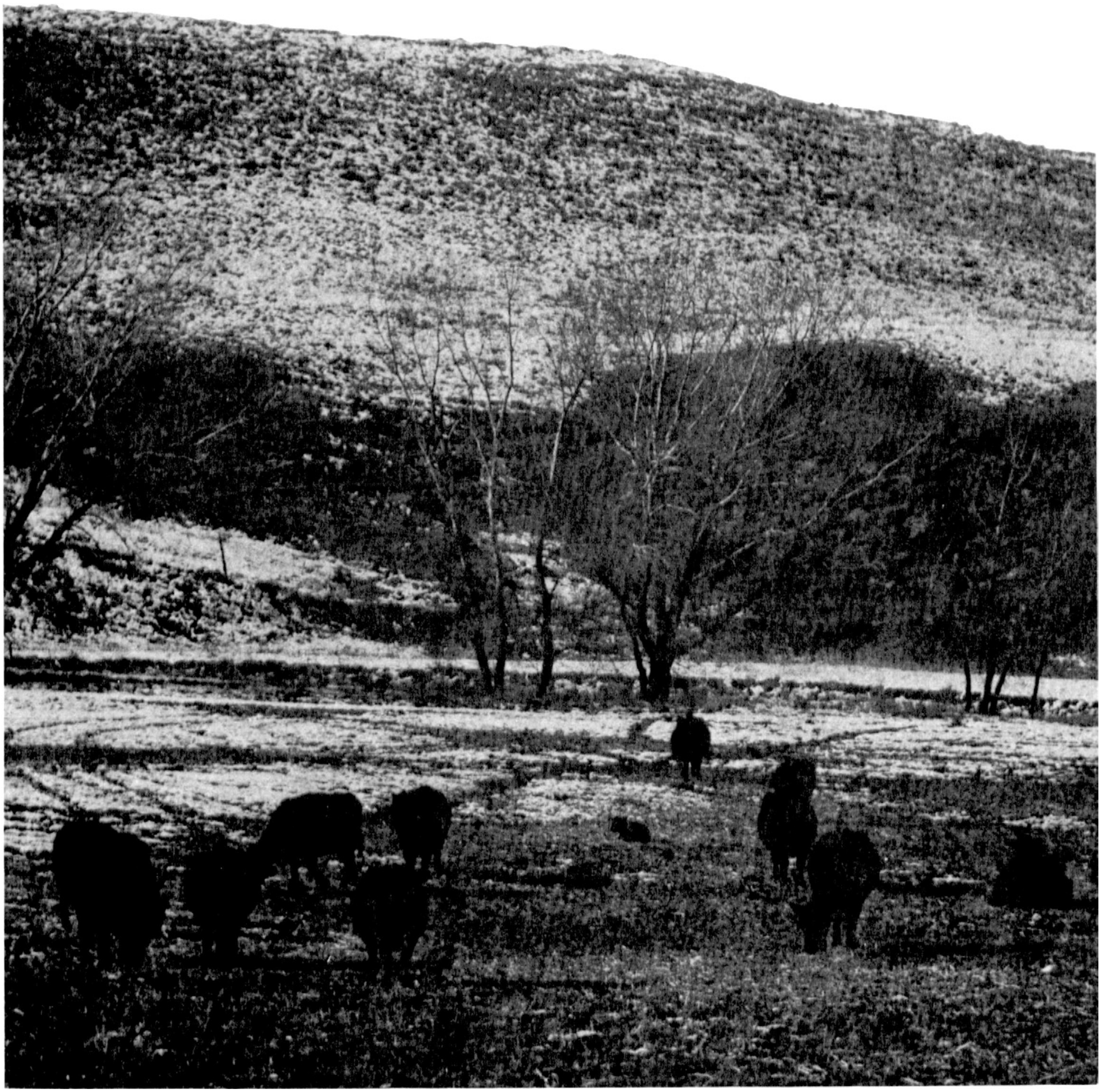
United States
Department of
Agriculture

Soil
Conservation
Service

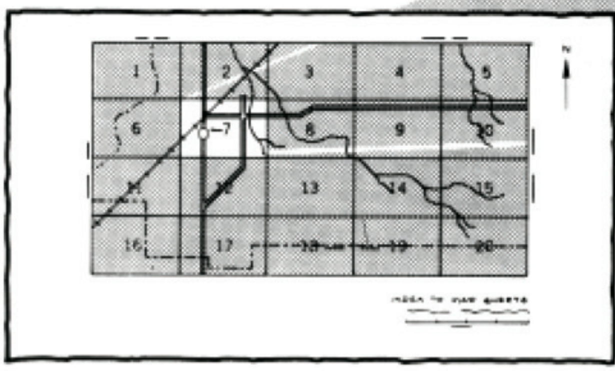
In cooperation with
Kansas Agricultural
Experiment Station

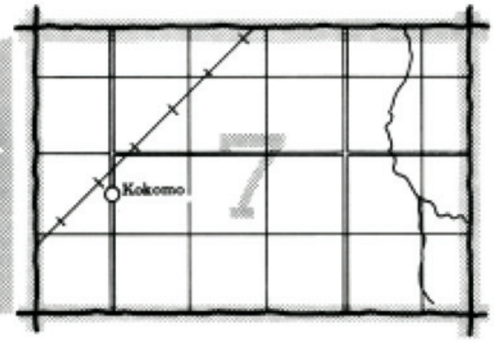
Soil Survey of Russell County Kansas



HOW TO USE

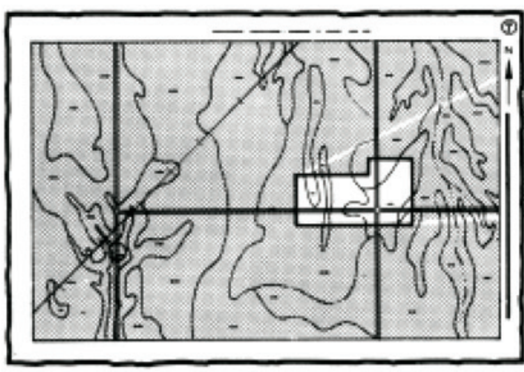
1. Locate your area of interest on the "Index to Map Sheets"

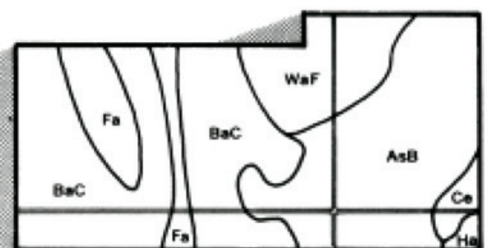




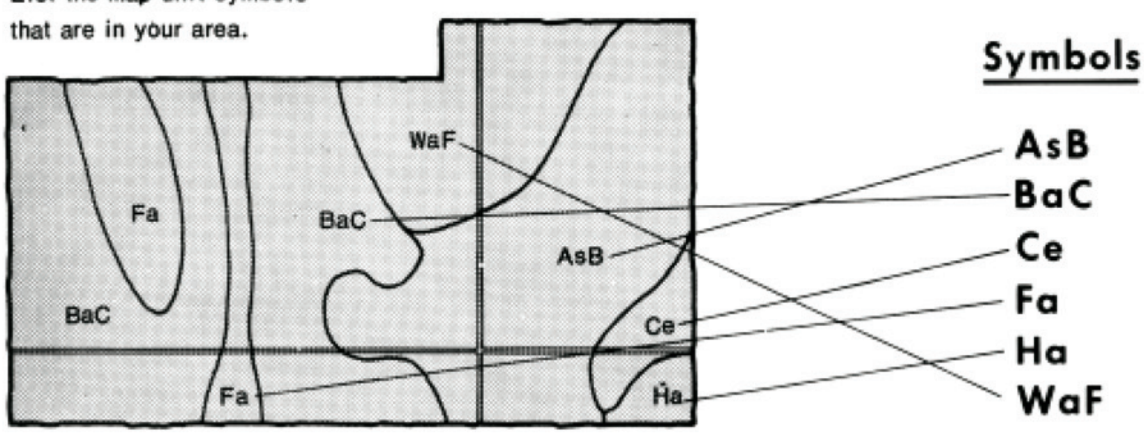
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



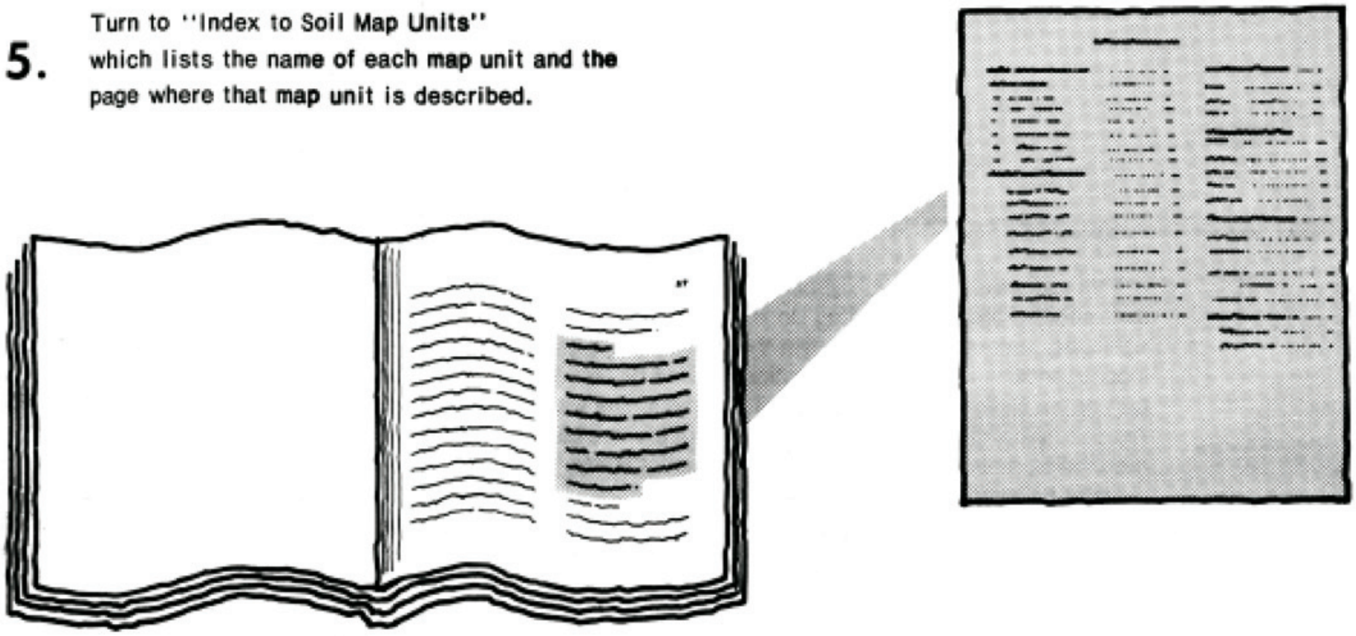


4. List the map unit symbols that are in your area.

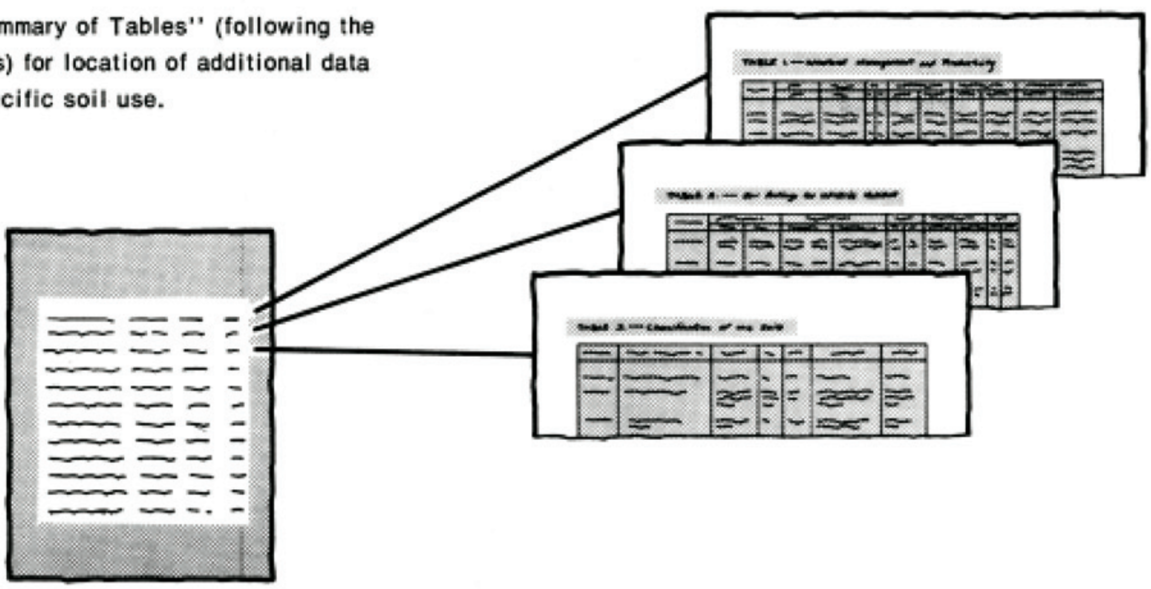


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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, or age.

This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Russell County Conservation District. Major fieldwork was performed in the period 1977-80. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

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: Cattle grazing in an area of Roxbury silt loam, occasionally flooded. The adjacent upland soils formed in material weathered from chalky limestone.

contents

soil series

Issued September 1982

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foreword

This soil survey contains information that can be used in land-planning programs in Russell County, Kansas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure 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.

John W. Tippie

John W. Tippie
State Conservationist
Soil Conservation Service

soil survey of
Russell County, Kansas

By Donald R. Jantz, William A. Wehmueller, and Homer D. Owens,
Soil Conservation Service

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

RUSSELL COUNTY is near the center of Kansas (fig. 1). It has a total area of 574,080 acres, or 897 square miles. According to a preliminary report of the 1980 census, it has a population of 8,771. Russell, the county seat, has a population of 5,394. The county was organized in 1872. It was named after Avra P. Russell, a Kansan who was a veteran of the Civil War.

Russell County is in the Rolling Plains and Breaks major land resource area. Elevation ranges from about 1,430 feet above sea level where the Saline River leaves the county to about 2,050 feet near the northwest corner of the county. The county is drained by the Saline and Smoky Hill Rivers and their tributaries.

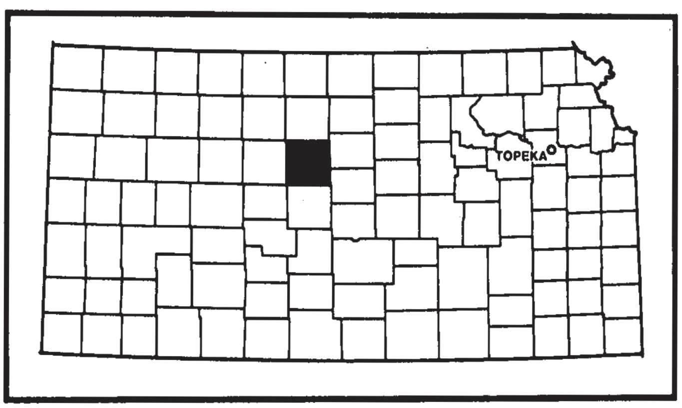

Figure 1.—Location of Russell County in Kansas.

The economy of Russell County is based primarily on farming, ranching, oil, and related enterprises.

This survey updates the soil survey of part of Russell County published in 1903 (*4*). It provides additional information and larger maps, which show the soils in greater detail.

general nature of the county

This section gives general information concerning the county. It describes the climate and the natural resources.

climate

Prepared by L. Dean Bark, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Russell County is typical continental, as can be expected of a location in the interior of a large land mass in the middle latitudes. It is characterized by large daily and annual variations in temperature. Winter is cold because of frequent outbreaks of polar air, but it lasts only from December through February. Warm summer temperatures prevail for about 6 months every year. They provide a long growing season for the crops commonly grown in the county. Spring and fall generally are short.

Russell County generally is west of the flow of moisture-laden air from the Gulf of Mexico and east of the strong rain-shadow effects of the Rocky Mountains. As a result, the amount of annual precipitation is marginal for cropping year after year. The precipitation falls during showers and thunderstorms that can be extremely heavy at times.

Severe windstorms and tornadoes accompany the heavy thunderstorms, but they are infrequent and local in extent. Hail is a more severe hazard, but the crop damage caused by hail is not so great as that in counties to the west.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Russell in the period 1951 to 1976. 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 30.7 degrees F, and the average daily minimum temperature is 18.7 degrees. The lowest temperature on record, which occurred at Russell on February 12, 1899, is -28 degrees. In summer the average temperature is 77.3 degrees, and the average daily maximum temperature is 89.9 degrees. The highest recorded temperature, which occurred at Russell on July 24, 1936, is 118 degrees.

The total annual precipitation is 26.63 inches. Of this, 20.29 inches, or 76 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13.99 inches. The heaviest 1-day rainfall during the period of record was 5.73 inches at Russell on September 17, 1967.

Average seasonal snowfall is 26.5 inches. The greatest snowfall, 60.3 inches, occurred during the winter of 1959-60. On an average of 25 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The sun shines 76 percent of the time possible in summer and 65 percent in winter. The prevailing wind is from the south. Average windspeed is 13.1 miles per hour. It is highest in the spring. It results in significant soil loss and crop damage during the drier years. As a result, measures that conserve moisture and help to prevent soil loss are needed.

natural resources

Robert W. Snyder, district conservationist, Soil Conservation Service, helped prepare this section.

Soil is the most valuable natural resource in Russell County. On more than half of the acreage, it is well suited to cultivated crops. Good quality native grasses grow on the steeper, shallow soils. Irrigation has not been successful because water of good quality is not available in sufficient quantity. The water in the Saline and Smoky Hill Rivers is high in content of salt, particularly during periods of low flow.

The county has an adequate supply of sand and gravel for local use. The deposits are fairly well distributed throughout the county.

Oil was discovered near Fairport in 1922. Since that time, the county has been one of the top oil producers in the state. Currently, more than 3,000 wells are active.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

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, it 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 description and names 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. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

soil descriptions

1. Harney-Nibson-Armo association

Deep and shallow, gently sloping to moderately steep, well drained and somewhat excessively drained soils that have a silty or loamy subsoil; on uplands and foot slopes

This association is on broad ridgetops, side slopes, and foot slopes that are drained by intermittent streams. In some areas it is cut by deeply entrenched drainageways. Slope ranges from 1 to 25 percent.

This association makes up about 66 percent of the county. It is about 36 percent Harney soils, 30 percent Nibson soils, 12 percent Armo soils, and 22 percent minor soils (fig. 2).

The deep, well drained Harney soils formed in loess on ridgetops and side slopes. They are gently sloping and moderately sloping. Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is silty clay loam about 19 inches thick. The upper part is grayish brown and firm, and the lower part is light brownish gray, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The shallow, somewhat excessively drained Nibson soils formed in loamy material weathered from interbedded chalky shale and soft limestone. They are moderately sloping to moderately steep and are on ridgetops and side slopes. Typically, the surface layer is dark grayish brown, calcareous silt loam about 7 inches thick. The subsoil is light brownish gray, friable, calcareous silty clay loam about 5 inches thick. The substratum is white, calcareous silty clay loam. White chalky limestone is at a depth of about 18 inches.

The deep, well drained Armo soils formed in loamy and silty sediments weathered from chalky limestone. They are moderately sloping and strongly sloping and are on foot slopes. Typically, the surface layer is dark gray, calcareous loam about 8 inches thick. The subsoil is about 26 inches thick. It is firm and calcareous. The upper part is grayish brown silty clay loam, and the lower part is pale brown clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Dorrance, Nuckolls, Roxbury, and Wakeen soils. The excessively drained Dorrance soils are on high terraces and uplands near the river valleys. The deep Nuckolls soils are on side slopes. The deep Roxbury soils are on flood plains. The moderately deep Wakeen soils are on the upper side slopes and on ridgetops.

About 65 percent of this association is used for cultivated crops. The rest is mainly range. Wheat, grain sorghum, and forage sorghum are the main crops. Controlling erosion and maintaining good tilth and fertility are concerns in managing cropland. Maintaining a good stand of desirable grasses is the main concern in managing range.

2. Corinth-Harney association

Moderately deep and deep, gently sloping to strongly sloping, well drained soils that have a silty or clayey subsoil; on uplands

This association is on convex ridgetops and side slopes. It commonly is drained by intermittent drainageways. Slope ranges from 1 to 15 percent.

This association makes up about 7 percent of the county. It is about 48 percent Corinth soils, 43 percent Harney soils, and 9 percent minor soils (fig. 3).

The moderately deep Corinth soils formed in material weathered from calcareous shale. They are moderately sloping on ridgetops and moderately sloping and strongly sloping on side slopes. Typically, the surface layer is grayish brown, calcareous silty clay loam about 6 inches thick. The subsoil is about 21 inches thick. It is firm and calcareous. The upper part is pale brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is pale yellow, calcareous silty clay. Pale yellow shale is at a depth of about 36 inches.

The deep Harney soils formed in loess on ridgetops. They are gently sloping and moderately sloping. Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is silty clay loam about 19 inches thick. The upper part is grayish brown and firm, and the lower part is light brownish gray, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Nibson, Roxbury, and Wakeen soils. The shallow Nibson soils are moderately sloping to moderately steep and are on narrow side slopes. The deep Roxbury soils are on flood plains. The moderately deep Wakeen soils are gently sloping on ridgetops and moderately sloping on side slopes.

About half of this association is used for cultivated crops. The rest is mainly range. Wheat, grain sorghum, and forage sorghum are the main crops. Controlling erosion and conserving moisture are concerns in managing cropland. Maintaining a good stand of desirable grasses is the main concern in managing range.

3. Corinth-Bogue-Armo association

Moderately deep and deep, moderately sloping and strongly sloping, well drained and moderately well drained soils that have a silty, clayey, or loamy subsoil; on uplands and foot slopes

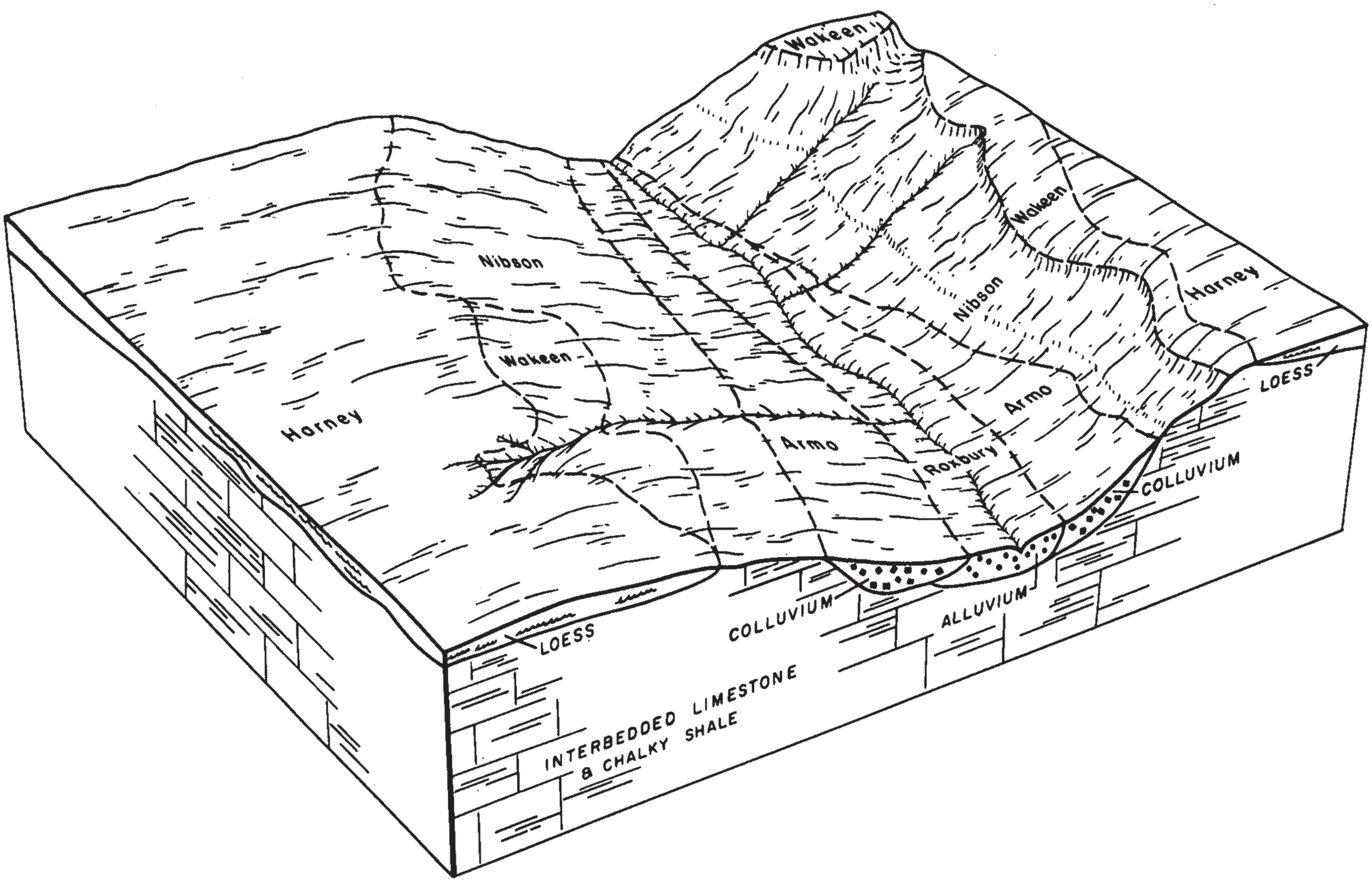

Figure 2.—Typical pattern of soils and parent material in the Harney-Nibson-Armo association.

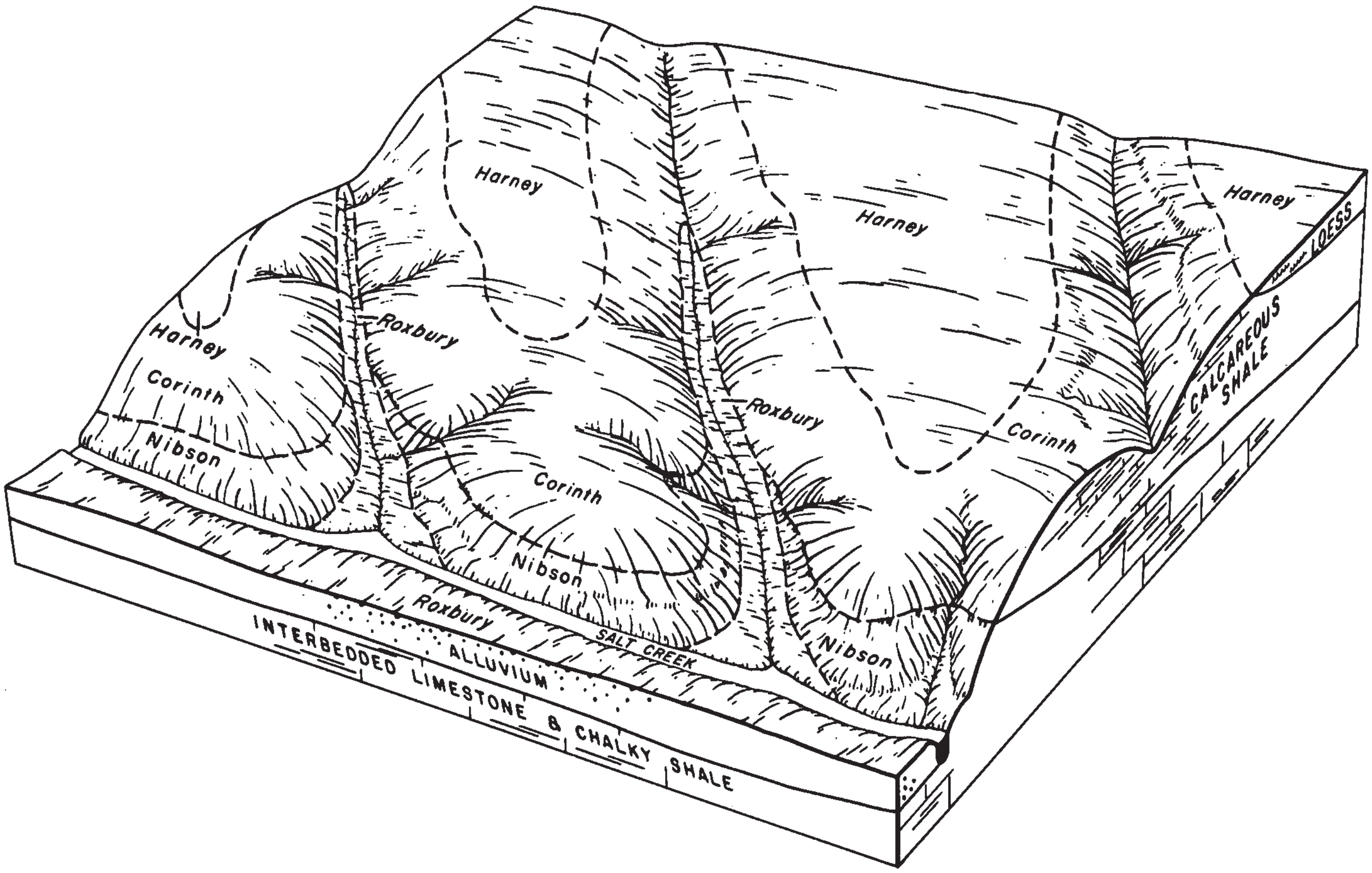

Figure 3.—Typical pattern of soils and parent material in the Corinth-Harney association.

This association is on ridgetops, side slopes, and foot slopes. It is drained by many intermittent streams. Slope ranges from 2 to 15 percent.

This association makes up about 4 percent of the county. It is about 28 percent Corinth soils, 26 percent Bogue soils, 21 percent Armo soils, and 25 percent minor soils (fig. 4).

The moderately deep, well drained Corinth soils formed in material weathered from calcareous shale. They are moderately sloping on ridgetops and moderately sloping and strongly sloping on side slopes. Typically, the surface layer is grayish brown, calcareous silty clay loam about 6 inches thick. The subsoil is about 21 inches thick. It is firm and calcareous. The upper part is pale brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is pale yellow, calcareous silty clay. Pale yellow shale is at a depth of about 36 inches.

The moderately deep, moderately well drained Bogue soils formed in material weathered from clayey shale. They are moderately sloping and strongly sloping and are on side slopes and narrow, convex ridgetops. Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is extremely firm clay about 18 inches thick. It is dark gray in the upper part and gray and mottled in the lower part. Gray clayey shale is at a depth of about 23 inches.

The deep, well drained Armo soils formed in loamy and silty sediments weathered from chalky limestone. They are moderately sloping and strongly sloping and are on foot slopes. Typically, the surface layer is dark gray, friable, calcareous loam about 8 inches thick. The subsoil is about 26 inches thick. It is firm and calcareous. The upper part is grayish brown silty clay loam, and the lower part is pale brown clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Harney, Nibson, Nuckolls, and Roxbury soils. The deep, well drained Harney and Nuckolls soils are on ridgetops and the upper side slopes. The shallow Nibson soils are on the upper side slopes. The deep Roxbury soils are on flood plains.

This association is used mainly as range. Some moderately sloping areas of the Armo and Corinth soils

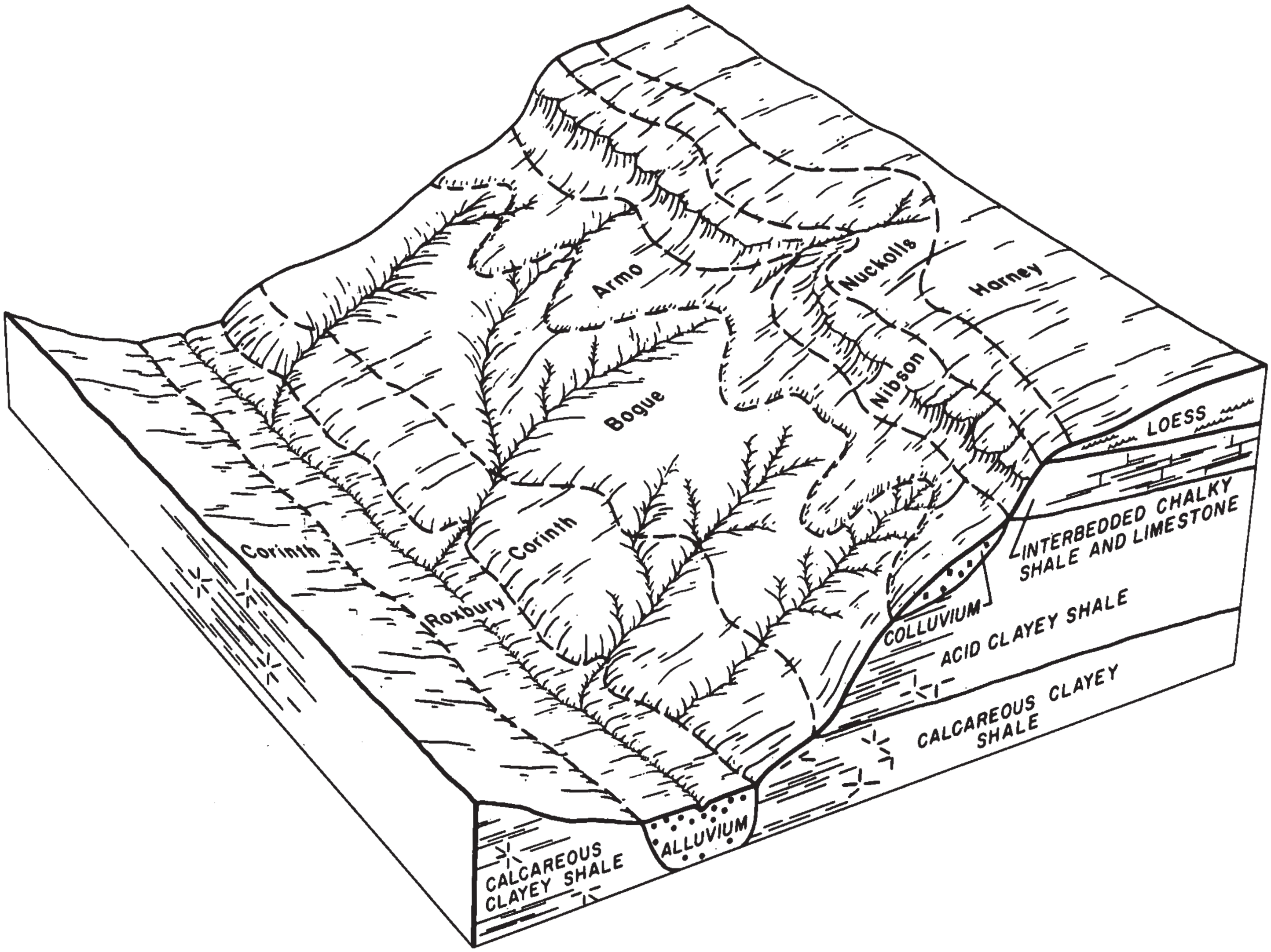

Figure 4.—Typical pattern of soils and parent material in the Corinth-Bogue-Armo association.

are used for cultivated crops. Proper stocking rates and a uniform distribution of grazing are needed in the areas used as range.

4. Crete-Harney association

Deep, nearly level to moderately sloping, moderately well drained and well drained soils that have a clayey or silty subsoil; on uplands

This association is on broad, smooth ridgetops that are dissected by a few intermittent streams. Slope ranges from 0 to 7 percent.

This association makes up about 7 percent of the county. It is about 73 percent Crete soils, 25 percent Harney soils, and 2 percent minor soils (fig. 5).

The moderately well drained Crete soils formed in loess. They are nearly level. Typically, the surface layer is dark gray silt loam about 6 inches thick. The subsurface layer is dark gray, friable silty clay loam about 5 inches thick. The subsoil is about 27 inches thick. It is firm. It is dark grayish brown silty clay loam in the upper part, grayish brown silty clay in the next part, and light brownish gray, mottled silty clay loam in the lower part. The substratum to a depth of 60 inches is mottled silty clay loam. It is light gray in the upper part and pale brown in the lower part.

The well drained Harney soils formed in loess. They are gently sloping and moderately sloping. Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is silty clay loam about 19 inches thick. The upper part is grayish brown and firm, and the lower part is light brownish gray, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Minor in this association are Nibson and Wakeen soils. The shallow Nibson and moderately deep Wakeen soils are moderately sloping and strongly sloping and are on narrow side slopes adjacent to the intermittent streams.

Nearly all of this association is used for cultivated crops. Wheat, grain sorghum, and forage sorghum are the major crops. Erosion is a hazard on the gently sloping and moderately sloping Harney soils. Controlling erosion and maintaining good tilth and fertility are the main concerns in managing cropland.

5. Lancaster-Hedville-Edalgo association

Moderately deep and shallow, moderately sloping to steep, well drained and somewhat excessively drained soils that have a loamy or dominantly clayey subsoil; on uplands

This association is on ridgetops and side slopes. It is drained by many intermittent drainageways and a few small creeks. In some areas it is cut by deeply entrenched valleys. Shale or sandstone bedrock commonly crops out on the steeper slopes. Slope ranges from 3 to 30 percent.

This association makes up about 4 percent of the county. It is about 53 percent Lancaster soils, 21 percent Hedville soils, 11 percent Edalgo soils, and 15 percent minor soils (fig. 6).

The moderately deep, well drained Lancaster soils formed in material weathered from noncalcareous sandstone and sandy shale. They are moderately sloping and strongly sloping and are on smooth ridgetops and side slopes. Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 29 inches thick. It is brown and friable. It is loam in the upper part and clay loam in the lower part. Light brown and very pale brown sandy shale and weakly consolidated sandstone are at a depth of about 36 inches.

The shallow, somewhat excessively drained Hedville soils formed in material weathered from noncalcareous

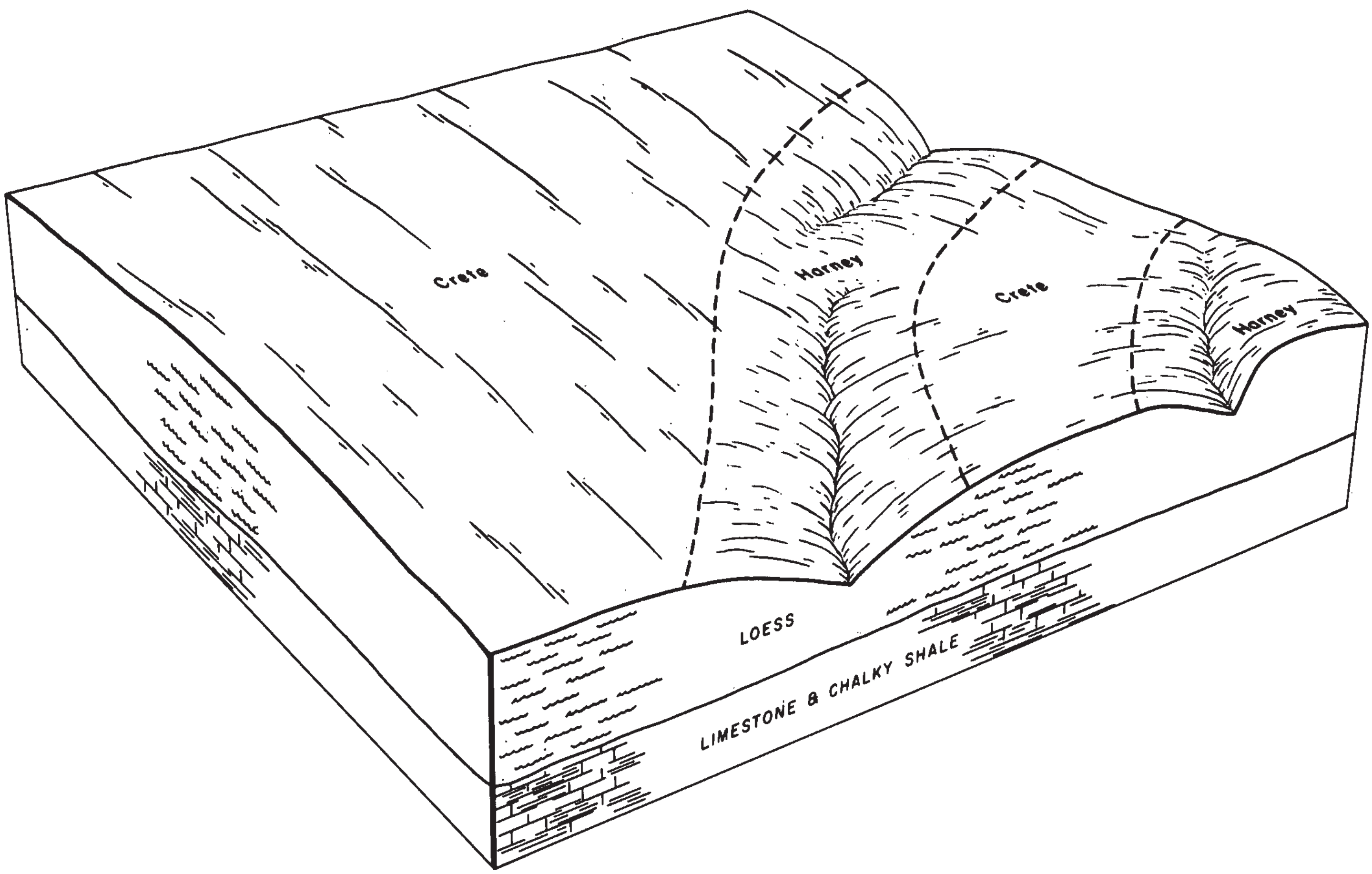

Figure 5.—Typical pattern of soils and parent material in the Crete-Harney association.

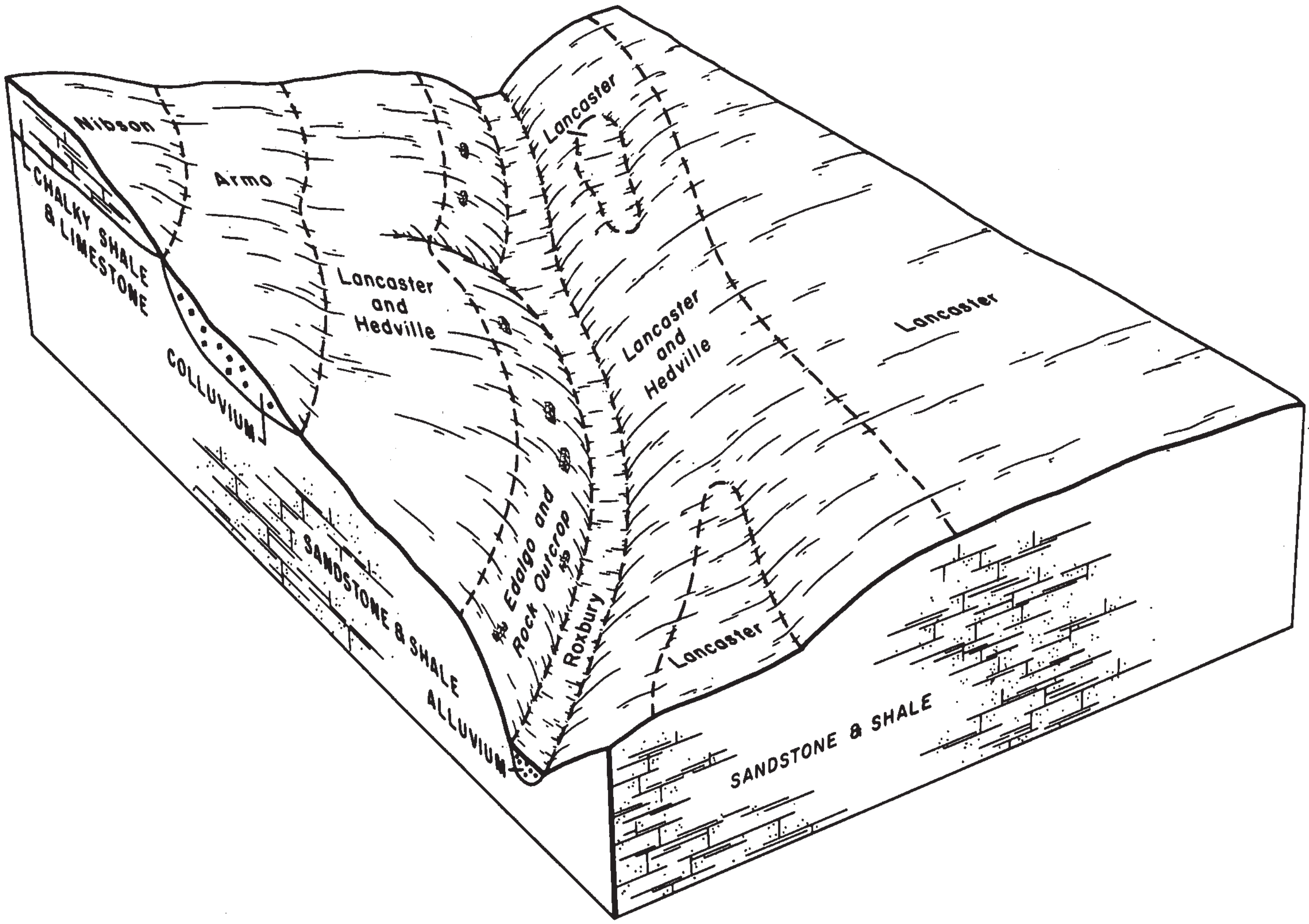

Figure 6.—Typical pattern of soils and parent material in the Lancaster-Hedville-Edalgo association.

sandstone. They are strongly sloping and moderately steep and are on narrow ridgetops and sharp slope breaks. Typically, the surface layer is dark grayish brown loam about 12 inches thick. Brown and strong brown sandstone is at a depth of about 12 inches.

The moderately deep, well drained Edalgo soils formed in material weathered from noncalcareous shale. They are strongly sloping to steep and are on ridgetops and side slopes. Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is grayish brown, friable silt loam about 4 inches thick. The subsoil is about 12 inches thick. The upper part is brown, friable silty clay loam, and the lower part is light brownish gray, firm silty clay. The substratum is gray silty clay. Light gray shale is at a depth of about 26 inches.

Minor in this association are Armo, Nibson, and Roxbury soils. The deep, calcareous Armo soils are on foot slopes and concave side slopes. The shallow Nibson soils are on the upper side slopes. The deep Nuckolls soils are on the lower side slopes. Roxbury soils are on flood plains along drainageways.

This association is used mainly as range. The main management concern is maintaining a vigorous stand of native grasses.

6. Roxbury-McCook association

Deep, nearly level, well drained soils that have a silty or loamy subsoil; on terraces and flood plains

This association is on bottom land along the major streams in the county. The soils are subject to flooding.

Slope generally is 0 to 2 percent but is steeper along the stream channels.

This association makes up about 12 percent of the county. It is about 65 percent Roxbury soils, 14 percent McCook soils, and 21 percent minor soils.

The Roxbury soils formed in calcareous, silty alluvium on terraces and flood plains. Typically, the surface layer is dark gray, calcareous silt loam about 17 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 9 inches thick. The subsoil is grayish brown, friable, calcareous silty clay loam about 14 inches thick. The substratum to a depth of about 60 inches is grayish brown, calcareous silt loam.

The McCook soils formed in calcareous alluvium on terraces. Typically, the surface soil is grayish brown, calcareous silt loam about 12 inches thick. The next 16 inches is light brownish gray, very friable, calcareous very fine sandy loam. The substratum to a depth of about 60 inches is light gray and light brownish gray, calcareous very fine sandy loam.

Minor in this association are Armo, Eltree, Humbarger, and Munjor soils. Armo and Eltree soils are on foot slopes. They are not stratified. The loamy Humbarger soils are on flood plains along the rivers. Munjor soils are on terraces. They contain more sand than the Roxbury and McCook soils.

This association is used mainly for cultivated crops. The main crops are wheat, grain sorghum, forage sorghum, and alfalfa. Flooding is a hazard in some years. Maintaining good tilth and fertility are the major concerns in managing cropland.

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 identifies 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, Roxbury silt loam, occasionally flooded, is one of several phases in the Roxbury series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* generally consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Lancaster-Hedville loams, 8 to 25 percent slopes, is an example. Some complexes consist of a soil and a miscellaneous area. Edalgo-Rock outcrop complex, 10 to 30 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. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

The descriptions and names of the soils identified on the detailed maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

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

Ae—Armo loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on foot slopes below limestone hills (fig. 7). Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark gray, calcareous loam about 8 inches thick. The subsoil is about 28 inches thick. It is firm and calcareous. The upper part is grayish brown silty clay loam, and the lower part is pale brown clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. Limestone fragments are in the subsoil and substratum. In some areas the surface soil is more than 20 inches thick. In other areas chalky shale and limestone are at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of the shallow Nibson soils on the upper side slopes. These soils make up about 5 percent of the unit.

Permeability is moderate in the Armo soil, and available water capacity is high. Runoff is medium. Organic matter content is moderate, and natural fertility is medium. The soil is mildly alkaline or moderately alkaline throughout. Tilth is good in the surface layer.

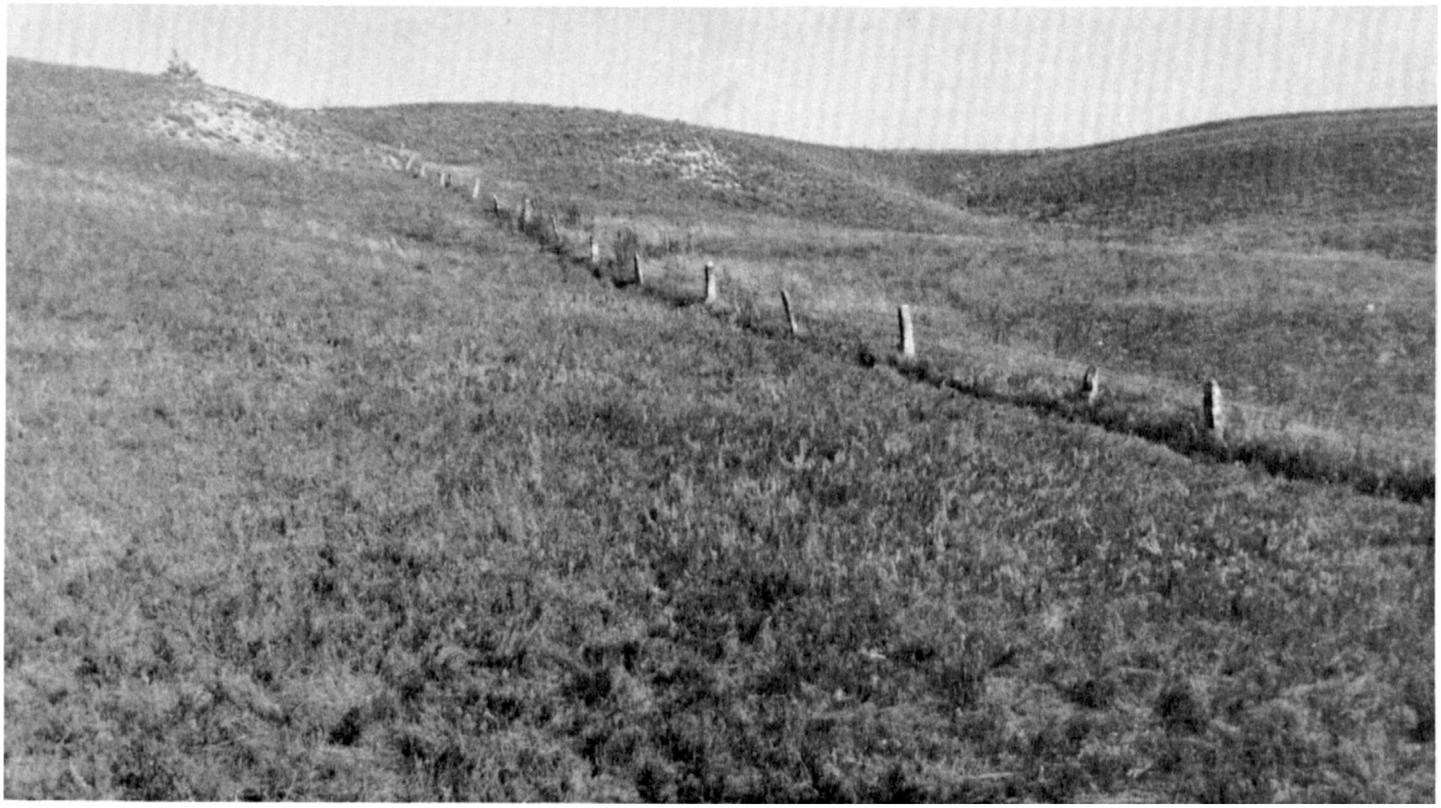

Figure 7.—An area of Armo loam, 3 to 7 percent slopes, on foot slopes below an area of the steeper, shallow Nibson soils.

About three-fourths of the acreage is used for cultivated crops. This soil is moderately well suited to wheat, grain sorghum, forage sorghum, alfalfa, and hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by terraces, grassed waterways, contour farming, and minimum tillage. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the rate of water infiltration, and helps to maintain the organic matter content and good tilth.

This soil is well suited to range. If the range is overgrazed, however, the growth of the more productive grasses is retarded and unwanted vegetation invades. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

The many areas where cropland joins range can be managed as habitat for upland wildlife, such as pheasants. Planting shrubs in these areas provides winter cover for the wildlife.

This soil is well suited to dwellings. It is moderately well suited to local roads and streets, septic tank absorption fields, and sewage lagoons. Low strength is a limitation on sites for local roads and streets. Strengthening or replacing the base material, however, helps to overcome this limitation. The moderate permeability somewhat restricts the absorption of effluent in septic tank absorption fields. Enlarging the field, however, commonly overcomes this limitation. Seepage and slope are limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. If the less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is IIIe.

Ag—Armo loam, 7 to 15 percent slopes. This deep, strongly sloping, well drained soil is on foot slopes adjacent to limestone hills. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is dark gray, calcareous loam about 8 inches thick. The subsoil is about 26 inches thick. It is firm and calcareous. The upper part is grayish brown silty clay loam, and the lower part is pale brown clay loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. Limestone fragments are in the subsoil and substratum.

In some areas chalky shale and limestone are at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Nibson and Roxbury soils. The shallow Nibson soils are on the upper side slopes. Roxbury soils are dark to a depth of more than 20 inches. They are on flood plains along narrow drainageways. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Armo soil, and available water capacity is high. Runoff is rapid. Organic matter content is moderate, and natural fertility is medium. The soil is mildly alkaline or moderately alkaline throughout.

Most of the acreage is range (fig. 8). This soil generally is unsuitable for cultivated crops because of a severe hazard of erosion. It is best suited to range. The major concern of management is the hazard of erosion. An adequate plant cover and ground mulch reduce the runoff rate and help to prevent excessive soil loss. Overgrazing destroys the protective plant cover and causes deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive grasses and by weeds. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

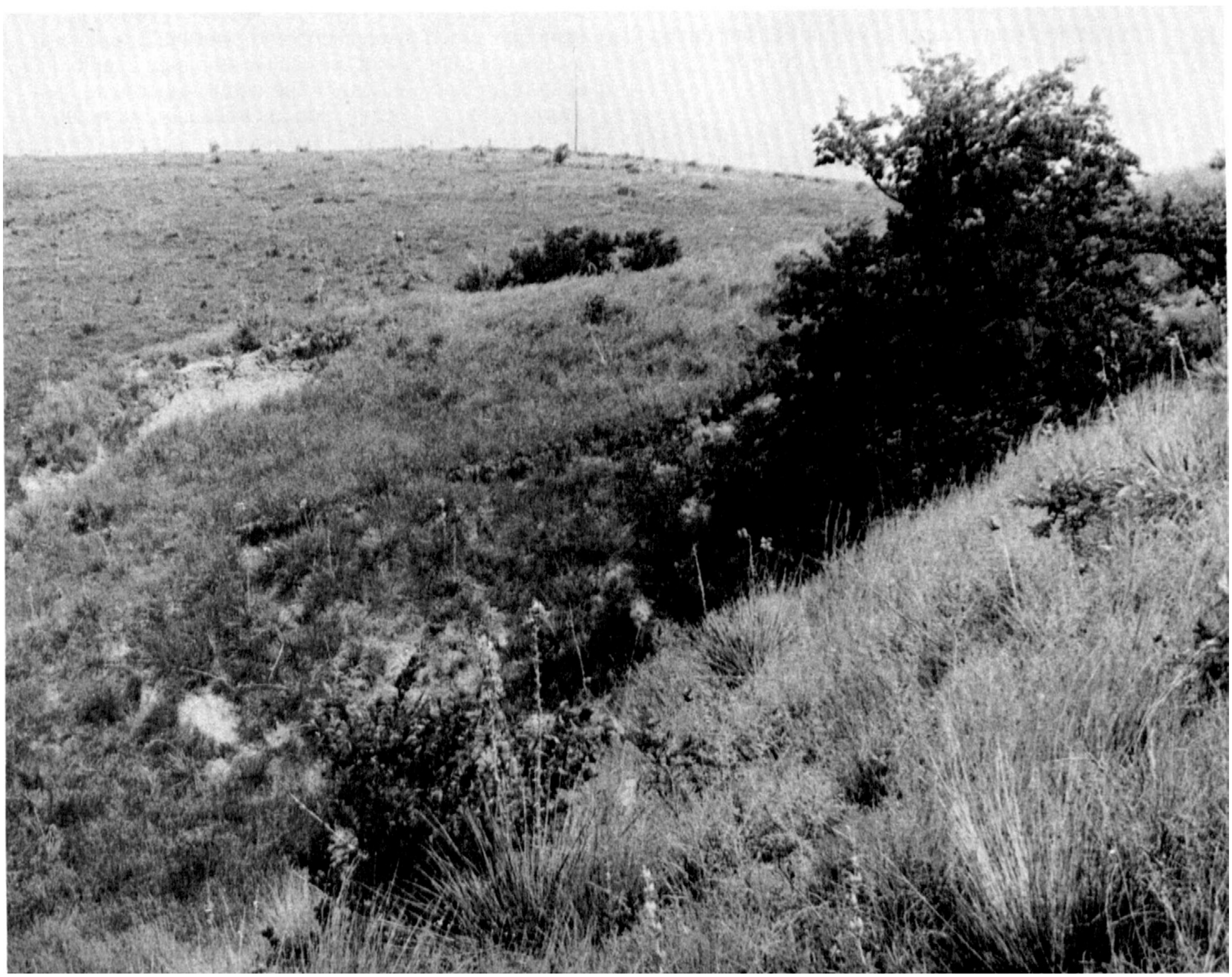

Figure 8.—An area of Armo loam, 7 to 15 percent slopes, used as range.

This soil is moderately well suited to dwellings and local roads and streets. The slope is a limitation on sites for dwellings, and low strength is a limitation on sites for local roads and streets. Some land shaping commonly is needed on sites for dwellings. Strengthening or replacing the base material helps to prevent the road damage caused by low strength.

This soil is moderately well suited to septic tank absorption fields and is poorly suited to sewage lagoons. The moderate permeability somewhat restricts the absorption of effluent in septic tank absorption fields. As a result of the moderate permeability and the slope, the effluent tends to seep laterally and surfaces in some downslope areas. Enlarging the field commonly overcomes the slow absorption of the effluent. Slope and seepage are limitations on sites for sewage lagoons. If less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction. Sealing the lagoon helps to control seepage.

The capability subclass is VIe.

Bo—Bogue clay, 3 to 15 percent slopes. This moderately deep, moderately sloping and strongly sloping, moderately well drained soil is on the sides and tops of ridges in the uplands. Individual areas are irregular in shape and range from 10 to 300 acres in size.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is extremely firm clay about 18 inches thick. It is dark gray in the upper part and gray and mottled in the lower part. Gray clayey shale is at a depth of about 23 inches. In some areas the depth to shale is less than 20 inches.

Included with this soil in mapping are small areas of Armo and Dorrance soils. The deep, calcareous Armo soils are on the lower side slopes. Dorrance soils have a sandy subsoil. They are on the upper side slopes and on ridges. Included soils make up about 5 percent of the unit.

Permeability is very slow in the Bogue soil, and available water capacity is very low. Runoff is rapid. Organic matter content is moderately low, and natural fertility is low. The surface layer is neutral. Root penetration is difficult in the surface layer and subsoil and is restricted by the shale at a depth of about 23 inches. Because of the high content of clay, moisture is released slowly to plants. The shrink-swell potential is high.

Nearly all of the acreage is range. The soil generally is unsuitable for cultivated crops because of a severe hazard of erosion and the very low available water capacity. It is best suited to range. The major concerns of management are the hazard of erosion and the very low available water capacity. If the range is overgrazed, the more desirable grasses are replaced by less productive grasses and by weeds and the runoff rate is increased. An adequate plant cover reduces the runoff rate, helps to prevent excessive soil loss, and increases the moisture supply. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Sites that are suitable for stock water ponds generally are available in the larger areas of this soil.

This soil is poorly suited to local roads and streets and to dwellings. Low strength and the high shrink-swell potential are severe limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps prevent the damage caused by low strength or by shrinking and swelling. The shrink-swell potential also is a severe limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil generally is unsuitable as a septic tank absorption field because of the depth to bedrock. It is poorly suited to sewage lagoons because of the depth to bedrock and the slope. The deeper soils on the lower side slopes are better sites. If less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is VIe.

Cc—Corinth silty clay loam, 2 to 7 percent slopes. This moderately deep, moderately sloping, well drained soil is on the sides and tops of ridges in the uplands. Individual areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is grayish brown, calcareous silty clay loam about 6 inches thick. The subsoil is about 21 inches thick. It is firm and calcareous. The upper part is pale brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is pale yellow, calcareous silty clay. Pale yellow shale is at a depth of about 36 inches. In some areas the surface layer is dark grayish brown and is 7 or more inches thick. In other areas the depth to shale is less than 20 inches.

Included with this soil in mapping are small areas of the deep Harney soils on ridgetops. These soils make up about 5 percent of the unit.

Permeability is slow in the Corinth soil, and available water capacity is low. Runoff is medium. Organic matter content and natural fertility are low. The soil is mildly alkaline or moderately alkaline throughout. Tilth generally is good, but working the soil is somewhat difficult in eroded areas where plowing has mixed part of the subsoil with the surface layer. Root penetration is restricted by the shale at a depth of about 36 inches. The shrink-swell potential is high in the subsoil.

About half of the acreage is used for cultivated crops. The rest is mainly range. Wheat, grain sorghum, and forage sorghum are the main crops (fig. 9). This soil is poorly suited to cultivated crops and is moderately well suited to pasture and hay. If cultivated crops are grown, erosion and drought are hazards and the low fertility is a limitation. Terraces, grassed waterways, contour farming, a cover of crop residue, and minimum tillage help to prevent excessive soil loss. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the rate of water infiltration, and improves fertility.

This soil is well suited to range. If the range is overgrazed, however, the more desirable grasses are replaced by less productive grasses and the runoff rate is increased. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil is moderately well suited to local roads and streets and to dwellings. Low strength and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage caused by low strength or by shrinking and swelling. The shrink-swell potential also is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil generally is unsuitable as a septic tank absorption field because of the slow permeability and the depth to bedrock. It is only moderately well suited to sewage lagoons because the depth to bedrock is a limitation. The deeper soils on the lower side slopes are better sites.

The capability subclass is IVe.

Cd—Corinth silty clay loam, 7 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on the sides of upland drainageways. Individual areas are irregular in shape and range from 10 to 150 acres in size.

Figure 9.—Baled sorghum hay in a terraced area of Corinth silty clay loam, 2 to 7 percent slopes.

Typically, the surface layer is grayish brown, calcareous silty clay loam about 6 inches thick. The subsoil is about 19 inches thick. It is firm and calcareous. The upper part is pale brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is pale yellow, calcareous silty clay. Pale yellow shale is at a depth of about 36 inches. In some areas the surface layer is silty clay. In other areas the depth to shale is less than 20 inches.

Included with this soil in mapping are small areas of Nibson and Roxbury soils. The shallow Nibson soils are on the lower side slopes. Roxbury soils are dark to a depth of more than 20 inches. They are on flood plains along narrow drainageways. Included soils make up about 5 percent of the unit.

Permeability is slow in the Corinth soil, and available water capacity is low. Runoff is rapid. Organic matter content and natural fertility are low. The soil is mildly alkaline or moderately alkaline throughout. Root penetration is restricted by the shale at a depth of about 36 inches. The shrink-swell potential is high in the subsoil.

Most areas are used as range. This soil generally is unsuitable for cultivated crops because of a severe hazard of erosion. It is best suited to range. The major concerns of management are the hazard of erosion and the low available water capacity. Overgrazing retards the growth and reduces the vigor of the grasses and increases the runoff rate. An adequate plant cover reduces the runoff rate and helps to prevent excessive soil loss. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

This soil is poorly suited to local roads and streets and to dwellings. Low strength and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage caused by low strength and by shrinking and swelling. The shrink-swell potential also is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil generally is unsuitable as a septic tank absorption field because of the slow permeability and the depth to bedrock. It is poorly suited to sewage lagoons because of the depth to bedrock and the slope. The deeper soils on the lower side slopes are better sites. If less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is VIe.

Cr—Crete silt loam, 0 to 1 percent slopes. This deep, nearly level, moderately well drained soil is on broad flats or in slight depressions in the uplands. Individual areas range from 80 to several hundred acres in size.

Typically, the surface layer is dark gray silt loam about 6 inches thick. The subsurface layer is dark gray, friable silty clay loam about 5 inches thick. The subsoil is about 27 inches thick. It is firm. It is dark grayish brown silty clay loam in the upper part, grayish brown silty clay in the next part, and light brownish gray, mottled silty clay loam in the lower part. The substratum to a depth of about 60 inches is mottled silty clay loam. It is light gray in the upper part and pale brown in the lower part. In some areas the subsoil is less clayey.

Permeability and runoff are slow. Available water capacity is high. Organic matter content is moderate, and natural fertility is high. The surface layer is medium acid. Tilth is good. The shrink-swell potential is high in the subsoil.

Nearly all of the acreage is cultivated. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Drought is a hazard in some years. Also, tillage is sometimes delayed in the spring because of wetness. Returning crop residue to the soil increases the rate of water infiltration and conserves moisture.

This soil is moderately well suited to local roads and streets and to dwellings. Low strength and the shrink-swell potential are limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage caused by low strength or by shrinking and swelling. The shrink-swell potential also is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling.

This soil is poorly suited to septic tank absorption fields because of the slow permeability. The effluent is more readily absorbed if the lateral lines are installed below the clayey subsoil. Enlarging the field also helps to overcome the slow absorption of the effluent. The soil is only moderately well suited to sewage lagoons because seepage is a limitation. Sealing the lagoon helps to control seepage. In places the clayey subsoil can be used to seal the floor of the lagoon.

The capability subclass is IIs.

De—Detroit silt loam. This deep, nearly level, moderately well drained soil is on terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 15 to 400 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is firm silty clay loam about 23 inches thick. The upper part is very dark grayish brown, the next part is grayish brown and calcareous, the lower part is pale brown and calcareous. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In some areas the depth to lime is less than 22 inches.

Included with this soil in mapping are small areas of Roxbury soils and small areas of clayey soils. The well drained Roxbury soils are along intermittent streams. The clayey soils are in slightly concave areas. Included soils make up about 10 percent of the unit.

Permeability is slow in the Detroit soil, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The surface layer is neutral. Tilth is good. The shrink-swell potential is high in the subsoil.

Nearly all of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. Drought is a hazard in some years. Returning crop residue to the soil increases the rate of water infiltration and conserves moisture.

This soil is poorly suited to dwellings. The flooding is the main hazard. Also, the shrink-swell potential is a limitation on sites for dwellings without basements. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. Because of the hazard of flooding, the highest areas on the landscape should be selected as sites for dwellings.

This soil is only moderately well suited to local roads because of low strength and the shrink-swell potential. Strengthening or replacing the base material, however, helps to prevent the damage caused by low strength or by shrinking and swelling.

This soil is well suited to sewage lagoons. It is poorly suited to septic tank absorption fields, however, because the slow permeability restricts the absorption of the effluent. Enlarging the field helps to overcome the slow absorption of the effluent.

The capability class is I.

Do—Dorrance sandy loam, 1 to 4 percent slopes. This deep, gently sloping, excessively drained soil is on uplands and high terraces. Individual areas are irregular in shape and range from 10 to 300 acres in size.

Typically, the surface soil is calcareous sandy loam about 14 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The next 5 inches is light brownish gray, very friable, calcareous sandy loam. The substratum to a depth of about 60 inches is very pale brown, calcareous gravelly sand. In some areas the soil is noncalcareous to a depth of 36 inches.

Included with this soil in mapping are small areas of the well drained Wells soils in the slightly higher positions on the landscape. These soils make up about 5 percent of the unit.

Permeability is very rapid in the Dorrance soil, and available water capacity is low. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. The surface soil is mildly alkaline. It is very friable, and tilth is good.

About half of the acreage is used for cultivated crops, and half is used as range. Wheat, grain sorghum, and forage sorghum are the main crops. This soil is poorly suited to cultivated crops and is moderately well suited to hay and pasture. The main concerns of management are controlling soil blowing, conserving moisture, and maintaining fertility. Stripcropping, leaving crop residue on the surface, and minimizing tillage help to control soil blowing and conserve moisture. Applications of fertilizer help to maintain fertility.

This soil is moderately well suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing, however, retards the growth and reduces the vigor of the grasses and increases the susceptibility to soil blowing. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition. They also help to prevent deterioration of the habitat for rangeland wildlife.

This soil is well suited to local roads and streets and to dwellings. It is poorly suited to septic tank absorption fields and sewage lagoons. The effluent from these disposal systems can contaminate shallow ground water because of seepage. The deeper included soils are better sites for septic tank absorption fields. Sealing sewage lagoons with clayey material helps to control seepage. The soil is a probable source of sand.

The capability subclass is IVs.

Dr—Dorrance gravelly sandy loam, 4 to 15 percent slopes. This deep, moderately sloping and strongly sloping, excessively drained soil is on upland ridgetops and side slopes near the river valleys. Individual areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, calcareous gravelly sandy loam about 11 inches thick. The next 4 inches is grayish brown, very friable, calcareous gravelly loamy sand. The upper part of the substratum is light gray, calcareous gravelly loamy sand. The lower part to a depth of about 60 inches is very pale brown, calcareous gravelly sand. In some areas the depth to gravelly sand is less than 10 inches.

Included with this soil in mapping are small areas of Armo soils near the head of some intermittent streams. These soils are less sandy than the Dorrance soil. They make up about 10 percent of the unit.

Permeability is very rapid in the Dorrance soil, and available water capacity is very low. Runoff is slow. Organic matter content is moderately low, and natural fertility is low. The surface layer is moderately alkaline.

Most areas are used as range (fig. 10). This soil generally is unsuited to cultivated crops because of the very low available water capacity. It is moderately well suited to range. The major concern of management is the very low available water capacity. If the range is overgrazed, the more desirable grasses are replaced by less productive grasses and by weeds. Proper stocking rates, a uniform distribution of grazing, and timely

Figure 10.—An area of Dorrance gravelly sandy loam, 4 to 15 percent slopes, used as range. Yucca plants are common on this soil.

deferment of grazing help to keep the range in good condition.

This soil is only moderately well suited to local roads and streets and to dwellings because of the slope. If the less sloping areas are selected as sites for these uses, less leveling and earthmoving are needed during construction.

This soil is poorly suited to septic tank absorption fields and sewage lagoons. The effluent from these disposal systems can contaminate shallow ground water because of seepage. Also, the slope is a limitation on sites for sewage lagoons. The deeper, more clayey included soils are better sites for septic tank absorption fields. Sealing the lagoon with clayey material helps to control seepage. If the less sloping areas are selected as sites for sewage lagoons, less leveling and banking will be needed during construction. The soil is a probable source of sand (fig. 11).

The capability subclass is VIs.

Es—Edalgo-Rock outcrop complex, 10 to 30 percent slopes. This strongly sloping to steep map unit occurs as areas of a moderately deep, well drained Edalgo soil intricately mixed with areas where shale bedrock crops out. It is on uplands that are dissected by deeply entrenched drainageways. The Edalgo soil is on the tops and sides of ridges. The Rock outcrop is on the steeper side slopes. Individual areas are irregular in shape and range from 10 to several hundred acres in size. They are about 60 percent Edalgo soil and 15 percent Rock outcrop. The Edalgo soil and Rock outcrop occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Edalgo soil has a surface layer of dark grayish brown silt loam about 6 inches thick. The subsurface layer is grayish brown, friable silt loam about 4 inches thick. The subsoil is about 12 inches thick. The upper part is brown, friable silty clay loam, and the lower part is light brownish gray, firm silty clay. The substratum is gray silty clay. Shale is at a depth of about 26 inches. In some areas the surface layer is loam. In other areas sandstone pebbles and stones are on the surface.

Typically, the Rock outcrop is multicolored, clayey shale. It has no plant cover.

Included with the Edalgo soil and Rock outcrop in mapping are small areas of Armo, Dorrance, and Lancaster soils and small areas where sandstone crops out. The deep Armo soils are on foot slopes. The excessively drained Dorrance soils are on the upper side slopes. The loamy Lancaster soils are on the middle part of some side slopes. The sandstone outcrops are on steep slopes above the shale outcrops. Included areas make up about 25 percent of the unit.

Permeability is very slow in the Edalgo soil, and available water capacity is low. Runoff is rapid. Organic matter content is moderate, and natural fertility is medium. The surface layer is slightly acid. Root penetration is restricted by the shale at a depth of about 26 inches. The shrink-swell potential is high in the subsoil.

Nearly all of the acreage is used as range. This map unit is unsuited to cultivated crops because erosion is a severe hazard and slopes are too steep for cultivation. The Edalgo soil is moderately well suited to range. The major concerns of management are erosion and the low available water capacity. Overgrazing retards the growth and reduces the vigor of the grasses and increases the runoff rate. Because of the rapid runoff, erosion is a severe hazard and the areas of bare Rock outcrop can be enlarged. An adequate plant cover reduces the runoff rate and helps to prevent excessive soil losses. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

This map unit generally is unsuitable for building site development and onsite waste disposal because of the slope and the depth to bedrock.

The capability subclass is VIIe.

Figure 11.—Sand and gravel pit in an area of Dorrance gravelly sandy loam, 4 to 15 percent slopes.

Et—Eltree silt loam, 0 to 3 percent slopes. This deep, nearly level and gently sloping, well drained soil is on foot slopes. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 7 inches thick. The subsurface layer is about 15 inches thick. It is friable and calcareous. It is dark gray silt loam in the upper part and grayish brown silty clay loam in the lower part. The subsoil to a depth of about 60 inches is friable, calcareous silty clay loam. The upper part is grayish brown, and the lower part is brown. In some areas the subsoil is clay loam.

Included with this soil in mapping are small areas of the shallow Nibson soils. These soils are more sloping than the Eltree soil and are near the upper part of the foot slopes. They make up about 5 percent of the unit.

Permeability is moderate in the Eltree soil, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The surface layer is mildly alkaline. It is friable, and tilth is good.

Most of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. If cultivated crops are grown, erosion is a hazard in the more sloping areas. It can be controlled, however, by minimum tillage, grassed waterways, terraces, and contour farming. Leaving crop residue on the surface helps to maintain good tilth and the organic matter content and increases the rate of water infiltration.

This soil is well suited to dwellings and is moderately well suited to local roads and streets. Low strength and the potential for frost action are limitations on sites for local roads and streets. Building the roads on raised, well compacted fill material and providing adequate side ditches and culverts reduce wetness and thus help to prevent the damage caused by frost action. Strengthening or replacing the base material helps to prevent the damage caused by low strength.

This soil is well suited to septic tank absorption fields and is moderately well suited to sewage lagoons. Seepage and slope are limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. If the less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is IIe.

Hb—Harney silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on the broad tops and sides of ridges in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 5 inches thick. The subsoil is silty clay loam about 19 inches thick. The upper part is grayish brown and firm, and the lower part is light brownish gray, friable, and calcareous. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas where plowing has mixed the upper part of the subsoil with the surface soil, the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Roxbury and Wakeen soils. Roxbury soils are less clayey in the subsoil than the Harney soil and are calcareous at or near the surface. They are on flood plains along upland drainageways. The moderately deep Wakeen soils are on the lower parts of side slopes. Included soils make up about 5 percent of the unit.

Permeability is moderately slow in the Harney soil, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The surface soil is slightly acid or neutral. Tilth is good. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is cultivated. This soil is well suited to wheat, grain sorghum, forage sorghum, and alfalfa. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, and a cover of crop residue reduce the runoff rate and help to prevent excessive soil loss. Leaving crop residue on the surface increases the rate of water infiltration and helps to maintain the organic matter content and good tilth.

The many areas where cropland joins range can be managed as habitat for upland wildlife, such as pheasants. Planting shrubs in these areas provides winter cover for the wildlife.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material.

This soil is moderately well suited to septic tank absorption fields and sewage lagoons. The moderately slow permeability somewhat restricts the absorption of effluent in septic tank absorption fields. The effluent is more readily absorbed if the lateral lines are installed below the clayey subsoil. Enlarging the field also helps to overcome the slow absorption of the effluent. Seepage and slope are limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. In places the more clayey part of the subsoil can be used as a sealer. If the less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is IIe.

Hc—Harney silty clay loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 120 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The subsoil is silty clay loam about 24 inches thick. It is grayish brown and firm in the upper part and light brownish gray, friable, and calcareous in the lower part. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some areas the depth to lime is less than 18 inches. In other areas the subsoil and substratum are reddish brown.

Included with this soil in mapping are small areas of the moderately deep Wakeen soils on the lower side slopes. These soils make up about 10 percent of the unit.

Permeability is moderately slow in the Harney soil, and available water capacity is high. Runoff is medium. Organic matter content is moderate, and natural fertility is high. The surface layer is slightly acid or neutral. It is friable, and tilth is good. The shrink-swell potential is moderate in the subsoil.

About half of the acreage is used for cultivated crops, and half is used as range. This soil is moderately well suited to grain sorghum, wheat, and alfalfa. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by terraces, grassed waterways, contour farming, and minimum tillage. Leaving crop residue on the surface reduces the runoff rate and the rate of water infiltration and helps to maintain the organic matter content and good tilth.

This soil is well suited to range. The major concerns of management are erosion and low forage production on abandoned cropland. An adequate plant cover and ground mulch reduce the runoff rate, help to prevent excessive soil loss, and increase the moisture supply. Proper stocking rates, deferred grazing, and a uniform distribution of grazing help to keep the range in good condition.

The many areas where cropland joins range can be managed as habitat for upland wildlife, such as pheasants. Planting shrubs in these areas provides winter cover for the wildife.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material.

This soil is moderately well suited to onsite sewage disposal. The moderately slow permeability somewhat restricts the absorption of effluent in septic tank absorption fields. The effluent is more readily absorbed if the lateral lines are installed below the clayey subsoil. Enlarging the field also helps to overcome the slow absorption of the effluent. Seepage and slope are limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. In places the more clayey part of the subsoil can be used to seal the floor of the lagoon. If less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is IIIe.

Hu—Humbarger loam. This deep, nearly level, well drained soil is on flood plains along rivers. It is occasionally flooded for very brief periods. Individual areas are long and generally are less than 800 feet wide. They range from 5 to 120 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 8 inches thick. The subsurface layer is grayish brown, friable, calcareous clay loam about 14 inches thick. The next 10 inches is grayish brown, friable, calcareous sandy loam. The substratum to a depth of about 60 inches is light brownish gray and grayish brown, calcareous loam. In some areas it has contrasting strata of more clayey or sandy material. In other areas the soil is silt loam throughout.

Included with this soil in mapping are small areas of Inavale and Munjor soils on knolls. These soils are more sandy than the Humbarger soil. They make up about 15 percent of the unit.

Permeability is moderate in the Humbarger soil, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is medium. The soil is mildly alkaline or moderately alkaline throughout. The surface layer is friable, and tilth is good.

About half of the acreage is cultivated, and half is range that is interspersed with some wooded areas. This soil is well suited to wheat, grain sorghum, and forage sorghum. It generally is well suited to hay and pasture, but it is poorly suited to alfalfa because in some areas the substratum has contrasting strata of sandy material. Flooding is a hazard in the cultivated areas. In some areas dikes and diversions help to control floodwater. Returning crop residue to the soil helps to maintain the organic matter content and good tilth and increases the rate of water infiltration.

This soil is well suited to range. If the range is overgrazed, however, the vigor of the grasses is reduced and the trees and brush that are common along the river channels encroach. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

The areas where cropland and grassland or woodland join can be used as habitat for many kinds of wildlife, including deer, quail, and songbirds. Good forest management increases the wildlife population.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIw.

Iv—Inavale loamy sand. This deep, nearly level and gently sloping, somewhat excessively drained soil is on terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous loamy sand about 8 inches thick. The next 8 inches is light brownish gray, very friable, calcareous loamy sand. The substratum to a depth of about 60 inches is very pale brown, calcareous sand. In a few areas the surface layer and substratum are fine sandy loam.

Included with this soil in mapping are some small areas of the loamy McCook soils. These soils are in low areas and depressions. They make up less than 5 percent of the unit.

Permeability is rapid in the Inavale soil, and available water capacity is low. Runoff is slow. Organic matter content and natural fertility are low. The soil is mildly alkaline throughout. The surface layer is very friable and can be easily tilled.

About half of the acreage is used for cultivated crops, and half is used as range. Wheat, grain sorghum, and forage sorghum are the main crops. This soil is poorly suited to cultivated crops and is moderately well suited to hay and pasture. Soil blowing and drought are hazards in the cultivated areas. Also, the low fertility is a limitation. Cover crops, stripcropping, and minimum tillage help to control soil blowing. Returning crop residue to the soil increases the organic matter content, improves fertility, and conserves moisture.

This soil is well suited to range. It is highly susceptible to soil blowing, however, if the plant cover is removed. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

This soil generally is unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood control measures. The soil is a probable source of sand.

The capability subclass is IVe.

Lc—Lancaster loam, 3 to 8 percent slopes. This moderately deep, moderately sloping, well drained soil is on the tops and sides of ridges in the uplands. Individual areas are irregular in shape and range from 10 to 90 acres in size.

Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 29 inches thick. It is brown and friable. It is loam in the upper part and clay loam in the lower part. Light brown and very pale brown sandy shale and weakly consolidated sandstone are at a depth of about 36 inches. In some areas the depth to sandstone and shale is more than 40 inches.

Included with this soil in mapping are small areas of the shallow Hedville soils on ridgetops. These soils make up about 5 percent of the unit.

Permeability and available water capacity are moderate in the Lancaster soil. Runoff is medium. Organic matter content is moderate, and natural fertility is medium. The surface layer is slightly acid. Tilth is good. Root penetration is restricted by the shale and sandstone at a depth of about 36 inches.

About half of the acreage is cultivated, and half is used as range. Wheat, grain sorghum, and forage sorghum are the main crops. This soil is moderately well suited to cultivated crops and to hay and pasture. Erosion and drought are hazards in the cultivated areas. Terraces, grassed waterways, contour farming, and a cover of crop residue reduce the runoff rate and help to prevent excessive soil loss.

This soil is well suited to range. If the range is overgrazed, however, the more desirable grasses are replaced by less productive grasses and the runoff rate is increased. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil is moderately well suited to local roads and streets and to dwellings. Low strength and the potential for frost action are limitations on sites for local roads and streets. Strengthening or replacing the base material, however, helps to prevent the damage caused by low strength and frost action. Building the roads on raised, well compacted fill material and providing side ditches and culverts reduce wetness and thus also help to prevent the damage caused by frost action. The shrink-swell potential is a limitation on sites for dwellings. Also, the depth to bedrock is a limitation on sites for dwellings with basements, but in most areas the rock is soft and can be excavated. Properly designing and reinforcing foundations and footings helps to prevent the structural damage caused by shrinking and swelling.

This soil is poorly suited to onsite waste disposal because of the depth to bedrock. The deeper soils on the lower parts of some slopes are better sites.

The capability subclass is IVe.

Lh—Lancaster-Hedville loams, 8 to 25 percent slopes. These soils are on uplands dissected by deeply entrenched drainageways. The moderately deep, strongly sloping, well drained Lancaster soil is on side slopes. The shallow, strongly sloping and moderately steep, somewhat excessively drained Hedville soil is on narrow ridgetops and sharp slope breaks. Individual areas are irregular in shape and range from 20 to several hundred acres in size. They are about 60 percent Lancaster soil and 25 percent Hedville soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Lancaster soil has a surface layer of grayish brown loam about 7 inches thick. The subsoil is about 29 inches thick. It is brown and friable. It is loam in the upper part and clay loam in the lower part. Light brown and very pale brown sandy shale and weakly consolidated sandstone are at a depth of about 36 inches.

Typically, the Hedville soil has a surface layer of dark grayish brown loam about 12 inches thick. Brown and strong brown sandstone is at a depth of about 12 inches.

Included with these soils in mapping are small areas of Armo soils and small areas where sandstone crops out (fig. 12). The deep, calcareous Armo soils are on the lower side slopes. The sandstone outcrops are on steep slopes near areas of the Hedville soil. Included areas make up about 15 percent of the unit.

Permeability is moderate in the Lancaster and Hedville soils. Available water capacity is moderate in the Lancaster soil and very low in the Hedville soil. Runoff is rapid on both soils. Organic matter content is moderate, and natural fertility is medium. The surface layer of the Lancaster soil is slightly acid. The Hedville soil is neutral. Root penetration is restricted by the shale and sandstone at a depth of about 36 inches in the Lancaster soil and by the sandstone at a depth of about 12 inches in the Hedville soil.

Most areas support native grasses. These soils are best suited to range. They generally are unsuited to cultivated crops because erosion is a severe hazard and because rocks on or near the surface interfere with tillage in many areas. The major concerns in managing range are the hazards of erosion and drought. Overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. An adequate plant cover and ground mulch reduce the runoff rate, increase the rate of water infiltration, and help to prevent excessive soil loss. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Sites that are suitable for stock water ponds generally are available in the larger areas of these soils.

The Lancaster soil is moderately well suited to local roads and streets. Low strength, the slope, and the potential for frost action are limitations. Strengthening or replacing the base material helps to prevent the damage caused by low strength and frost action. Building the roads on raised, well compacted fill material and providing side ditches and culverts reduce wetness and thus also help to prevent the damage caused by frost action. If the roads are built on the smoother, less sloping parts of the unit, less land shaping is needed.

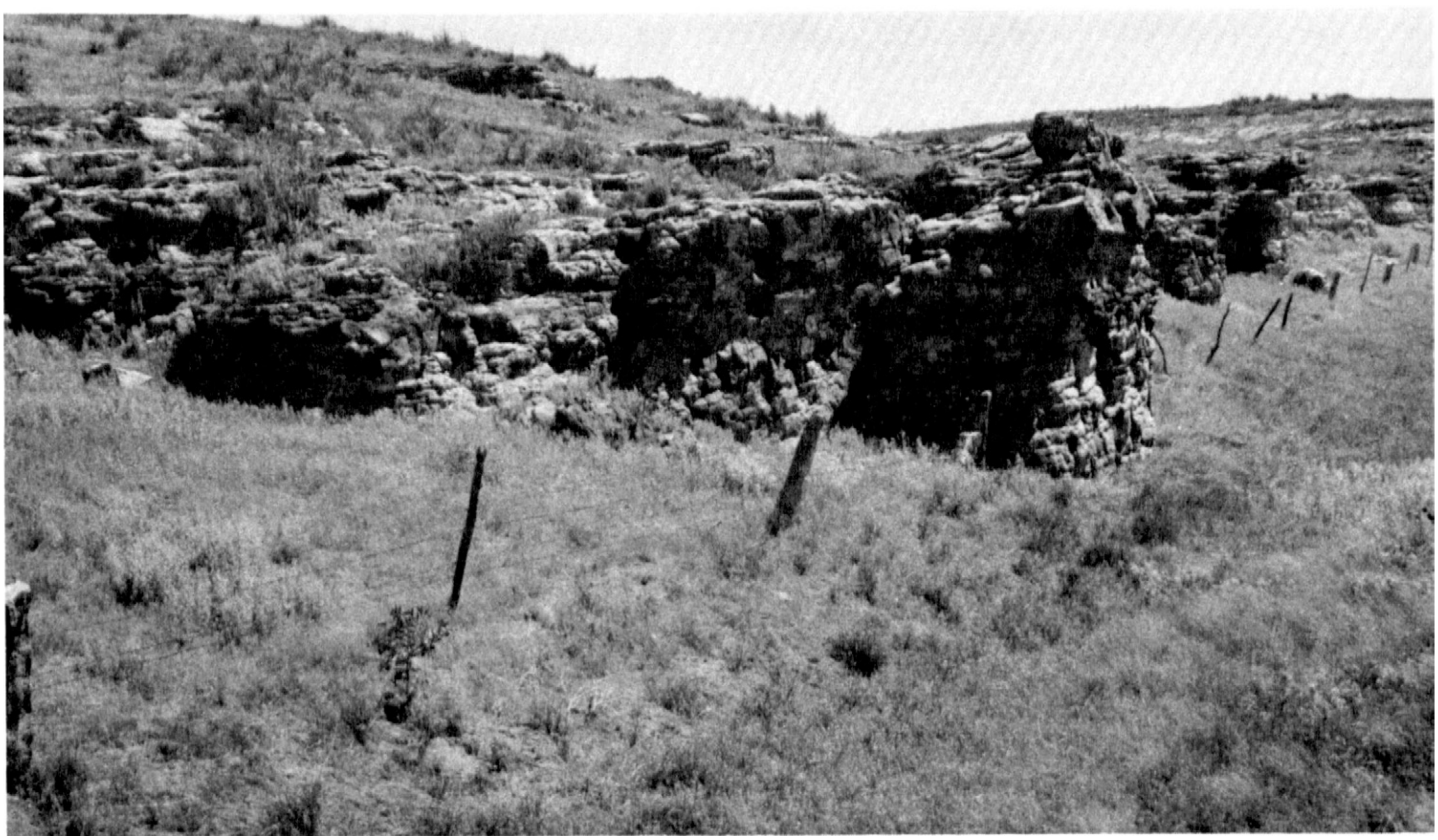

Figure 12.—An area of Lancaster-Hedville loams, 8 to 25 percent slopes. Sandstone commonly crops out in included areas of this unit.

The Lancaster soil is moderately well suited to dwellings. The shrink-swell potential and the slope are limitations. Also, the depth to bedrock is a limitation on sites for dwellings with basements, but in most areas the rock is soft and can be easily excavated. Properly designing and reinforcing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Less land shaping is needed if the smoother, less sloping parts of the unit are selected as sites for the dwellings.

The Lancaster soil is poorly suited to septic tank absorption fields and sewage lagoons because of the depth to bedrock. The deeper included soils on foot slopes are better sites. If the less sloping areas are selected as sites for sewage lagoons, less leveling and banking will be needed during construction.

The Hedville soil generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because of the depth to bedrock.

The capability subclass is VIe.

Mc—McCook silt loam. This deep, nearly level, well drained soil is on terraces along the major streams. It is subject to rare flooding. Individual areas are irregular in shape and range from 50 to several hundred acres in size.

Typically, the surface soil is grayish brown, calcareous silt loam about 12 inches thick. The next 16 inches is light brownish gray, very friable, calcareous very fine sandy loam. The substratum to a depth of about 60 inches is light gray and light brownish gray, calcareous very fine sandy loam. In some areas the surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Munjor soils near the terrace escarpments. These soils are more sandy throughout than the McCook soil. They make up about 5 percent of the unit.

Permeability is moderate in the McCook soil, and available water capacity is high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The soil is mildly alkaline or moderately alkaline throughout. The surface soil is very friable, and tilth is good.

Nearly all of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, alfalfa, and hay and pasture (fig. 13). The main management needs are measures that control soil

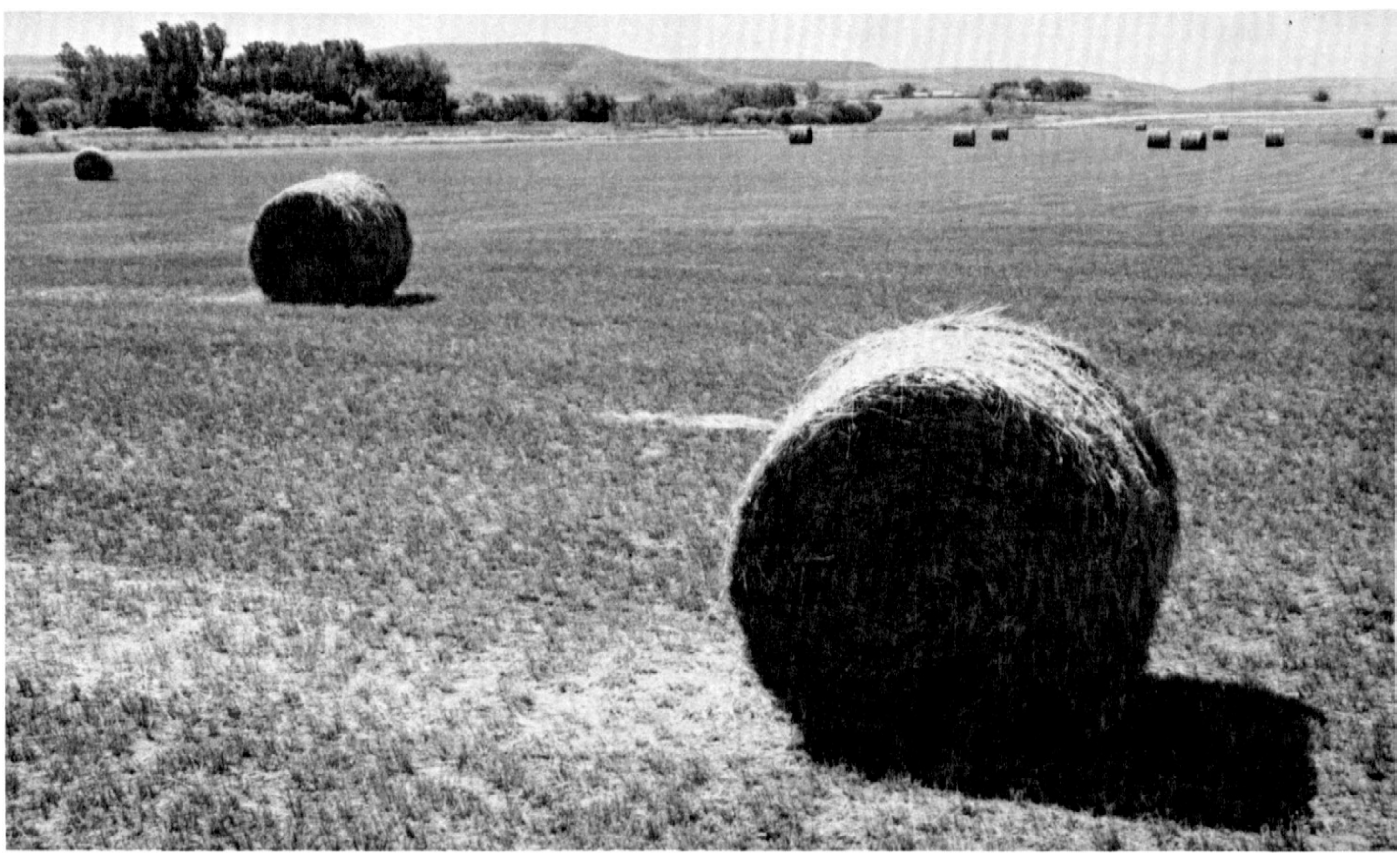

Figure 13.—Baled alfalfa in an area of McCook silt loam near the Saline River.

blowing and keep the level of fertility high. Returning crop residue to the soil conserves moisture and helps to maintain the organic matter content and the fertility level.

This soil generally is unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood control measures.

The capability class is I.

Mr—Munjor fine sandy loam. This deep, nearly level, well drained soil is on terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, calcareous fine sandy loam about 9 inches thick. The next 5 inches is light brownish gray, very friable, calcareous fine sandy loam. The substratum to a depth of about 60 inches is pale brown and brown, calcareous fine sandy loam.

Included with this soil in mapping are small areas of McCook soils in depressions. These soils are less sandy than the Munjor soil. They make up about 5 percent of the unit.

Permeability is moderately rapid in the Munjor soil, and available water capacity is moderate. Runoff is slow. Organic matter content is low, and natural fertility is medium. The soil is mildly alkaline or moderately alkaline throughout. The surface layer is very friable and can be easily tilled.

Most of the acreage is cultivated. This soil is moderately well suited to wheat, grain sorghum, forage sorghum, and alfalfa. The main management needs are measures that control soil blowing, conserve moisture, and improve fertility. Minimum tillage, stripcropping, and cover crops help to control soil blowing. Returning crop residue to the soil conserves moisture, increases the organic matter content, and improves fertility. Also, applications of fertilizer improve fertility.

The areas where cropland and grassland or woodland join can be used as habitat for many kinds of wildlife, including deer, quail, and songbirds. Good forest management increases the wildlife population.

This soil generally is unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIIe.

Ns—Nibson silt loam, 5 to 25 percent slopes. This shallow, moderately sloping to moderately steep, somewhat excessively drained soil is on upland ridges and side slopes. Individual areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 7 inches thick. The subsoil is light brownish gray, friable, calcareous silty clay loam about 5 inches thick. The substratum is white, calcareous silty clay loam. White chalky limestone is at a depth of about 18 inches. In places the depth to bedrock is more than 20 inches. In a few areas in the northwest corner of the county, the content of limestone fragments is more than 35 percent and the soil is underlain by massive limestone.

Included with this soil in mapping are small areas of Armo and Roxbury soils and small areas where limestone crops out (fig. 14). The deep Armo soils are on the lower side slopes. The deep Roxbury soils are on flood plains along narrow drainageways. The areas where limestone crops out are on steep breaks. Included areas make up about 10 percent of the unit.

Permeability is moderate in the Nibson soil, and available water capacity is low. Runoff is rapid. Organic matter content is moderately low, and natural fertility is low. The soil is moderately alkaline throughout. Root penetration is restricted by the limestone at a depth of about 18 inches. The shrink-swell potential is moderate in the subsoil and substratum.

Nearly all of the acreage is used as range. This soil generally is unsuited to cultivated crops because it is highly susceptible to erosion and is shallow. It is moderately well suited to range. The major concerns of management are erosion and the low available water capacity. Overgrazing reduces the extent of the protective plant cover and causes deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive grasses and by weeds. An adequate plant cover helps to prevent excessive soil loss and increases the rate of water infiltration. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Sites that are suitable for stock water ponds generally are available in the larger areas of this soil. They are suitable for development of wildlife habitat.

This soil is poorly suited to dwellings and local roads and streets. The slope is the main limitation. Also, the depth to bedrock is a limitation on sites for dwellings with basements and low strength a limitation on sites for local roads and streets. In most areas the rock is soft and can be easily excavated. Strengthening or replacing the base material helps to prevent the road damage caused by low strength. If the roads or dwellings are built on the smoother, less sloping parts of the unit, less land shaping is needed.

This soil is poorly suited to onsite sewage disposal because of the slope and the limited depth to bedrock. The deeper included soils on the lower side slopes are better sites.

The capability subclass is VIe.

Nu—Nuckolls silt loam, 3 to 7 percent slopes. This deep, moderately sloping, well drained soil is on upland and valley side slopes. Individual areas are irregular in shape and range from 10 to 160 acres in size.

Figure 14.—An old abandoned quarry from which post rock has been removed. The quarry is included in an area of Nibson silt loam, 5 to 25 percent slopes.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil is brown, firm silty clay loam about 17 inches thick. The substratum to a depth of about 60 inches is light brown and pink, calcareous silt loam. In some areas the subsoil is grayish brown.

Included with this soil in mapping are areas of Armo and Lancaster soils. The calcareous Armo soils are on the lower side slopes. They are less silty than the Nuckolls soil. They make up about 10 percent of the areas of this unit near the valley of the Smoky Hill River. The moderately deep Lancaster soils are on the upper side slopes. They make up about 10 percent of the areas of this unit in the northeastern part of the county.

Permeability is moderate in the Nuckolls soil, and available water capacity is high. Runoff is medium. Organic matter content is moderate, and natural fertility is high. The surface layer is neutral or mildly alkaline. It is friable, and tilth is good. The shrink-swell potential is moderate in the subsoil.

About three-fourths of the acreage is used for cultivated crops, and the rest is used as range. This soil is moderately well suited to wheat, grain sorghum, forage sorghum, and hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled, however, by terraces, grassed waterways, contour farming, and minimum tillage. Leaving crop residue on the surface reduces the runoff rate, increases the rate of water infiltration, and helps to maintain the organic matter content and good tilth.

This soil is well suited to range. Overgrazing, however, retards the growth and reduces the vigor of the grasses and increases the runoff rate. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential is a limitation on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material, however, help to prevent the damage caused by shrinking and swelling. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material.

This soil is moderately well suited to onsite sewage disposal. The moderate permeability somewhat restricts the absorption of effluent in septic tank absorption fields. Enlarging the field, however, helps to overcome this limitation. Seepage and slope are limitations on sites for sewage lagoons. Sealing the floor of the lagoon helps to control seepage. If the less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is IIIe.

Nx—Nuckolls silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is brown, calcareous silty clay loam about 5 inches thick. Erosion has removed part of the original surface layer, and plowing has mixed material from the subsoil with the remaining surface layer. The subsoil is brown, firm, calcareous silty clay loam about 17 inches thick. The substratum to a depth of about 60 inches is light brown and pink, calcareous silt loam. In some areas, the surface layer is dark brown, noncalcareous silt loam and the upper part of the subsoil is dark brown, noncalcareous silty clay loam. In other areas the surface layer and subsoil are clay loam.

Permeability is moderate, and available water capacity is high. Runoff is rapid. Organic matter content is moderately low, and natural fertility is medium. When dry, the surface layer is hard and tends to crust. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is cultivated. Wheat, grain sorghum, and forage sorghum are the main crops. This soil is poorly suited to cultivated crops and is well suited to hay and pasture. If cultivated crops are grown, further erosion is a hazard. Terraces, grassed waterways, contour farming, stubble mulching, and minimum tillage reduce the runoff rate and the susceptibility to erosion. Returning crop residue to the soil increases the rate of water infiltration and the organic matter content and improves tilth.

This soil is well suited to range. Some areas that formerly were cultivated have been seeded back to grass. Range seeding is needed to restore productivity on abandoned cropland. If the range is overgrazed, the more productive grasses are replaced by less desirable grasses. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition.

The many areas where cropland joins range can be managed as habitat for upland wildlife, such as pheasants. Planting shrubs in these areas provides winter cover for the wildlife.

This soil is moderately well suited to dwellings and local roads and streets. The shrink-swell potential and the slope are limitations on sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the damage caused by shrinking and swelling. If the roads or dwellings are built on the smoother, less sloping parts of the unit, less land shaping is needed. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material.

This soil is moderately well suited to septic tank absorption fields and is poorly suited to sewage lagoons. The slope is a limitation. Also, the moderate permeability somewhat restricts the absorption of effluent in septic tank absorption fields. As a result, the effluent tends to seep laterally and surfaces in some downslope areas. Enlarging the field commonly overcomes the slow absorption of the effluent. If the less sloping areas are selected as sites for sewage lagoons or septic tank absorption fields, less leveling and banking will be needed during construction.

The capability subclass is IVe.

Rb—Roxbury silt loam. This deep, nearly level, well drained soil is on terraces along the larger streams in the county. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface soil is dark gray, calcareous silt loam about 17 inches thick. The subsurface layer is dark grayish brown, friable, calcareous silt loam about 9 inches thick. The subsoil is grayish brown, friable, calcareous silty clay loam about 14 inches thick. The substratum to a depth of about 60 inches is grayish brown, calcareous silt loam. In some areas the subsoil is very fine sandy loam. In other areas the soil is more clayey throughout.

Permeability is moderate, and available water capacity is very high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The soil is mildly alkaline or moderately alkaline throughout. The surface soil is friable, and tilth is good. The shrink-swell potential is moderate in the subsoil and substratum.

Most of the acreage is used for cultivated crops. This soil is well suited to grain sorghum, wheat, and alfalfa. The main concerns of management are maintaining tilth and fertility. Returning crop residue to the soil and minimizing tillage increase the rate of water infiltration and help to maintain the organic matter content, fertility, and good tilth.

This soil is poorly suited to dwellings because of the flooding. It is only moderately well suited to local roads and streets because of low strength. Strengthening or replacing the base material, however, helps to prevent the damage caused by low strength. Because of the flooding, roads should be built on raised fill material and dwellings should be built on the highest parts of the landscape.

This soil is moderately well suited to septic tank absorption fields and sewage lagoons. Flooding is a hazard on sites for septic tank absorption fields and seepage a limitation on sites for sewage lagoons. Levees and dikes help to control floodwater. Sealing the lagoon helps to control seepage.

The capability class is I.

Rc—Roxbury silt loam, channeled. This deep, nearly level, well drained soil is on flood plains along small creeks and intermittent drainageways (fig. 15). It is frequently flooded for very brief periods. Individual areas are 165 to 700 feet wide and 600 to 7,000 feet long. They range from 5 to 100 acres in size.

Typically, the surface soil is dark grayish brown, calcareous silt loam about 26 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is grayish brown, calcareous silt loam. In some areas the subsoil is very fine sandy loam. In other areas the surface soil is clay loam.

Permeability is moderate, and available water capacity is very high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The soil is mildly alkaline or moderately alkaline throughout. The shrink-swell potential is moderate in the subsoil and substratum.

Most areas are used as range. This soil generally is not suited to cultivated crops because flooding is a hazard and operating ordinary farm equipment is difficult along the meandering stream channels. The soil is well suited to range. The range commonly is overgrazed and in poor condition, however, because it is in areas where livestock congregate near watering facilities and shade trees. In these areas the more desirable grasses are replaced by less productive grasses and by weeds. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

The vegetation common on this soil provides food and cover for many kinds of wildlife, including quail, deer, rabbits, and songbirds. The wildlife population can be increased by planting trees and shrubs along the border of cropland and range.

Figure 15.—An area of Roxbury silt loam, channeled.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is Vw.

Rf—Roxbury silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains along creeks and intermittent drainageways. It is occasionally flooded for very brief periods. Individual areas are 250 to 1,200 feet wide and 1/4 mile to more than 2 miles long. They range from 10 to 300 acres in size.

Typically, the surface soil is dark grayish brown, calcareous silt loam about 26 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 12 inches thick. The substratum to a depth of about 60 inches is grayish brown, calcareous silt loam. In some areas the subsoil and substratum are loam or clay loam.

Permeability is moderate, and available water capacity is very high. Runoff is slow. Organic matter content is moderate, and natural fertility is high. The soil is mildly alkaline or moderately alkaline throughout. The surface soil is friable, and tilth is good. The shrink-swell potential is moderate in the subsoil and substratum.

About two-thirds of the acreage is cultivated, and the rest is used as range. This soil is well suited to wheat, grain sorghum, forage sorghum, alfalfa, and hay and pasture (fig. 16). Floodwater damages crops in some years, but in other years the extra moisture increases productivity. Dikes and diversions help to prevent crop damage. Returning crop residue to the soil increases the rate of water infiltration and helps to maintain the organic matter content, fertility, and good tilth.

This soil is well suited to range. In many areas, however, the range is overgrazed and in poor condition. In these areas the more desirable grasses are replaced by less productive grasses and by weeds. Proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing help to keep the range in good condition. Placing salt blocks on the steeper adjacent soils helps to distribute grazing evenly.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding. Overcoming this hazard is difficult without major flood control measures.

The capability subclass is IIw.

Wb—Wakeen silt loam, 1 to 3 percent slopes. This moderately deep, gently sloping, well drained soil is on the tops and upper sides of ridges in the uplands. Individual areas are irregular in shape and range from 20 to 600 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 10 inches thick. The subsoil is about 21 inches thick. It is friable and calcareous. The upper part is grayish brown silty clay loam, the next part is light brownish gray silty clay loam, and the lower part is very pale brown silt loam. Chalky limestone is at a depth of about 31 inches.

Included with this soil in mapping are small areas of Harney and Nibson soils. The deep Harney soils are on broad ridgetops. The shallow Nibson soils are on the lower parts of the landscape. They cannot be easily tilled. Included soils make up about 10 percent of the unit.

Permeability and available water capacity are moderate in the Wakeen soil. Runoff is medium. Organic matter content is moderately low, and natural fertility is medium. The soil is mildly alkaline or moderately alkaline throughout. The surface layer is friable, and tilth is good. The shrink-swell potential is moderate in the subsoil.

About half of the acreage is used for cultivated crops, and half is used as range. This soil is moderately well suited to wheat, grain sorghum, forage sorghum, and hay and pasture. If cultivated crops are grown, erosion and drought are hazards. Terraces, grassed waterways, and contour farming reduce the runoff rate and help to prevent excessive soil loss. Returning crop residue to the soil increases the rate of water intake and the organic matter content and helps to maintain fertility and good tilth.

This soil is well suited to range. If the range is overgrazed, however, the extent of the protective plant cover is reduced and the more desirable taller grasses are replaced by less productive grasses. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition.

The many areas where cropland and range join can be managed as habitat for upland wildlife, such as pheasants. Planting shrubs in these areas provides winter cover for the wildlife.

This soil is moderately well suited to local roads and streets and to dwellings. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by properly designing and reinforcing foundations and footings. The depth to bedrock is a limitation on sites for dwellings with basements. The rock is soft, however, and in some areas can be easily excavated.

This soil is poorly suited to septic tank absorption fields and sewage lagoons because of the depth to bedrock. The deeper included soils in the higher areas on broad ridgetops are better sites.

The capability subclass is IIIe.

Wc—Wakeen silt loam, 3 to 7 percent slopes. This moderately deep, moderately sloping, well drained soil is on the sides and tops of ridges in the uplands. Individual

Figure 16.—Baled sorghum hay in an area of Roxbury silt loam, occasionally flooded.

areas are irregular in shape and range from 15 to 120 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 9 inches thick. The subsoil is about 22 inches thick. It is friable and calcareous. The upper part is grayish brown silty clay loam, the next part is light brownish gray silty clay loam, and the lower part is very pale brown silt loam. Chalky limestone is at a depth of about 31 inches. In some areas the depth to limestone bedrock is more than 40 inches.

Included with this soil in mapping are small areas of the shallow Nibson soils on the lower parts of the landscape. These soils cannot be easily tilled. They make up about 10 percent of the unit.

Permeability and available water capacity are moderate in the Wakeen soil. Runoff is rapid. Organic matter content is moderately low, and natural fertility is medium. The soil is mildly alkaline or moderately alkaline throughout. The surface layer is friable, and tilth is good. The shrink-swell potential is moderate in the subsoil.

About half of the acreage is cultivated, and the rest is used mainly as range. Wheat, grain sorghum, and forage sorghum are the main crops. This soil is poorly suited to cultivated crops and is moderately well suited to hay and pasture. Erosion and drought are hazards in the cultivated areas. Terraces, contour farming, and minimum tillage reduce the runoff rate and help to prevent excessive soil loss. Returning crop residue to the soil increases the rate of water intake and the organic matter content and helps to maintain fertility and good tilth.

This soil is well suited to range. If the range is overgrazed, however, the extent of the protective plant cover is reduced and the more desirable grasses are replaced by less productive grasses. An adequate plant cover reduces the runoff rate and helps to prevent excessive soil loss. Proper stocking rates, a uniform distribution of grazing, and timely deferment of grazing help to keep the range in good condition. Some areas that formerly were cultivated have been seeded back to grass. Range seeding is needed to restore productivity on abandoned cropland.

This soil is moderately well suited to local roads and streets and to dwellings. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by properly designing and reinforcing foundations and footings. The depth to bedrock is a limitation on sites for dwellings with basements. The rock is soft, however, and in some areas can be easily excavated.

This soil is poorly suited to onsite sewage disposal systems because of the depth to bedrock. The deeper, less sloping soils on the upper or lower parts of some side slopes are better sites.

The capability subclass is IVe.

Ws—Wells loam, 0 to 3 percent slopes. This deep, nearly level and gently sloping, well drained soil is on uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is dark grayish brown, friable clay loam about 4 inches thick. The subsoil is friable clay loam about 37 inches thick. The upper part is brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is pale brown sandy clay loam. In some areas the subsoil is silty clay loam and the substratum silt loam.

Included with this soil in mapping are small areas of Dorrance and Harney soils. Dorrance soils are in undulating areas. They are more sandy than the Wells soil. Harney soils are in slightly concave areas. Their subsoil contains more clay than that of the Wells soil. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Wells soil, and available water capacity is high. Runoff is medium. Organic matter content is moderate, and natural fertility is high. The surface layer is slightly acid. It is friable, and tilth is good.

Most of the acreage is used for cultivated crops. This soil is well suited to wheat, grain sorghum, forage sorghum, alfalfa, and hay and pasture. If cultivated crops are grown, erosion is a hazard in the more sloping areas. It can be controlled, however, by terraces, grassed waterways, contour farming, and minimum tillage. Returning crop residue to the soil helps to maintain the organic matter content, fertility, and good tilth.

This soil is well suited to dwellings and is moderately well suited to local roads and streets. Low strength is a limitation on sites for local roads and streets. It can be overcome, however, by strengthening or replacing the base material.

This soil is well suited to septic tank absorption fields and is moderately well suited to sewage lagoons. Seepage and slope are limitations on sites for sewage lagoons. Sealing the lagoon helps to control seepage. If the less sloping areas are selected as sites for the lagoons, less leveling and banking will be needed during construction.

The capability subclass is IIe.

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 providing 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 cropland, pasture, woodland, or range but is not urban or built-up land or water areas. It either is used for food or fiber or is available for those uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil economically to produce a sustained high yield of crops. 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 usually has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and 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 7 percent. More detailed information about the criteria for prime farmland is available at local offices of the Soil Conservation Service.

About 304,700 acres in Russell County, or nearly 55 percent of the total acreage, meets the requirements for prime farmland. The prime farmland occurs mainly as areas of the Harney-Nibson-Armo, Crete-Harney, and Roxbury-McCook associations, which are described under the heading "General soil map units." It also occurs, however, as scattered areas in other parts of the county. About 280,000 acres of this land is used for cultivated crops, mainly wheat and grain sorghum.

The map units in Russell County that are considered prime farmland are listed in this section. 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 in the section "Detailed soil map units."

The map units that meet the requirements for prime farmland are:

Ae	Armo loam, 3 to 7 percent slopes
Cr	Crete silt loam, 0 to 1 percent slopes
De	Detroit silt loam
Et	Eltree silt loam, 0 to 3 percent slopes
Hb	Harney silt loam, 1 to 3 percent slopes
Hc	Harney silty clay loam, 3 to 7 percent slopes
Hu	Humbarger loam
Lc	Lancaster loam, 3 to 8 percent slopes
Mc	McCook silt loam
Mr	Munjor fine sandy loam
Nu	Nuckolls silt loam, 3 to 7 percent slopes
Rb	Roxbury silt loam
Rf	Roxbury silt loam, occasionally flooded
Wb	Wakeen silt loam, 1 to 3 percent slopes
Ws	Wells loam, 0 to 3 percent slopes

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 rangeland; 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

Earl J. Bondy, conservation agronomist, 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 the arable soils.

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.

About 52 percent of the acreage in Russell County is used as cropland or is cropland that is summer fallowed. Wheat is grown on about 55 percent of the cropland, sorghum on 12 percent, and alfalfa, corn, oats, and other crops on 3 percent (*3*). About 30 percent of the cropland is summer fallowed. Smooth bromegrass is the main pasture grass. The acreage planted to alfalfa has increased in recent years. The acreage planted to all other crops has remained constant or declined. The acreage that is summer fallowed has slightly increased.

The productivity of the soils used for crops and pasture can be increased on most farms by applying the latest crop production technology. This soil survey can facilitate the application of such technology. The main management needs in the areas used for crops and pasture are measures that help to control water erosion and soil blowing, that result in the most efficient use of available water, and that maintain fertility and tilth.

Soil erosion is the major hazard on about 75 percent of the cropland in Russell County. If the surface layer is lost through erosion, productivity is reduced because available plant nutrients and organic matter, which has positive effects on soil structure and tilth, water infiltration, and the available water capacity, also are lost. Erosion is especially damaging on Corinth and other soils that have a clayey subsoil. Preparing a good seedbed and tilling are difficult in the clayey spots that remain after the original friable surface layer has eroded away.

Erosion on farmland commonly results in the pollution of streams by sediment, nutrients, and pesticides. Controlling erosion minimizes this pollution and thus helps to maintain the quality of water.

Measures that control erosion provide a protective cover of crops or crop residue, reduce the runoff rate, and increase the rate of water infiltration. Minimum tillage, terraces, diversions, contour farming, grassed waterways, and a cropping system that includes close growing crops as well as row crops or that keeps a protective plant cover on the surface for extended periods help to control erosion and thus preserve the productive capacity of the soil (fig. 17).

In the areas in Russell County used for sorghum and other row crops, minimum tillage is helping to control erosion on an increasing acreage. It is effective on most of the soils. Terraces and diversions reduce the susceptibility to erosion and the runoff rate by decreasing the length of the slopes. They are most effective on deep, well drained soils that have uniform, regular slopes. Most of the soils in the county have those characteristics.

Soil blowing is a hazard on the more sandy soils in the county, including Dorrance, Inavale, and Munjor soils. It can be controlled by a protective cover of plants or mulch, by windbreaks, or by tillage methods that roughen the surface.

Further information about measures that help to control water erosion and soil blowing on each kind of soil is available at local offices of the Soil Conservation Service.

Measures that maintain or improve fertility and tilth are needed on all of the soils used for crops and pasture. These include applications of lime and fertilizer and additions of organic material.

Applications of nitrate and phosphate fertilizer are effective on most of the arable soils in the county. On all soils the kinds and amounts of lime and fertilizer to be applied should be based on the results of soil tests, on the needs of the crop, on the expected level of yields, and on practical experience. The Cooperative Extension Service can help to determine the kinds and amounts needed.

Organic matter affects fertility and tilth because it provides plant nutrients, increases the rate of water intake, helps to prevent surface crusting, and helps to control erosion. Most of the soils in the county that are used for crops have a surface layer of silt loam or loam. A surface crust forms during periods of intense rainfall. The crusted surface is hard when dry and is nearly impervious to water. Because of the hard surface, the runoff rate increases. Regularly adding organic material improves soil structure and helps to prevent surface crusting. Leaving crop residue on the surface also helps to prevent crusting.

A limited available water capacity is a concern in managing Corinth, Lancaster, Wakeen, and other moderately deep soils. The bedrock underlying these soils restricts root penetration. Measures that reduce the runoff rate, maintain tilth, and increase the rate of water infiltration conserve moisture.

Measures that maintain or improve the quality or quantity of forage are needed in the areas used for tame grasses. Proper stocking rates, rotation grazing, well distributed watering and salting facilities, applications of fertilizer, and control of unwanted vegetation help to keep the pasture in good condition.

Figure 17.—Grassed waterway in an area of Wakeen silt loam, 3 to 7 percent slopes. The waterway helps to prevent gullying.

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 5. 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 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 insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil listed 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 5 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.

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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider 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 rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. 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 slight 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.

Capability subclasses are groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Loren J. Pearson, range conservationist, Soil Conservation Service, helped prepare this section.

About 42 percent of the acreage in Russell County is rangeland. The larger areas of rangeland are on uplands adjacent to the major valleys. In these areas the soils generally are too shallow or too steep for cultivated crops. The rangeland is used mainly for cow-calf enterprises, but steers are raised in some areas.

Much of the rangeland is grazed only during the summer, but some areas are grazed all year. In winter the forage provided by rangeland typically is supplemented by grain sorghum and small grain stubble and some new wheat and then by dry feed and alfalfa.

The amount of supplemental feed that is necessary can be decreased by reduced stocking rates, which lengthen the grazing season in the areas of native grasses.

Forage production is affected by the soil on which the grasses grow. Lowland and Terrace range sites provide excellent grazing during all but the least favorable seasons. Shallow, Limy, and Sandstone range sites are less productive because the soils are more droughty and have a shallow root zone (fig. 18).

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below

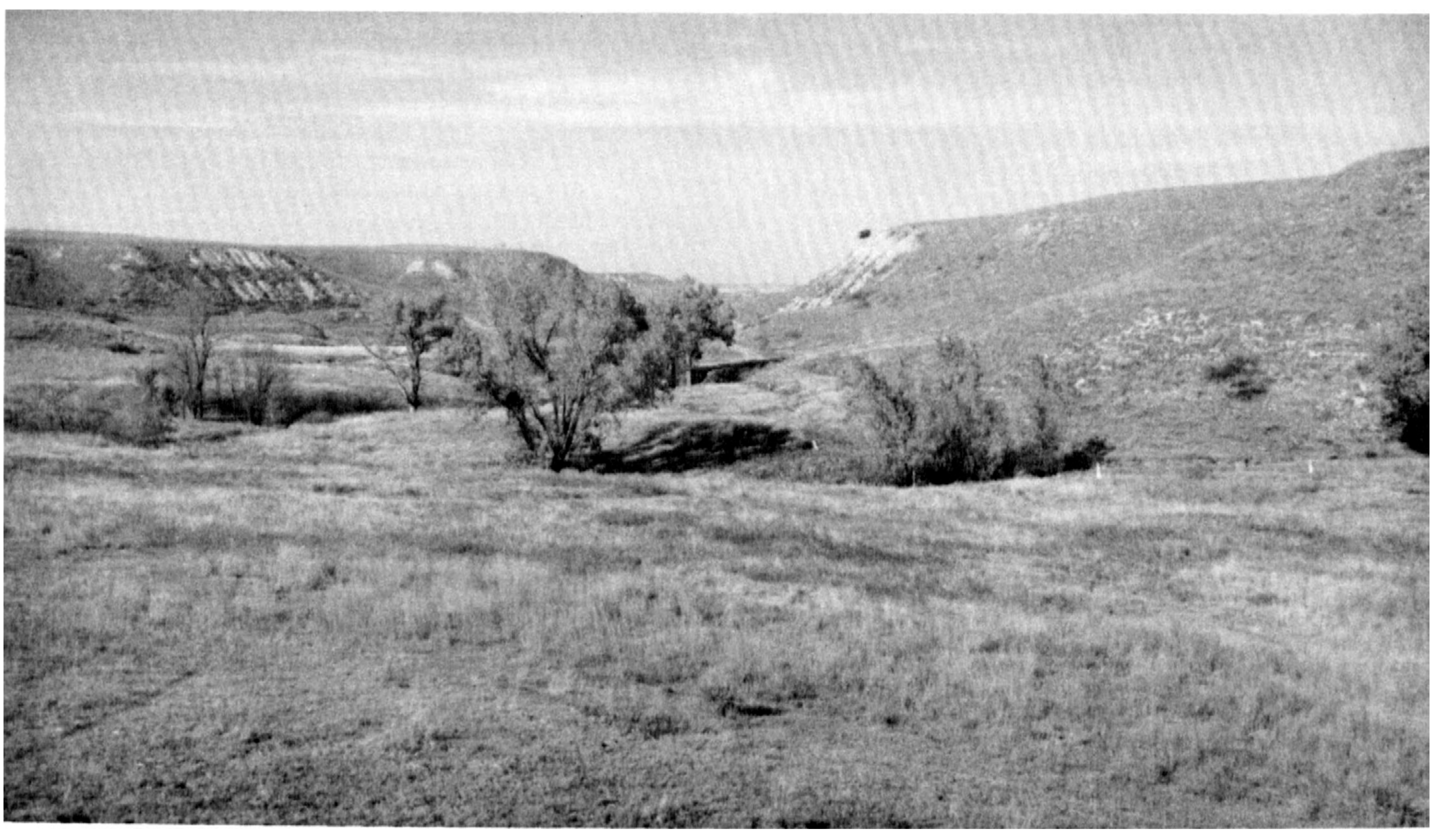

Figure 18.—An area of Roxbury silt loam, channeled, and Nibson silt loam, 5 to 25 percent slopes, used as range. The Roxbury soil is assigned to the Loamy Lowland range site and the Nibson soil to the Limy Upland range site.

average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Measures that maintain or improve the vigor of the native grasses are important management needs. Examples are proper stocking rates, timely deferment of grazing, and a uniform distribution of grazing. Each of these measures provides a rest period when the grasses can build up plant vigor. The grasses remain healthy and vigorous if about 50 percent of the seasonal growth remains at the end of the grazing season.

On an estimated 6,000 acres in the county, soils assigned to capability class VI are used for cultivated crops. Range seeding is needed to restore the productivity of these soils. It also is needed on badly depleted rangeland. The grass cover helps to control erosion and reduces the runoff rate.

windbreaks and environmental plantings and native woodland

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

The wooded areas in Russell County generally are along streams and in upland drainageways. Also, some hedgerows of osageorange are in scattered areas throughout the county.

The trees along the streams and drainageways commonly are eastern cottonwood, green ash, common hackberry, and black willow. Other commonly occurring species are honeylocust, Russian mulberry, boxelder, slippery elm, American elm, black locust, and American plum. Black walnut and bur oak grow in some areas, mainly along the major tributaries of the larger streams. Many of the trees can be used for wood products and firewood, but they are not sufficiently concentrated to be of commercial value.

Landowners have planted trees at various times on most of the ranch headquarters and farmsteads in Russell County. Siberian elm is the most common tree around the farmsteads, especially in the older windbreaks. Examples of other trees and shrubs planted in windbreaks are eastern redcedar, honeylocust, common hackberry, osageorange, Russian-olive, lilac, and tamarisk (fig. 19). Tree planting around ranch headquarters and farmsteads is a continual need because old trees deteriorate and die, because insects or diseases destroy some trees, and because new windbreaks are needed in areas where farming or ranching is expanding.

Several field windbreaks or shelterbelts have been planted in the county. The shelterbelts generally are eight to ten rows of many different species, including eastern redcedar, Siberian elm, honeylocust, eastern cottonwood, osageorange, common hackberry, green ash, Russian mulberry, black locust, northern catalpa, and Russian-olive.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the soils on the site should be suited to the species selected for planting. Selecting suitable species helps to ensure survival and a maximum growth rate. The growth rate is greatly affected by the permeability, available water capacity, and fertility of the soil.

An inadequate moisture supply limits tree survival in many areas of the county. As a result, the main management needs are proper site preparation prior to planting and control of weeds and other competing plants after planting. Drip irrigation or any other method of supplemental watering also helps to overcome the moisture deficiency.

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, keep snow from blowing off 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

Figure 19.—A windbreak of eastern redcedar on Harney silt loam, 1 to 3 percent slopes.

plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 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 or the Cooperative Extension Service or from a nursery.

recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Russell County has several areas of scenic, geologic, and historic interest. Many farm ponds and the Saline and Smoky Hill Rivers provide opportunities for water sports. The pheasant season attracts many hunters in the fall.

Wilson State Park, a scenic public park at Wilson Reservoir, provides opportunities for camping, picnicking, fishing, and boating. A good sand beach is available for swimming and sunbathing. About 6,500 acres of land around the lake is open to the public for hunting.

The potential for further recreational development in the county is fair.

The soils of the survey area are rated in table 8 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 or the suitability for sewage lagoons 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 8, 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 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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 mild 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, horseback riding, and bicycling 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.

wildlife habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Russell County are ring-necked pheasant, bobwhite quail, cottontail rabbit, white-tailed deer, and several species of waterfowl. The hunting seasons in the fall attract thousands of people to this part of the state. Most upland game birds are hunted on privately owned land with the permission of the landowner. Wilson Reservoir and the farm ponds provide generally good opportunities for hunting ducks and geese during the open season.

Nongame species are numerous because the habitat types are diverse. Cropland, woodland, and grassland are interspersed throughout the county (fig. 20). Each of these habitat types provides a habitat for a particular group of species. Birdwatchers and observers of other kinds of wildlife frequently use the Wilson Reservoir.

Furbearers are common along the Saline and Smoky Hill Rivers and their tributaries. Coyote, raccoon, muskrat, and beaver are trapped or hunted on a limited basis.

Stock water ponds, the Saline and Smoky Hill Rivers, and the Wilson Reservoir provide good to excellent fishing throughout most of the year. The species commonly caught are largemouth bass, bluegill, channel catfish, bullhead, and flathead catfish. Also, crappie, walleye, white bass, and striped bass are caught at the reservoir.

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 9, 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

Figure 20.—An area of Roxbury silt loam, occasionally flooded, and Nibson silt loam, 5 to 25 percent slopes. The interspersed range, cropland, and wooded creek channels provide habitat for a wide variety of wildlife.

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 wheat, grain sorghum, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bromegrass, sweetclover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, grama, western wheatgrass, switchgrass, goldenrod, sunflowers, ragweed, and native legumes.

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, hackberry, elm, cottonwood, mulberry, black walnut, and ash. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, American plum, and fragrant sumac.

Coniferous plants furnish browse, seeds, and cones. 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 redcedar, pine, spruce, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of native shrubs are gooseberry, dogwood, buckbrush, prairie rose, chokecherry, and sumac.

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, cattails, indigobush, saltgrass, prairie cordgrass, 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, mourning dove, pheasant, meadowlark, field sparrow, and cottontail rabbit.

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 owls, hawks, thrushes, woodpeckers, squirrels, opossum, 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, shore birds, redwing blackbirds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include jackrabbits, prairie dogs, badgers, prairie chickens, deer, meadowlarks, killdeer, and hawks.

Technical assistance in planning wildlife areas and in determining the vegetation suitable for planting can be obtained from the local office of the Soil Conservation Service. Additional information and assistance can be obtained from the Kansas Fish and Game Commission and the Cooperative Extension Service.

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 adsorbed 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 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. 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, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, 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.

sanitary facilities

Table 11 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 11 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 11 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 11 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, highly organic layers, 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 12 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 12, 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 13 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; subsidence of organic layers; 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. 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.

engineering index properties

Table 14 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. "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 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." 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, SP-SM.

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.

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

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 and the amount of soil lost. 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 18 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 18 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 15, 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 16 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.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 16 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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of 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 is 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.

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 specified as either soft or hard. If the rock is soft or fractured, excavations generally 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 excavations.

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 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 (*6*). 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. In table 17, the soils of the survey area are classified according to the system. 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 Mollisol.

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 Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

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 Argiustolls (*Argi*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that have an ustic 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 Argiustolls.

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, montmorillonitic, mesic Typic Argiustolls.

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. The soil is compared with similar soils and with nearby soils of other 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* (*5*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, matrix colors in the descriptions are for dry 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."

Armo series

The Armo series consists of deep, well drained, moderately permeable soils on foot slopes in the uplands. These soils formed in loamy and silty sediments weathered from chalky limestone. Slope ranges from 3 to 15 percent.

Armo soils are similar to Eltree and Wakeen soils and commonly are adjacent to Nibson soils. Eltree soils have a mollic epipedon that is more than 20 inches thick. Wakeen soils are moderately deep over chalky shale and limestone. They are higher on the landscape than the Armo soils. Nibson soils are shallow over chalky limestone and shale. They are on side slopes above the Armo soils.

Typical pedon of Armo loam, 7 to 15 percent slopes, 50 feet south and 50 feet east of the northwest corner of sec. 14, T. 12 S., R. 12 W.

A1—0 to 8 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, friable; common fine and very fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

B2—8 to 24 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium blocky structure; hard, firm; very fine roots, common in the upper part, few in the lower part; few small limestone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

B3ca—24 to 34 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak fine and medium blocky structure; hard, firm; few very fine roots; many limestone fragments; many soft masses of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C1—34 to 48 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few very fine roots in the upper part; common small limestone fragments; few soft masses of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—48 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; many limestone fragments; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches. The soils typically contain lime throughout. They are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly loam, but the range includes silt loam. The B2 horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is clay loam, silty clay loam, or loam. The C horizon has colors similar to those of the B2 horizon. It is silt loam or clay loam. The content of chalk fragments 0.5 millimeter to 1 inch in diameter ranges from 15 to 30 percent.

Bogue series

The Bogue series consists of moderately deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in material weathered from clayey shale. Slope ranges from 3 to 15 percent.

Bogue soils commonly are adjacent to Armo, Corinth, and Dorrance soils. Armo and Corinth soils are less clayey throughout than the Bogue soils. They are on foot slopes and side slopes below those soils. Dorrance soils contain more sand throughout than the Bogue soils. Also, they are higher on the landscape.

Typical pedon of Bogue clay, 3 to 15 percent slopes, 150 feet south and 60 feet east of the northwest corner of sec. 19, T. 11 S., R. 14 W.

A1—0 to 5 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; moderate fine subangular blocky structure; very hard, firm; common fine and very fine roots; neutral; clear smooth boundary.

B1—5 to 9 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; moderate fine subangular blocky structure; extremely hard, extremely firm; common very fine roots; neutral; gradual smooth boundary.

B2—9 to 18 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; few fine distinct light olive brown (2.5Y 5/6) mottles; weak medium blocky structure; extremely hard, extremely firm; few very fine roots along faces of peds; few small pockets and seams filled with calcite; mildly alkaline; clear smooth boundary.

B3—18 to 23 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; few, thin, mostly horizontal strata of light olive brown (2.5Y 5/6) material; weak fine platy structure; extremely hard, extremely firm; few very fine roots along faces of peds; few seams filled with calcite; mildly alkaline; clear smooth boundary.

Cr—23 inches; gray (5Y 5/1) clayey shale.

The thickness of the solum ranges from 12 to 23 inches. The depth to clayey shale ranges from 20 to 40 inches. The depth to lime, generally calcite, varies. The solum contains lime in all pedons. Reaction is neutral to moderately alkaline throughout the profile.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1. The B2 horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2. Some pedons have a C horizon, which has hue of 2.5Y or 5Y, value of 3 to 6 (2 to 4 moist), and chroma of 1 to 3.

Corinth series

The Corinth series consists of moderately deep, well drained, slowly permeable soils on uplands. These soils formed in material weathered from calcareous shale. Slope ranges from 2 to 15 percent.

Corinth soils commonly are adjacent to Bogue, Harney, and Nibson soils. Bogue soils are more clayey throughout than the Corinth soils. Also, they are higher on the landscape. Harney soils are more than 40 inches deep over bedrock. They are on slopes above the Corinth soils. Nibson soils are less than 20 inches deep over chalky shale and limestone. They typically are lower on the landscape than the Corinth soils.

Typical pedon of Corinth silty clay loam, 2 to 7 percent slopes, 1,180 feet south and 120 feet east of the northwest corner of sec. 17, T. 13 S., R. 15 W.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay loam, brown (10YR 4/3) moist; moderate very fine subangular blocky structure; hard, friable; common fine and very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

B21—6 to 12 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate fine and very fine subangular blocky structure; very hard, firm; few very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

B22—12 to 21 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; moderate medium and coarse blocky structure; very hard, firm; few very fine roots along faces of peds; strong effervescence; moderately alkaline; clear smooth boundary.

B3ca—21 to 27 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; light brownish gray (2.5Y 6/2) stains on faces of a few peds; weak medium and coarse blocky structure; very hard, firm; few very fine roots along faces of peds; about 15 percent soft masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C—27 to 36 inches; pale yellow (2.5Y 7/4) silty clay, light olive brown (2.5Y 5/4) moist; weak medium blocky and platy structure; very hard, firm; few very fine roots on faces of peds; about 10 percent shale fragments; strong effervescence; moderately alkaline; clear smooth boundary.

Cr—36 inches; pale yellow (2.5Y 7/4) shale.

The thickness of the solum ranges from 15 to 30 inches. The depth to shale ranges from 20 to 40 inches. The soils contain free lime throughout. They are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. The B2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. It is silty clay loam or silty clay. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 6 moist), and chroma of 4 to 8.

Crete series

The Crete series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess. Slope is 0 to 1 percent.

Crete soils are similar to Detroit and Harney soils and commonly are adjacent to Harney soils. Their subsoil contains more clay than that of the similar soils. Detroit soils are on terraces. Harney soils have a mollic epipedon that is less than 20 inches thick. They are more sloping than the Crete soils and typically are lower on the landscape.

Typical pedon of Crete silt loam, 0 to 1 percent slopes, 2,330 feet east and 925 feet south of the northwest corner of sec. 31, T. 13 S., R. 14 W.

A11—0 to 6 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine granular structure; hard, friable; common fine and very fine roots; medium acid; clear smooth boundary.

A12—6 to 11 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate fine granular structure; hard, friable; common fine and very fine roots; slightly acid; clear smooth boundary.

B1—11 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky structure; hard, firm; common very fine roots; neutral; clear smooth boundary.

B21t—14 to 22 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, firm; few very fine roots; shiny surfaces on peds; neutral; clear smooth boundary.

B22t—22 to 27 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium blocky structure; very hard, firm; few very fine roots; shiny surfaces on peds; neutral; clear smooth boundary.

B3ca—27 to 38 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse blocky structure; very hard, firm; few very fine roots; few small lime concretions; moderately alkaline; clear smooth boundary.

C1—38 to 57 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium blocky structure; hard, friable; few very fine roots; few fine very dark brown concretions; few small lime concretions; moderately alkaline; gradual smooth boundary.

C2—57 to 60 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, friable; few very fine roots; few threads of lime; moderately alkaline.

The thickness of the solum ranges from 30 to 42 inches. The thickness of the mollic epipedon ranges from 20 to 36 inches. The depth to lime ranges from 25 to 40 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It is silty clay in which the content of clay ranges from 45 to 52 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silty clay loam or silt loam.

Detroit series

The Detroit series consists of deep, moderately well drained, slowly permeable soils on terraces. These soils formed in alluvium. Slope ranges from 0 to 2 percent.

Detroit soils are similar to Crete and Harney soils and commonly are adjacent to Roxbury soils. Crete soils contain more clay in the subsoil than the Detroit soils. They are on uplands. Harney soils also are on uplands. Their mollic epipedon is less than 20 inches thick. Roxbury soils have lime at or near the surface. They are on low terraces and flood plains.

Typical pedon of Detroit silt loam, 1,500 feet west and 300 feet north of the southeast corner of sec. 24, T. 11 S., R. 12 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; few very fine roots; neutral; clear smooth boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; few very fine roots; neutral; gradual smooth boundary.

B21t—11 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; strong fine and medium blocky structure; hard, firm; few very fine roots; neutral; gradual smooth boundary.

B22t—22 to 28 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium blocky structure; hard, firm; few fine and very fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

B3—28 to 34 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; few very fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—34 to 48 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; few threads and small soft masses of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—48 to 60 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; strata with slightly higher value; massive; slightly hard, friable; common threads and small soft masses of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 50 inches. The depth to lime ranges from 22 to 30 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is slightly acid or neutral. The B2t horizon has hue of 10YR, value of 3 to 5 (2 to 4 moist), and chroma of 2 or 3. It is neutral or mildly alkaline silty clay loam or silty clay. The C horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Dorrance series

The Dorrance series consists of deep, excessively drained, very rapidly permeable soils on high terraces and on uplands. These soils formed in loamy material underlain by sandy and gravelly sediments at a depth of 10 to 24 inches (fig. 21). Slope ranges from 1 to 15 percent.

Dorrance soils are similar to Inavale soils and commonly are adjacent to Armo, Hedville, McCook, and Wells soils. Inavale soils are more than 20 inches deep over sand and gravel. They are on low terraces. Armo, McCook, and Wells soils are less sandy than the Dorrance soils. Also, Armo and Wells soils typically are higher on the landscape. McCook soils are on terraces. Hedville soils are 4 to 20 inches deep over bedrock. They are strongly sloping and moderately steep and are near escarpments.

Typical pedon of Dorrance gravelly sandy loam, 4 to 15 percent slopes, 2,300 feet south and 10 feet east of the northwest corner of sec. 22, T. 12 S., R. 13 W.

A1—0 to 11 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable; common fine and very fine roots; about 15 percent gravel; strong effervescence; moderately alkaline; clear smooth boundary.

AC—11 to 15 inches; grayish brown (10YR 5/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; few fine and very fine roots; about 20 percent gravel; violent effervescence; moderately alkaline; clear smooth boundary.

C1—15 to 26 inches; light gray (10YR 7/2) gravelly loamy sand, brown (10YR 5/3) moist; single grained; loose; about 20 percent gravel; violent effervescence; moderately alkaline; clear smooth boundary.

C2—26 to 60 inches; very pale brown (10YR 7/3) gravelly sand, light yellowish brown (10YR 6/4) moist; single grained; loose; about 15 percent gravel; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 24 inches. The depth to lime ranges from 0 to 10 inches.

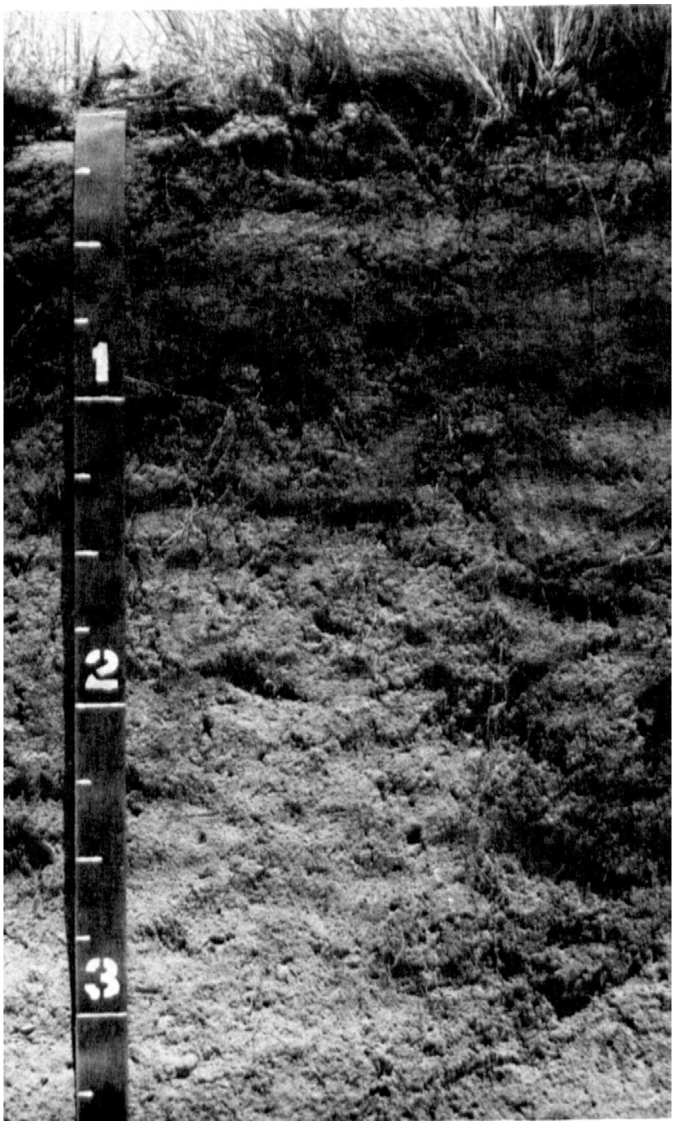

Figure 21.—Profile of Dorrance sandy loam. Loose loamy sand or coarser textured material is at a depth of 10 to 24 inches. Depth is marked in feet.

The mollic epipedon is 7 to 19 inches thick. The content of quartz pebbles and limestone fragments ranges from 5 to 35 percent.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is sandy loam or gravelly sandy loam. It ranges from neutral to moderately alkaline. The AC horizon has hue of 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline sand or gravelly sand.

Edalgo series

The Edalgo series consists of moderately deep, well drained, very slowly permeable soils on uplands. These soils formed in material weathered from noncalcareous shale. Slope ranges from 10 to 30 percent.

Edalgo soils commonly are adjacent to Armo and Dorrance soils. Armo soils are more than 40 inches deep over bedrock and contain lime throughout. They are on foot slopes. Dorrance soils contain more sand throughout than the Edalgo soils. Also, they are higher on the landscape.

Typical pedon of Edalgo silt loam, in an area of Edalgo-Rock outcrop complex, 10 to 30 percent slopes, 2,430 feet north and 1,040 feet east of the southwest corner of sec. 33, T. 14 S., R. 11 W.

A11—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine and very fine roots; few fine sandstone and quartz pebbles; slightly acid; clear smooth boundary.

A12—6 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; many fine and very fine roots; few fine quartz pebbles; slightly acid; clear smooth boundary.

B1—10 to 16 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate fine and very fine subangular blocky structure; hard, friable; common fine and very fine roots; few fine sandstone and quartz pebbles; neutral; clear smooth boundary.

B2t—16 to 22 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; very hard, firm; common very fine roots; neutral; clear smooth boundary.

C—22 to 26 inches; gray (10YR 6/1) silty clay, gray (10YR 5/1) moist; weak coarse blocky structure; hard, firm; few very fine roots between peds; few films and concretions of lime; mildly alkaline; clear smooth boundary.

Cr—26 inches; light gray (10YR 7/1) shale.

The solum is 18 to 36 inches thick. It does not contain lime, but in most pedons the C horizon has threads or concretions of lime. The depth to shale bedrock is 20 to 40 inches.

The A horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay, silty clay loam, or clay loam. The C horizon has hue of 5YR to 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 6. It is clay or silty clay.

Eltree series

The Eltree series consists of deep, well drained, moderately permeable soils on foot slopes. These soils formed in calcareous, silty colluvial and alluvial sediments. Slope ranges from 0 to 3 percent.

Eltree soils are similar to Armo, Nuckolls, and Roxbury soils and commonly are adjacent to Armo, Nibson, and Roxbury soils. Armo and Nuckolls soils have a mollic epipedon that is less than 20 inches thick. They are more sloping than the Eltree soils and are higher on the landscape. Roxbury soils are weakly stratified in the lower part. They are nearly level and are on terraces and flood plains. Nibson soils are 10 to 20 inches deep over chalky shale and limestone. They are on uplands.

Typical pedon of Eltree silt loam, 0 to 3 percent slopes, 2,400 feet north and 1,800 feet east of the southwest corner of sec. 4, T. 13 S., R. 12 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; few very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

A12—7 to 14 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine granular structure; hard, friable; few very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

A13—14 to 22 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky structure; hard, friable; few very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

B21ca—22 to 34 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, friable; few very fine roots; a few pebbles; many threads of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

B22ca—34 to 60 inches; brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; moderate fine subangular blocky structure; hard, friable; few very fine roots; a few pebbles; many threads of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 35 to 60 inches. Lime typically is at the surface, but in some pedons the depth to lime is as much as 15 inches. The thickness of the mollic epipedon ranges from 20 to 30 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly silt loam and silty clay loam, but the range includes loam. The B2 horizon has hue of 7.5YR or 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is silt loam or silty clay loam.

Harney series

The Harney series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loess. Slope ranges from 1 to 7 percent.

Harney soils are similar to Crete, Detroit, and Nuckolls soils and commonly are adjacent to Corinth, Crete, Nuckolls, and Wakeen soils. The nearly level Crete soils are slightly higher on the landscape than the Harney soils. Also, they contain more clay in the subsoil and have a mollic epipedon that is more than 20 inches thick. Detroit soils also have a mollic epipedon that is more than 20 inches thick. They are on terraces. Nuckolls soils are lower on the landscape than the Harney soils. Also, their subsoil contains less clay. Corinth and Wakeen soils are 20 to 40 inches deep over shale. They are lower on the landscape than the Harney soils.

Typical pedon of Harney silt loam, 1 to 3 percent slopes, 600 feet south and 50 feet east of the northwest corner of sec. 4, T. 11 S., R. 13 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; hard, friable; common very fine roots; neutral; abrupt smooth boundary.

A12—7 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine and very fine subangular blocky structure; hard, friable; common very fine roots; neutral; clear smooth boundary.

B21t—12 to 19 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, firm; common very fine roots; mildly alkaline; clear smooth boundary.

B22t—19 to 25 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine blocky structure; very hard, firm; few very fine roots; mildly alkaline; clear smooth boundary.

B3ca—25 to 31 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium blocky structure; hard, friable; few very fine roots; few lime concretions; slight effervescence; moderately alkaline; gradual smooth boundary.

C—31 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; hard, friable; few very fine roots; few films and threads of lime; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 48 inches. The depth to lime ranges from 18 to 30 inches. The mollic epipedon ranges from 10 to 20 inches in thickness. In most pedons it includes the upper part of the B2t horizon.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is slightly acid or neutral silt loam or silty clay loam. The upper part of the B2t horizon has colors similar to those of the A horizon. The part below the mollic epipedon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. The B2t horizon is silty clay or silty clay loam in which the content of clay ranges from 35 to 42 percent. It is neutral to moderately alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is silt loam or silty clay loam.

Hedville series

The Hedville series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in material weathered from noncalcareous sandstone. Slope ranges from 8 to 25 percent.

Hedville soils are similar to Nibson soils and commonly are adjacent to Armo and Lancaster soils. Nibson soils are calcareous throughout and are shallow over chalky shale and soft limestone. They are higher on the landscape than the Hedville soils. Armo soils are deep over bedrock and are calcareous throughout. They typically are higher on the landscape than the Hedville soils. Lancaster soils are 20 to 40 inches deep over sandstone and sandy shale. Their positions on the landscape are similar to those of the Hedville soils.

Typical pedon of Hedville loam, in an area of Lancaster-Hedville loams, 8 to 25 percent slopes, 1,950 feet east and 450 feet north of the southwest corner of sec. 23, T. 13 S., R. 11 W.

A1—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many very fine roots; about 5 percent sandstone fragments; neutral; clear smooth boundary.

R—12 inches; brown (10YR 5/3) and strong brown (7.5YR 5/6) sandstone.

The thickness of the solum, or the depth to sandstone, ranges from 4 to 20 inches. The content of coarse fragments 1 to 10 inches in diameter ranges from 0 to 15 percent. Reaction is medium acid to neutral.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. Some pedons have a thin B2 or C horizon between the mollic epipedon and the bedrock. This thin horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4.

Humbarger series

The Humbarger series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in calcareous, loamy alluvium. Slope ranges from 0 to 2 percent.

Humbarger soils are similar to McCook and Roxbury soils and commonly are adjacent to Inavale, McCook, and Munjor soils on terraces. McCook soils have a mollic epipedon that is less than 20 inches thick. Roxbury soils contain less sand in the subsoil than the Humbarger soils. Inavale and Munjor soils lack a mollic epipedon and contain more sand than the Humbarger soils.

Typical pedon of Humbarger loam, 2,240 feet north and 30 feet west of the southeast corner of sec. 35, T. 12 S., R. 14 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

A12—8 to 22 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common very fine roots; few worm casts; strong effervescence; moderately alkaline; clear smooth boundary.

AC—22 to 32 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common very fine roots; few worm casts; strong effervescence; moderately alkaline; clear smooth boundary.

C—32 to 52 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline; gradual smooth boundary.

Ab—52 to 60 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; strong effervescence; moderately alkaline.

The solum and the mollic epipedon range from 20 to 40 inches in thickness. Most pedons are calcareous to the surface, but some do not have lime in the upper 15 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly loam or clay loam, but the range includes silt loam. The AC horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is sandy loam, loam, clay loam, or silty clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam, sandy loam, or silt loam.

Inavale series

The Inavale series consists of deep, somewhat excessively drained, rapidly permeable soils on terraces.

These soils formed in sandy alluvium. Slope ranges from 0 to 3 percent.

Inavale soils are similar to Dorrance and Munjor soils and commonly are adjacent to Humbarger, McCook, and Munjor soils. Dorrance and Humbarger soils have a mollic epipedon. Dorrance soils are on uplands or high terraces, and Humbarger soils are on flood plains. Munjor, Humbarger, and McCook soils are less sandy than the Inavale soils. McCook soils are slightly higher on the terraces than the Inavale soils.

Typical pedon of Inavale loamy sand, 2,500 feet east and 1,980 feet south of the northwest corner of sec. 34, T. 14 S., R. 11 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; common very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

AC—8 to 16 inches; light brownish gray (10YR 6/2) loamy sand, dark brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; common very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C—16 to 60 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grained; loose; few very fine roots in the upper part; thin strata of loamy very fine sand; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 10 to 30 inches. The soils range from neutral to moderately alkaline throughout.

The A horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is loamy sand or loamy fine sand. The AC and C horizons have hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. They are dominantly loamy fine sand, loamy sand, or sand. In many pedons, however, the C horizon has strata of finer or coarser textured material.

Lancaster series

The Lancaster series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from noncalcareous sandstone and sandy shale. Slope ranges from 3 to 12 percent.

Lancaster soils are similar to Wells soils and commonly are adjacent to Armo, Hedville, and Nuckolls soils. Wells, Armo, and Nuckolls soils are more than 40 inches deep over bedrock. Armo soils are on foot slopes, and Nuckolls soils are on side slopes below the Lancaster soils. Hedville soils are less than 20 inches deep over sandstone. Their positions on the landscape are similar to those of the Lancaster soils.

Typical pedon of Lancaster loam, in an area of Lancaster-Hedville loams, 8 to 25 percent slopes, 400 feet east and 120 feet north of the southwest corner of sec. 24, T. 13 S., R. 11 W.

A1—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common fine and very fine roots; few worm casts; few siltstone fragments less than one-half inch in diameter; slightly acid; clear smooth boundary.

B1—7 to 13 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard; friable; common very fine roots; few worm casts; slightly acid; clear smooth boundary.

B2t—13 to 26 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky and moderate fine granular structure; slightly hard, friable; common very fine roots; few worm casts; few shale fragments less than 1 inch in diameter; neutral; clear smooth boundary.

B3—26 to 36 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; few very fine roots; few fine shale fragments; neutral; clear smooth boundary.

Cr—36 inches; very pale brown (10YR 7/4) and light brown (7.5YR 6/4) sandy shale and weakly consolidated sandstone.

The thickness of the solum, or the depth to sandy shale or sandstone, ranges from 20 to 40 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. The B2t horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 6. It is clay loam or loam. The B3 horizon has hue of 5YR or 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 4 to 6. It is sandy clay loam, clay loam, fine sandy loam, or loam. The B2t and B3 horizons are slightly acid or neutral.

McCook series

The McCook series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in calcareous alluvium. Slope ranges from 0 to 2 percent.

McCook soils are similar to Humbarger and Roxbury soils and commonly are adjacent to those soils and to Inavale and Munjor soils. Humbarger soils have a mollic epipedon that is more than 20 inches thick. They are on flood plains. Roxbury soils have a mollic epipedon that is more than 20 inches thick and contain more clay in the subsoil than the McCook soils. Also, they commonly are slightly higher on the terraces. Inavale and Munjor soils contain more sand throughout than the McCook soils. Also, they are slightly lower on the terraces.

Typical pedon of McCook silt loam, 200 feet north and 200 feet west of the southeast corner of sec. 27, T. 14 S., R. 12 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common medium roots; strong effervescence; moderately alkaline; clear smooth boundary.

A12—6 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; common medium roots; strong effervescence; moderately alkaline; clear smooth boundary.

AC—12 to 28 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—28 to 46 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; few very fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—46 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; thin strata of darker and finer textured material; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches. The mollic epipedon ranges from 10 to 20 inches in thickness. Most pedons are calcareous to the surface, but some do not have lime in the upper 10 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam and fine sandy loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is silt loam or very fine sandy loam.

Munjor series

The Munjor series consists of deep, well drained, moderately rapidly permeable soils on terraces. These soils formed in calcareous, loamy alluvium. Slope ranges from 0 to 2 percent.

Munjor soils are similar to Inavale soils and commonly are adjacent to Inavale and McCook soils. Inavale soils contain more sand than the Munjor soils. Their positions on the landscape are similar to those of the Munjor soils. McCook soils contain less sand than the Munjor soils. Also, they are slightly higher on the landscape.

Typical pedon of Munjor fine sandy loam, 2,490 feet south and 990 feet east of the northwest corner of sec. 26, T. 12 S., R. 13 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

AC—9 to 14 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—14 to 48 inches; pale brown (10YR 6/3) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; many thin darker strata; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—48 to 60 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 3 to 15 inches. The depth to lime is less than 10 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes loam, sandy loam, and loamy sand. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly fine sandy loam, sandy loam, or loam but in some pedons is sand or loamy sand below a depth of 40 inches.

Nibson series

The Nibson series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from interbedded chalky shale and soft limestone (fig. 22). Slope ranges from 5 to 25 percent.

Nibson soils are similar to Hedville soils and commonly are adjacent to Armo, Harney, and Wakeen soils. Hedville soils are noncalcareous. They are lower on the landscape than the Nibson soils. Armo and Harney soils are more than 40 inches deep over bedrock. Armo soils are on foot slopes, and Harney soils are on ridgetops. Wakeen soils are 20 to 40 inches deep over chalky limestone and shale. They are slightly higher on the landscape than the Nibson soils.

Typical pedon of Nibson silt loam, 5 to 25 percent slopes, 1,800 feet west and 200 feet south of the northeast corner of sec. 17, T. 15 S., R. 13 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, friable; common fine and very fine roots; a few small limestone fragments; strong effervescence;

Figure 22.—Profile of Nibson silt loam. Chalky shale and soft limestone are at a depth of 10 to 20 inches.

moderately alkaline; clear smooth boundary.

B2—7 to 12 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable; common fine and very fine roots; about 10 percent limestone fragments; strong effervescence; moderately alkaline; clear smooth boundary.

C—12 to 18 inches; white (10YR 8/2) silty clay loam, light gray (10YR 7/2) moist; massive; slightly hard, friable; few very fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

Cr—18 inches; white (10YR 8/2) chalky limestone.

The thickness of the solum ranges from 10 to 15 inches. The depth to unweathered chalky shale or soft limestone ranges from 10 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 10 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. The B2 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silt loam or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is silt loam or silty clay loam.

Nuckolls series

The Nuckolls series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in brownish loess. Slope ranges from 3 to 11 percent.

Nuckolls soils are similar to Eltree, Harney, and Wells soils and commonly are adjacent to Harney and Lancaster soils. Eltree soils have a mollic epipedon that is more than 20 inches thick. They are on foot slopes. Harney soils are higher on the landscape than the Nuckolls soils. Also, their subsoil contains more clay. Wells soils are on the lower side slopes. Their subsoil contains more sand than that of the Nuckolls soils. Lancaster soils are 20 to 40 inches deep over sandy shale or sandstone. They are higher on the landscape than the Nuckolls soils.

Typical pedon of Nuckolls silt loam, 3 to 7 percent slopes, 270 feet south and 260 feet east of the northwest corner of sec. 29, T. 11 S., R. 1 W.

Ap—0 to 6 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; hard, friable; common very fine roots; mildly alkaline; abrupt smooth boundary.

B1—6 to 14 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate fine blocky structure; very hard, firm; few very fine roots; few fine very dark brown concretions; mildly alkaline; clear smooth boundary.

B2—14 to 23 inches; brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/3) moist; moderate medium blocky structure; very hard, firm; few very fine roots; few fine very dark brown concretions; mildly alkaline; clear smooth boundary.

C1—23 to 46 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; weak medium blocky structure; hard, friable; few very dark brown concretions; common lime concretions; strong effervescence; mildly alkaline; clear smooth boundary.

C2—46 to 60 inches; pink (7.5YR 7/4) silt loam, light brown (7.5YR 6/4) moist; massive; slightly hard, friable; few fine very dark brown concretions; few lime concretions; strong effervescence; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. It is neutral or mildly alkaline in the upper part and mildly alkaline or moderately alkaline in the lower part. The depth to lime ranges from 20 to 36 inches. The mollic epipedon ranges from 7 to 14 inches in thickness.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is silt loam or silty clay loam. The B2 horizon has hue of 5YR to 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 6. It is silt loam or silty clay loam. The C horizon has hue of 7.5YR or 10YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 6.

Nuckolls silty clay loam, 6 to 11 percent slopes, eroded, is a taxadjunct to the Nuckolls series because it lacks a mollic epipedon and has lime at or near the surface. These differences, however, do not significantly affect the use or behavior of the soil.

Roxbury series

The Roxbury series consists of deep, well drained, moderately permeable soils on terraces and flood plains. These soils formed in calcareous alluvium. Slope ranges from 0 to 2 percent.

Roxbury soils are similar to Eltree, Humbarger, and McCook soils and commonly are adjacent to Armo, McCook, and Nibson soils. Eltree soils are not stratified. They are on foot slopes. Humbarger soils are on flood plains. Their subsoil contains more sand than that of the Roxbury soils. McCook soils are on terraces. They do not have a B horizon, contain less clay in the C horizon than the Roxbury soils, and have a mollic epipedon that is less than 20 inches thick. Armo soils also have a mollic epipedon that is less than 20 inches thick. They are on foot slopes. Nibson soils are less than 20 inches deep over bedrock. They are on uplands.

Typical pedon of Roxbury silt loam, 2,530 feet north and 800 feet west of the southeast corner of sec. 9, T. 13 S., R. 12 W.

A11—0 to 17 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine granular structure; hard, friable; common very fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

A12—17 to 26 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; few very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

B2—26 to 40 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky structure; hard, friable; few very fine roots; many threads of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C—40 to 60 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable; a few thin strata of slightly darker material; few very fine roots; few threads of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 50 inches. The mollic epipedon is more than 20 inches thick. The depth to lime is less than 15 inches. The soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam and silty clay loam. The B2 horizon has hue of 10YR, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is dominantly silt loam, silty clay loam, or loam but in some pedons has thin strata of more clayey or more sandy material.

Wakeen series

The Wakeen series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in residuum of chalky limestone and shale. Slope ranges from 1 to 7 percent.

Wakeen soils are similar to Armo soils and commonly are adjacent to Corinth, Harney, and Nibson soils. Armo soils are more than 40 inches deep over bedrock. They are on foot slopes. Corinth soils lack a mollic epipedon. They are higher on the landscape than the Wakeen soils. Harney soils are more than 40 inches deep over bedrock. They are higher on the landscape than the Wakeen soils. Nibson soils are less than 20 inches deep over chalky shale and limestone. They are on the lower side slopes.

Typical pedon of Wakeen silt loam, 3 to 7 percent slopes, 2,440 feet south and 1,280 feet west of the northeast corner of sec. 22, T. 15 S., R. 15 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; common very fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

B1—9 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; few very fine roots; few fine threads and coatings of lime in the lower part; slight effervescence; moderately alkaline; clear smooth boundary.

B2—13 to 18 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate fine subangular blocky structure; hard, friable; few very fine roots; few small limestone fragments; strong effervescence; moderately alkaline; clear smooth boundary.

B3—18 to 31 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; moderate fine subangular blocky structure; hard, friable; few small lime concretions; strong effervescence; moderately alkaline; abrupt smooth boundary.

Cr—31 inches; chalky limestone.

The thickness of the solum, or the depth to chalky limestone, ranges from 20 to 40 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. The soils contain lime throughout and are mildly alkaline or moderately alkaline.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. The B2 horizon has hue of 10YR, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 6. It is silty clay loam or silt loam.

Wells series

The Wells series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in old alluvium. Slope ranges from 0 to 3 percent.

These soils are taxadjuncts to the Wells series because they typically are less red and have lime nearer to the surface than is defined as the range for the series. These differences, however, do not significantly affect the use or behavior of the soils.

Wells soils are similar to Lancaster and Nuckolls soils and commonly are adjacent to Dorrance and Harney soils. Lancaster soils are 20 to 40 inches deep over sandy shale or sandstone. The subsoil of Nuckolls soils contains less sand than that of the Wells soils. Dorrance soils are more sandy than the Wells soils. Also, they are lower on the landscape. Harney soils are higher on the landscape than the Wells soils. Also, their subsoil contains less sand and more clay.

Typical pedon of Wells loam, 0 to 3 percent slopes, 1,940 feet east and 270 feet north of the southwest corner of sec. 24, T. 14 S., R. 13 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; few very fine roots; slightly acid; abrupt smooth boundary.

A3—8 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; few very fine roots; neutral; clear smooth boundary.

B21t—12 to 17 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; few very fine roots; neutral; clear smooth boundary.

B22t—17 to 32 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, friable; few very fine roots; neutral; abrupt smooth boundary.

B3—32 to 49 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; common threads and films of lime; mildly alkaline; gradual smooth boundary.

C—49 to 60 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable; few threads and small masses of lime; mildly alkaline.

The thickness of the solum ranges from 35 to 55 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches. The depth to lime ranges from 15 to 35 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It ranges from slightly acid to mildly alkaline. The B2t horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 3. It ranges from neutral to moderately alkaline. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (5 or 6 moist), and chroma of 3 to 6. It is clay loam, sandy clay loam, or sandy loam. It is mildly alkaline or moderately alkaline.

formation of the soils

The characteristics of a soil at any given place are determined by the interactions among five factors of soil formation—climate, plants and other living organisms, parent material, relief, and time. Each of these factors affects the formation of every soil, and each modifies the effects of the other four. The effects of the individual factors vary from place to place. The interactions among the factors are more complex for some soils than for others.

Climate and vegetation act on the parent material and gradually change it to a natural body of soil. Relief modifies the effects of climate and vegetation, mainly through its effect on runoff and temperature. The nature of the parent material affects the kind of soil that forms. Time is needed for changing the parent material into a soil. Generally, a long period is needed for the formation of distinct soil horizons.

parent material

Parent material is the weathered rock or partly weathered material in which soils form. It affects the texture, structure, color, natural fertility, and many other properties of the soil. The soils in Russell County formed in alluvium, colluvium, loess, and residuum of chalky limestone, shale, or sandstone.

Alluvium is sediment deposited by floodwater in stream valleys. In the valleys of the Smoky Hill and Saline Rivers, it ranges from silty to sandy and some of the material is derived from the Rocky Mountain region. In the smaller valleys the sediment generally is silty and of local origin. Detroit, Humbarger, Inavale, McCook, Munjor, and Roxbury soils formed in alluvial material.

The colluvium in Russell County is loamy or silty sediment that accumulated at the base of the steeper slopes as a result of gravity. It is derived from chalky shale and limestone bedrock or from loess deposits. Armo and Eltree soils formed partly in colluvial material.

Loess is silty, wind-deposited material, some of which has been carried hundreds of miles from its source. Peorian Loess of the Wisconsin Glaciation was deposited during the Pleistocene epoch. It covers many of the uplands in the county. In most areas it is very pale brown or light gray, calcareous, and friable. Crete and Harney soils formed in this material. Loveland Loess is the parent material of Nuckolls soils. This pink material was deposited during Illinoian time.

The bedrock that crops out in the county is chalky limestone, shale, or sandstone. The chalky limestone and shale are of the Upper Cretaceous System. The calcareous Corinth, Nibson, and Wakeen soils formed in residuum of these chalky rocks. Bogue soils formed in residuum of noncalcareous, clayey shale of the Upper Cretaceous System. Edalgo, Hedville, and Lancaster soils formed in material weathered from shale or sandstone of the Dakota Formation, which is in the Lower Cretaceous System.

climate

Climate affects the physical and chemical weathering processes and the biological processes at work in the parent material. These processes are most active when the soil is warm and moist.

The continental climate of Russell County is characterized by intermittent dry and moist periods. These periods can last for less than a year or for several years. The soil material dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become saturated with excess moisture. The accumulation of lime in the lower part of the subsoil in Harney soils is an indication of this excess moisture. The downward movement of water is of major importance in transforming the parent material into a soil that has distinct horizons.

Climate is an important factor affecting soil formation throughout a wide region, but it does not significantly differentiate soils in a small area, such as a survey area.

plant and animal life

Plants generally affect the content of plant nutrients and of organic matter in the soil and the color of the surface layer. Bacteria and fungi help to decompose the plants, thus releasing more nutrients. Earthworms, cicadas, and burrowing animals help to keep the soil open and porous.

The mid and tall prairie grasses have had a significant effect on soil formation in Russell County. As a result of the grasses, the upper part of a typical soil in the county is dark and is high in content of organic matter. In many areas the next part is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color and high in content of lime.

Human activities, such as farming and ranching, have a great effect on soil formation. In many areas in the county, they have increased the susceptibility to erosion and increased or decreased the content of organic matter. Also, land leveling and industrial or urban development have altered the relief.

relief

Relief affects soil formation through its effect on drainage, runoff, plant cover, and soil temperature. Most important is the effect that it has on the movement of water on the surface and into the soil.

Runoff is more rapid on the steeper soils in the uplands than on less sloping soils. As a result, erosion is more extensive. Relief has retarded the formation of Hedville soils, which formed in the oldest parent material in the county. Runoff is rapid on these strongly sloping and moderately steep soils, and much of the soil material is removed as soon as the soil forms.

time

The length of time needed for soil formation depends mainly on the other factors of soil formation. As water moves downward through the soil, soluble matter and fine particles are leached gradually from the surface layer and are deposited in the subsoil. The extent of leaching depends not only on the amount of water that has penetrated the surface but also on the amount of time that has elapsed.

Some of the soils in the county are young. McCook soils, which formed in recent alluvium, are an example. They show very little evidence of horizon differentiation other than a slight darkening of the surface layer. The older soils have well defined horizons. Crete soils, which have been forming for thousands of years, are an example.

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glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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

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.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

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.

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.

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 removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

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.

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.

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 7.5 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 (7.5 centimeters) in diameter.

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. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

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, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A 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) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

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 A or B 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, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

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 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

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

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.

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.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

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.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

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.

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 0.20 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.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

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

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

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.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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 insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm 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 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.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

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 grained* (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 profile below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

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 1951-76 at Russell, Kansas]

Month	Temperature					Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	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	In	In	In		In
January-----	39.5	15.8	27.7	70	-15	.47	.12	.89	1	4.8
February---	45.5	20.6	33.1	81	-7	.79	.19	1.57	2	5.9
March------	52.8	27.7	40.3	87	-2	1.69	.35	2.34	4	6.5
April------	65.8	40.1	53.0	91	18	2.42	1.20	3.51	4	1.6
May--------	75.8	51.3	65.6	99	30	3.85	1.80	5.61	7	0.0
June-------	86.7	61.6	74.2	107	44	3.81	1.56	5.56	6	0.0
July-------	92.1	67.1	79.6	108	52	3.50	1.52	4.96	6	0.0
August-----	90.9	65.5	78.2	108	49	3.25	1.45	4.87	5	0.0
September--	80.5	55.4	68.0	103	35	3.46	.88	5.48	5	0.0
October----	70.2	43.6	56.9	95	21	1.76	.42	2.86	3	0.4
November---	53.5	29.2	41.4	78	3	.96	.07	2.05	2	3.0
December---	43.0	19.8	31.4	70	-6	.67	.19	1.02	2	4.3
Year-----	66.4	41.5	54.0	108	-15	26.63	19.57	34.09	47	26.5

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1931-60 at Russell, Kansas]

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 16	April 28	May 10
2 years in 10 later than--	April 11	April 23	May 5
5 years in 10 later than--	April 2	April 13	April 25
First freezing temperature in fall:			
1 year in 10 earlier than--	October 20	October 14	October 2
2 years in 10 earlier than--	October 24	October 19	October 6
5 years in 10 earlier than--	November 3	October 28	October 16

TABLE 3.--GROWING SEASON

[Recorded in the period 1931-60 at Russell, Kansas]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	196	178	153
8 years in 10	203	185	160
5 years in 10	215	198	174
2 years in 10	227	212	188
1 year in 10	233	219	195

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

Map symbol	Soil name	Acres	Percent
Ae	Armo loam, 3 to 7 percent slopes	30,800	5.4
Ag	Armo loam, 7 to 15 percent slopes	23,800	4.2
Bo	Bogue clay, 3 to 15 percent slopes	6,000	1.1
Cc	Corinth silty clay loam, 2 to 7 percent slopes	11,700	2.0
Cd	Corinth silty clay loam, 7 to 15 percent slopes	13,900	2.4
Cr	Crete silt loam, 0 to 1 percent slopes	30,100	5.2
De	Detroit silt loam	1,900	0.3
Do	Dorrance sandy loam, 1 to 4 percent slopes	2,200	0.4
Dr	Dorrance gravelly sandy loam, 4 to 15 percent slopes	12,600	2.2
Es	Edalgo-Rock outcrop complex, 10 to 30 percent slopes	2,300	0.4
Et	Eltree silt loam, 0 to 3 percent slopes	3,400	0.6
Hb	Harney silt loam, 1 to 3 percent slopes	117,900	20.5
Hc	Harney silty clay loam, 3 to 7 percent slopes	47,800	8.3
Hu	Humbarger loam	3,000	0.5
Iv	Inavale loamy sand	880	0.2
Lc	Lancaster loam, 3 to 8 percent slopes	1,800	0.3
Lh	Lancaster-Hedville loams, 8 to 25 percent slopes	20,100	3.5
Mc	McCook silt loam	9,700	1.7
Mr	Munjor fine sandy loam	3,200	0.6
Ns	Nibson silt loam, 5 to 25 percent slopes	113,800	19.8
Nu	Nuckolls silt loam, 3 to 7 percent slopes	12,100	2.1
Nx	Nuckolls silty clay loam, 6 to 11 percent slopes, eroded	5,000	0.9
Rb	Roxbury silt loam	21,500	3.7
Rc	Roxbury silt loam, channeled	13,900	2.4
Rf	Roxbury silt loam, occasionally flooded	13,700	2.4
Wb	Wakeen silt loam, 1 to 3 percent slopes	11,800	2.1
Wc	Wakeen silt loam, 3 to 7 percent slopes	24,000	4.2
Ws	Wells loam, 0 to 3 percent slopes	6,200	1.1
	Water	9,000	1.5
	Total	574,080	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. 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	Winter wheat	Grain sorghum	Alfalfa hay	Smooth bromegrass
	Bu	Bu	Ton	AUM*
Ae------------------------ Armo	32	46	2.2	3.8
Cc------------------------ Corinth	24	34	1.5	3.1
Cr------------------------ Crete	36	52	2.8	4.0
De------------------------ Detroit	38	56	---	5.0
Do------------------------ Dorrance	18	30	2.0	---
Et------------------------ Eltree	37	52	2.8	4.0
Hb------------------------ Harney	35	50	2.7	4.0
Hc------------------------ Harney	32	46	2.0	3.6
Hu------------------------ Humbarger	31	50	3.0	5.0
Iv------------------------ Inavale	25	34	2.0	---
Lc------------------------ Lancaster	28	46	---	3.6
Mc------------------------ McCook	38	56	3.0	---
Mr------------------------ Munjor	32	50	2.1	---
Nu------------------------ Nuckolls	32	48	2.0	3.6
Nx------------------------ Nuckolls	26	40	1.5	3.0
Rb------------------------ Roxbury	38	56	4.2	5.6
Rc------------------------ Roxbury	---	---	---	4.0
Rf------------------------ Roxbury	33	52	3.7	5.6
Wb------------------------ Wakeen	28	42	---	3.0
Wc------------------------ Wakeen	25	38	---	2.5
Ws------------------------ Wells	36	52	3.6	5.0

* 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.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ae, Ag-------------- Armo	Limy Upland--------------------	Favorable	4,000	Big bluestem-------------------	40
		Normal	3,000	Little bluestem----------------	20
		Unfavorable	1,000	Sideoats grama-----------------	10
				Indiangrass--------------------	5
				Switchgrass--------------------	5
				Leadplant----------------------	5
				Western wheatgrass-------------	5
Bo------------------ Bogue	Blue Shale---------------------	Favorable	3,000	Big bluestem-------------------	40
		Normal	2,000	Little bluestem----------------	20
		Unfavorable	1,000	Sideoats grama-----------------	15
				Leadplant----------------------	10
				Indiangrass--------------------	5
Cc, Cd-------------- Corinth	Limy Upland--------------------	Favorable	4,000	Big bluestem-------------------	40
		Normal	2,500	Little bluestem----------------	20
		Unfavorable	1,000	Sideoats grama-----------------	10
				Switchgrass--------------------	5
				Indiangrass--------------------	5
				Western wheatgrass-------------	5
				Leadplant----------------------	5
Cr------------------ Crete	Clay Upland--------------------	Favorable	4,000	Big bluestem-------------------	25
		Normal	2,800	Little bluestem----------------	15
		Unfavorable	2,000	Switchgrass--------------------	10
				Sideoats grama-----------------	10
				Indiangrass--------------------	5
				Western wheatgrass-------------	5
				Tall dropseed------------------	5
				Blue grama---------------------	5
De------------------ Detroit	Loamy Terrace------------------	Favorable	5,000	Big bluestem-------------------	30
		Normal	4,500	Little bluestem----------------	10
		Unfavorable	3,000	Switchgrass--------------------	10
				Western wheatgrass-------------	10
				Sideoats grama-----------------	10
				Indiangrass--------------------	5
				Maximilian sunflower-----------	5
Do------------------ Dorrance	Sands--------------------------	Favorable	3,000	Little bluestem----------------	20
		Normal	2,500	Sand bluestem------------------	15
		Unfavorable	1,500	Blue grama---------------------	10
				Indiangrass--------------------	10
				Switchgrass--------------------	10
Dr------------------ Dorrance	Gravelly Hills-----------------	Favorable	2,000	Blue grama---------------------	25
		Normal	1,500	Little bluestem----------------	20
		Unfavorable	1,000	Sideoats grama-----------------	15
				Sand bluestem------------------	5
				Tall dropseed------------------	5
Es*:					
Edalgo--------------	Clay Upland--------------------	Favorable	4,500	Big bluestem-------------------	30
		Normal	3,000	Little bluestem----------------	15
		Unfavorable	2,000	Switchgrass--------------------	15
				Indiangrass--------------------	10
				Tall dropseed------------------	5
				Sideoats grama-----------------	5
Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Et: Eltree	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Leadplant	5
				Western wheatgrass	5
Hb, Hc: Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,000	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
				Western ragweed	5
Hu: Humbarger	Loamy Lowland	Favorable	6,500	Big bluestem	35
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Indiangrass	10
				Western wheatgrass	10
				Little bluestem	5
Iv: Inavale	Sands	Favorable	3,800	Sand bluestem	30
		Normal	3,000	Prairie sandreed	20
		Unfavorable	2,200	Western wheatgrass	20
				Little bluestem	15
				Switchgrass	5
Lc: Lancaster	Loamy Upland	Favorable	5,000	Big bluestem	30
		Normal	3,500	Little bluestem	25
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
Lh*:					
Lancaster	Loamy Upland	Favorable	5,000	Big bluestem	30
		Normal	3,500	Little bluestem	25
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
Hedville	Shallow Sandstone	Favorable	4,000	Little bluestem	35
		Normal	3,000	Big bluestem	30
		Unfavorable	2,000	Switchgrass	5
				Indiangrass	5
				Sideoats grama	5
Mc: McCook	Loamy Terrace	Favorable	4,000	Big bluestem	25
		Normal	3,600	Little bluestem	15
		Unfavorable	2,800	Switchgrass	10
				Indiangrass	10
				Western wheatgrass	10
				Canada wildrye	5
				Sedge	5
				Blue grama	5
				Sideoats grama	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Mr: Munjor	Sandy Terrace	Favorable	4,000	Blue grama	15
		Normal	3,000	Sand bluestem	15
		Unfavorable	2,000	Big bluestem	10
				Little bluestem	10
				Prairie sandreed	10
				Western wheatgrass	10
				Switchgrass	5
				Indiangrass	5
				Sideoats grama	5
				Sand dropseed	5
Ns: Nibson	Limy Upland	Favorable	4,000	Big bluestem	30
		Normal	2,500	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	20
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5
Nu: Nuckolls	Loamy Upland	Favorable	3,500	Little bluestem	20
		Normal	2,500	Big bluestem	15
		Unfavorable	1,500	Sideoats grama	15
				Blue grama	10
				Western wheatgrass	10
				Buffalograss	5
				Switchgrass	5
Rc, Rf: Roxbury	Loamy Lowland	Favorable	6,500	Big bluestem	40
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Indiangrass	10
				Western wheatgrass	10
				Little bluestem	5
Wb, Wc: Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Blue grama	5

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

TABLE 7.--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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ae, Ag: Armo	Fragrant sumac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, bur oak, Russian-olive, Rocky Mountain juniper.	Ponderosa pine, honeylocust, green ash, Siberian elm.	---	---
Bo: Bogue	Peking cotoneaster, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, common hackberry, Russian-olive, green ash, Rocky Mountain juniper.	Austrian pine, honeylocust, Russian mulberry.	Siberian elm	---
Cc, Cd: Corinth	Fragrant sumac, Tatarian honeysuckle, Siberian peashrub, silver buffaloberry.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Cr: Crete	Amur honeysuckle, Peking cotoneaster, Siberian peashrub.	Eastern redcedar, Rocky Mountain juniper, common hackberry.	Austrian pine, green ash, honeylocust, Russian-olive, Russian mulberry.	Siberian elm	---
De: Detroit	Amur honeysuckle, Siberian peashrub, Peking cotoneaster.	Rocky Mountain juniper.	Austrian pine, Russian-olive, green ash, honeylocust, Russian mulberry, common hackberry, eastern redcedar.	Siberian elm	Eastern cottonwood.
Do, Dr. Dorrance					
Es*:					
Edalgo	Siberian peashrub, Amur honeysuckle, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, common hackberry.	Austrian pine, honeylocust, Russian-olive, green ash, Russian mulberry.	Siberian elm	---
Rock outcrop.					
Et: Eltree	American plum	Amur honeysuckle, lilac.	Eastern redcedar, ponderosa pine, Russian mulberry, Russian-olive, Austrian pine, green ash.	Honeylocust, common hackberry.	---
Hb, Hc: Harney	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, bur oak, honeylocust, Russian-olive, Austrian pine, green ash, common hackberry.	Siberian elm	---
Hu: Humbarger	---	Siberian peashrub, silver buffaloberry.	Eastern redcedar, Russian mulberry, Russian-olive, ponderosa pine, green ash.	Siberian elm, common hackberry, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Iv----------------- Inavale	Lilac, American plum.	Common chokecherry	Eastern redcedar, Austrian pine, Scotch pine, Russian mulberry, green ash, common hackberry.	Siberian elm, honeylocust.	Eastern cottonwood.
Lc----------------- Lancaster	Fragrant sumac, lilac, Siberian peashrub.	Rocky Mountain juniper, Russian mulberry, Russian-olive.	Eastern redcedar, green ash, Austrian pine, bur oak, honeylocust.	Siberian elm------	---
Lh*:					
Lancaster---------	Fragrant sumac, lilac, Siberian peashrub.	Rocky Mountain juniper, Russian mulberry, Russian-olive.	Eastern redcedar, green ash, Austrian pine, bur oak, honeylocust.	Siberian elm------	---
Hedville.					
Mc----------------- McCook	---	Tatarian honeysuckle, Siberian peashrub, silver buffaloberry.	Eastern redcedar, ponderosa pine, common hackberry, green ash, Russian-olive, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
Mr----------------- Munjor	American plum-----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry.	Ponderosa pine, Russian-olive, green ash, Russian mulberry, eastern redcedar.	Siberian elm, honeylocust.	Eastern cottonwood.
Ns. Nibson					
Nu, Nx------------ Nuckolls	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, green ash, common hackberry, Austrian pine, honeylocust, Russian-olive, bur oak.	Siberian elm------	---
Rb----------------- Roxbury	---	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry.	Russian mulberry, ponderosa pine, green ash, Russian-olive, eastern redcedar.	Common hackberry, Siberian elm, honeylocust.	Eastern cottonwood.
Rc, Rf------------ Roxbury	---	Tatarian honeysuckle, Siberian peashrub, silver buffaloberry.	Eastern redcedar, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Siberian elm, common hackberry, honeylocust.	Eastern cottonwood.
Wb, Wc------------ Wakeen	Siberian peashrub, fragrant sumac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Russian-olive, Rocky Mountain juniper, bur oak.	Honeylocust, Siberian elm, ponderosa pine, green ash.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ws----------------- Wells	Lilac, Amur honeysuckle, fragrant sumac.	Russian mulberry	Eastern redcedar, common hackberry, Russian-olive, honeylocust, bur oak, Austrian pine, green ash.	Siberian elm------	---

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

TABLE 8.--RECREATIONAL 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]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ae-------------------- Armo	Slight---------------	Slight---------------	Moderate: slope.	Slight.
Ag-------------------- Armo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Bo-------------------- Bogue	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
Cc-------------------- Corinth	Slight---------------	Slight---------------	Moderate: slope, depth to rock.	Slight.
Cd-------------------- Corinth	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
Cr-------------------- Crete	Slight---------------	Slight---------------	Slight---------------	Slight.
De-------------------- Detroit	Severe: flooding.	Slight---------------	Slight---------------	Slight.
Do-------------------- Dorrance	Slight---------------	Slight---------------	Moderate: small stones.	Slight.
Dr-------------------- Dorrance	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Es*:				
Edalgo---------------	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.
Rock outcrop.				
Et-------------------- Eltree	Slight---------------	Slight---------------	Moderate: slope.	Slight.
Hb, Hc---------------- Harney	Slight---------------	Slight---------------	Moderate: slope.	Slight.
Hu-------------------- Humbarger	Severe: flooding.	Slight---------------	Moderate: flooding.	Slight.
Iv-------------------- Inavale	Severe: flooding.	Slight---------------	Slight---------------	Slight.
Lc-------------------- Lancaster	Slight---------------	Slight---------------	Moderate: slope.	Slight.
Lh*:				
Lancaster------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Hedville-------------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones.	Moderate: slope.
Mc-------------------- McCook	Severe: flooding.	Slight---------------	Slight---------------	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mr------------------ Munjor	Severe: flooding.	Slight---------------	Slight---------------	Slight.
Ns------------------ Nibson	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
Nu------------------ Nuckolls	Slight---------------	Slight---------------	Moderate: slope.	Slight.
Nx------------------ Nuckolls	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Rb------------------ Roxbury	Severe: flooding.	Slight---------------	Slight---------------	Slight.
Rc------------------ Roxbury	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Rf------------------ Roxbury	Severe: flooding.	Slight---------------	Moderate: flooding.	Slight.
Wb, Wc-------------- Wakeen	Slight---------------	Slight---------------	Moderate: slope, depth to rock.	Slight.
Ws------------------ Wells	Slight---------------	Slight---------------	Moderate: slope.	Slight.

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

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ae: Armo	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Ag: Armo	Poor	Fair	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Bo: Bogue	Poor	Fair	Poor	---	---	Poor	Very poor.	Poor	Poor	Poor	Very poor.	Poor.
Cc, Cd: Corinth	Fair	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Cr: Crete	Good	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
De: Detroit	Good	Good	Good	---	---	Good	Good	Good	Good	---	Poor	Good.
Do, Dr: Dorrance	Poor	Poor	Fair	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Es*: Edalgo	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Rock outcrop.												
Et: Eltree	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Hb: Harney	Good	Good	Fair	---	---	Fair	Poor	Fair	Fair	---	Very poor.	Poor.
Hc: Harney	Fair	Good	Fair	---	---	Fair	Poor	Poor	Fair	---	Very poor.	Poor.
Hu: Humbarger	Good	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor	Fair.
Iv: Inavale	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Lc: Lancaster	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Lh*: Lancaster	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Hedville	Very poor.	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Mc: McCook	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Mr: Munjor	Fair	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Ns: Nibson	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Nu, Nx: Nuckolls	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Rb------------------ Roxbury	Good	Good	Good	Fair	Fair	Fair	Poor	Fair	Good	Fair	Poor	Fair.
Rc------------------ Roxbury	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor	Fair.
Rf------------------ Roxbury	Good	Good	Good	Fair	Fair	Fair	Poor	Fair	Good	Fair	Poor	Fair.
Wb, Wc-------------- Wakeen	Fair	Good	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Ws------------------ Wells	Good	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.

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

TABLE 10.--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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ae----------------- Armo	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Severe: low strength.
Ag----------------- Armo	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Bo----------------- Bogue	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Cc----------------- Corinth	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Cd----------------- Corinth	Moderate: depth to rock, slope, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
Cr----------------- Crete	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
De----------------- Detroit	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Do----------------- Dorrance	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
Dr----------------- Dorrance	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Es*:					
Edalgo------------	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell, slope.
Rock outcrop.					
Et----------------- Eltree	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: low strength, frost action.
Hb----------------- Harney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Hc----------------- Harney	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Hu----------------- Humbarger	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Iv----------------- Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Lc----------------- Lancaster	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Lh*:					
Lancaster	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.
Hedville	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Mc: McCook	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Mr: Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ns: Nibson	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
Nu: Nuckolls	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Nx: Nuckolls	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Rb: Roxbury	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Rc, Rf: Roxbury	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Wb: Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wc: Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Ws: Wells	Slight	Slight	Slight	Slight	Severe: low strength.

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

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ae: Armo	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: too clayey, thin layer.
Ag: Armo	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: too clayey, slope, thin layer.
Bo: Bogue	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Cc: Corinth	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Cd: Corinth	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Cr: Crete	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
De: Detroit	Severe: percs slowly.	Slight	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Do: Dorrance	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Dr: Dorrance	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Es*:					
Edalgo	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, slope.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
Et: Eltree	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Hb, Hc: Harney	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Hu: Humbarger	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Iv: Inavale	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.

See footnote at end of table.

TABLE 11.--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
Lc------------------ Lancaster	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Lh*:					
Lancaster-----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Hedville------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Mc------------------ McCook	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Mr------------------ Munjor	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Ns------------------ Nibson	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Nu------------------ Nuckolls	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
Nx------------------ Nuckolls	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Rb------------------ Roxbury	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Rc, Rf-------------- Roxbury	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Wb, Wc-------------- Wakeen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Ws------------------ Wells	Slight------------	Moderate: seepage, slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.

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

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ae, Ag: Armo	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Bo: Bogue	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Cc, Cd: Corinth	Poor: low strength, area reclaim, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Cr: Crete	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
De: Detroit	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Do, Dr: Dorrance	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
Es*:				
Edalgo	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Rock outcrop.				
Et: Eltree	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hb, Hc: Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hu: Humbarger	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Iv: Inavale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Lc: Lancaster	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Lh*:				
Lancaster	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Hedville	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Mc: McCook	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Mr: Munjor	Good	Probable	Improbable: too sandy.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ns: Nibson	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Nu: Nuckolls	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Nx: Nuckolls	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Rb, Rc, Rf: Roxbury	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wb, Wc: Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Ws: Wells	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

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

TABLE 13.--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]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ae---------------- Armo	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope---------	Favorable-----	Favorable.
Ag---------------- Armo	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope---------	Slope---------	Slope.
Bo---------------- Bogue	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock percs slowly.	Slope, droughty, depth to rock.
Cc---------------- Corinth	Moderate: slope, depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slope, percs slowly, depth to rock	Depth to rock, erodes easily	Depth to rock, erodes easily.
Cd---------------- Corinth	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Slope, percs slowly, depth to rock	Slope, depth to rock erodes easily	Slope, depth to rock, erodes easily.
Cr---------------- Crete	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily	Erodes easily	Erodes easily, percs slowly.
De---------------- Detroit	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly, erodes easily	Erodes easily	Erodes easily, percs slowly.
Do---------------- Dorrance	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Dr---------------- Dorrance	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Es*:						
Edalgo-----------	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock slope.	Slope, depth to rock erodes easily	Slope, erodes easily, depth to rock.
Rock outcrop.						
Et---------------- Eltree	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Hb---------------- Harney	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Hc---------------- Harney	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope---------	Erodes easily	Erodes easily.
Hu---------------- Humbarger	Moderate: seepage.	Severe: piping.	Deep to water	Flooding------	Favorable-----	Favorable.
Iv---------------- Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Lc---------------- Lancaster	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Lh*:						
Lancaster	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock	Slope, depth to rock.
Hedville	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock	Slope, depth to rock.
Mc McCook	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Mr Munjor	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Soil blowing	Favorable.
Ns Nibson	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock	Slope, depth to rock.
Nu Nuckolls	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Nx Nuckolls	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily	Slope, erodes easily.
Rb Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Rc, Rf Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Wb Wakeen	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock	Depth to rock, erodes easily	Erodes easily, depth to rock.
Wc Wakeen	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily	Erodes easily, depth to rock.
Ws Wells	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable	Favorable.

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

TABLE 14.--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	
Ae, Ag------------ Armo	0-8	Loam--------------	CL	A-6, A-4	0	95-100	90-100	90-100	70-95	25-40	7-18
	8-24	Loam, silty clay loam, clay loam.	CL	A-6, A-4, A-7	0	95-100	90-100	90-100	70-90	25-45	7-22
	24-60	Silt loam, clay loam, loam.	CL	A-6, A-4	0	95-100	85-100	70-100	65-80	25-45	7-22
Bo---------------- Bogue	0-5	Clay--------------	CH, MH	A-7	0	100	100	90-100	90-100	55-85	35-50
	5-23	Clay--------------	CH, MH	A-7	0	100	100	90-100	90-100	60-90	35-50
	23	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cc, Cd------------ Corinth	0-6	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	70-90	38-60	18-35
	6-36	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	75-95	40-60	20-40
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cr---------------- Crete	0-6	Silt loam--------	CL	A-4, A-6	0	100	100	100	95-100	30-40	8-15
	6-27	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-38
	27-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	15-35
De---------------- Detroit	0-7	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	85-95	25-40	8-20
	7-34	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	90-100	45-55	20-30
	34-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	95-100	90-100	20-45	5-25
Do---------------- Dorrance	0-19	Sandy loam-------	SC, CL, CL-ML, SM-SC	A-2, A-4	0	95-100	85-100	45-90	25-70	20-30	4-10
	19-60	Gravelly loamy sand, sand, gravelly sand.	SP-SM, SP	A-1, A-2, A-3	0	80-100	40-95	15-60	1-10	<20	NP
Dr---------------- Dorrance	0-11	Gravelly sandy loam.	SC, SM-SC	A-1, A-2, A-4	0-5	70-100	50-85	25-80	15-50	20-30	4-10
	11-15	Gravelly loamy sand, gravelly sandy loam, loamy sand.	SM, SM-SC	A-1, A-2	0-5	70-100	50-95	25-65	12-35	<25	NP-7
	15-60	Gravelly loamy sand, sand, gravelly sand.	SP-SM, SP	A-1, A-2, A-3	0	80-100	40-95	15-60	1-10	<20	NP
Es*:											
Edalgo-----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-40	5-15
	10-16	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	80-95	25-45	10-25
	16-26	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0	100	100	90-100	85-95	45-70	20-40
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Et---------------- Eltree	0-14	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-40	3-15
	14-60	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	95-100	90-100	65-100	25-45	7-22
Hb---------------- Harney	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	7-31	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	31-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20

See footnote at end of table.

TABLE 14.--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	
Hc------------ Harney	0-7	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	85-100	35-45	15-22
	7-31	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	31-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Hu------------ Humbarger	0-8	Loam-------------	CL	A-6, A-4	0	95-100	90-100	80-100	55-90	25-40	7-20
	8-60	Clay loam, sandy loam, loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	90-100	80-95	40-80	20-40	5-20
Iv------------ Inavale	0-8	Loamy sand-------	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	<25	NP-5
	8-16	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	16-60	Fine sand, loamy fine sand, sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
Lc------------ Lancaster	0-13	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	85-100	50-85	20-35	5-15
	13-36	Clay loam, loam, sandy clay loam.	CL-ML, SC, SM-SC, CL	A-4, A-6	0	100	100	80-100	36-80	20-35	5-15
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
Lh*:											
Lancaster-------	0-13	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	85-100	50-85	20-35	5-15
	13-36	Clay loam, loam, sandy clay loam.	CL-ML, SC, SM-SC, CL	A-4, A-6	0	100	100	80-100	36-80	20-35	5-15
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hedville--------	0-12	Loam-------------	SM, ML, SC, CL	A-4, A-6	0-15	70-100	70-100	50-85	35-70	<35	NP-13
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mc------------ McCook	0-12	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	12-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	55-100	<20	NP-10
Mr------------ Munjor	0-9	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	95-100	65-100	30-55	15-30	NP-7
	9-60	Fine sandy loam, loamy very fine sand, loam.	SM, SC, ML, CL	A-4	0	100	95-100	85-100	35-65	15-30	3-10
Ns------------ Nibson	0-7	Silt loam--------	CL	A-4, A-6	0-15	85-100	80-95	65-95	60-90	25-40	8-20
	7-18	Silty clay loam, silt loam.	CL	A-6, A-7	0-15	85-95	80-95	60-90	55-90	30-45	10-25
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Nu------------ Nuckolls	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	90-100	24-40	2-15
	6-46	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-98	28-48	10-25
	46-60	Silt loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	80-95	25-40	5-20
Nx------------ Nuckolls	0-5	Silty clay loam	ML, CL	A-4, A-6	0	100	100	95-100	90-100	24-40	2-15
	5-60	Silt loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	80-95	25-40	5-20
Rb, Rc, Rf------- Roxbury	0-26	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	65-100	25-40	7-20
	26-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	95-100	65-100	30-50	7-25

See footnote at end of table.

TABLE 14.--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	
Wb, Wc------------ Wakeen	0-9	Silt loam---------	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	7-20
	9-31	Silty clay loam, silt loam.	CL, ML	A-6, A-7-6	0	100	100	90-100	75-95	30-50	10-25
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ws---------------- Wells	0-8	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	95-100	65-85	20-30	5-15
	8-60	Clay loam, sandy clay loam, sandy loam.	SC, CL, ML, SM	A-4, A-6	0	100	100	80-100	35-85	20-40	NP-15

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

TABLE 15.--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	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
Ae, Ag	0-8	18-27	1.25-1.40	0.6-2.0	0.21-0.24	6.6-8.4	<2	Low	0.28	5	4L	1-3
Armo	8-24	18-35	1.30-1.40	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low	0.28			
	24-60	18-35	1.30-1.45	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low	0.28			
Bo	0-5	50-75	1.10-1.30	<0.06	0.11-0.14	6.6-8.4	<2	High	0.28	3	4	---
Bogue	5-23	60-80	1.30-1.45	<0.06	0.09-0.11	6.6-8.4	<2	High	0.28			
	23	---	---	---	---	---	---	---	---			
Cc, Cd	0-6	27-39	1.35-1.50	0.2-0.6	0.19-0.23	7.4-8.4	<2	Moderate	0.37	4	4L	.5-1
Corinth	6-36	35-45	1.45-1.50	0.06-0.6	0.11-0.18	7.4-8.4	<2	High	0.37			
	36	---	---	---	---	---	---	---	---			
Cr	0-6	20-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.0	<2	Moderate	0.37	4	6	2-4
Crete	6-27	42-52	1.10-1.30	0.06-0.6	0.12-0.20	6.1-7.3	<2	High	0.37			
	27-60	25-40	1.20-1.40	0.2-2.0	0.18-0.22	7.4-8.4	<2	High	0.37			
De	0-11	22-27	1.25-1.40	0.2-0.6	0.22-0.24	6.1-7.3	<2	Low	0.37	5	6	2-4
Detroit	11-34	35-45	1.35-1.50	0.06-0.2	0.12-0.15	6.6-7.8	<2	High	0.37			
	34-60	18-35	1.30-1.50	0.2-0.6	0.18-0.20	6.6-8.4	<2	Moderate	0.37			
Do	0-19	10-20	1.35-1.45	2.0-6.0	0.14-0.21	6.6-8.4	<2	Low	0.28	3	3	1-3
Dorrance	19-60	1-7	1.60-1.70	>20	0.02-0.06	7.4-8.4	<2	Low	0.10			
Dr	0-11	10-20	1.45-1.55	2.0-6.0	0.10-0.18	6.6-8.4	<2	Low	0.20	3	5	1-3
Dorrance	11-15	5-18	1.50-1.65	6.0-20	0.07-0.12	7.4-8.4	<2	Low	0.10			
	15-60	1-7	1.60-1.70	>20	0.02-0.06	7.4-8.4	<2	Low	0.10			
Es*:												
Edalgo	0-10	15-27	1.30-1.40	0.6-2.0	0.18-0.24	5.6-7.3	<2	Low	0.37	3	6	2-4
	10-16	28-37	1.35-1.50	0.06-0.6	0.10-0.22	5.6-7.3	<2	Moderate	0.37			
	16-26	35-52	1.40-1.60	<0.06	0.10-0.18	5.6-7.8	<2	High	0.37			
	26	---	---	---	---	---	---	---	---			
Rock outcrop.												
Et	0-14	12-27	1.25-1.35	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.32	5	4L	1-3
Eltree	14-60	18-35	1.35-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low	0.43			
Hb	0-7	22-27	1.30-1.40	0.6-2.0	0.22-0.24	5.6-7.8	<2	Low	0.32	5	6	2-4
Harney	7-31	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	31-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low	0.43			
Hc	0-7	28-35	1.30-1.40	0.6-2.0	0.21-0.23	5.6-7.8	<2	Moderate	0.32	5	7	2-4
Harney	7-31	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	Moderate	0.43			
	31-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low	0.43			
Hu	0-8	16-27	1.30-1.40	0.6-2.0	0.22-0.24	7.4-8.4	<2	Moderate	0.28	5	4L	1-3
Humbarger	8-60	12-32	1.40-1.50	0.6-2.0	0.13-0.20	7.9-8.4	<2	Low	0.28			
Iv	0-8	7-18	1.50-1.60	6.0-20	0.10-0.12	6.6-7.8	<2	Low	0.17	5	2	.5-1
Inavale	8-16	3-10	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.17			
	16-60	3-10	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	<2	Low	0.17			
Lc	0-13	12-26	1.35-1.45	0.6-2.0	0.17-0.22	5.6-6.5	<2	Low	0.28	4	6	2-6
Lancaster	13-36	12-26	1.40-1.55	0.6-2.0	0.15-0.19	6.1-7.3	<2	Low	0.28			
	36	---	---	---	---	---	---	---	---			
Lh*:												
Lancaster	0-13	12-26	1.35-1.45	0.6-2.0	0.17-0.22	5.6-6.5	<2	Low	0.28	4	6	2-6
	13-36	12-26	1.40-1.55	0.6-2.0	0.15-0.19	6.1-7.3	<2	Low	0.28			
	36	---	---	---	---	---	---	---	---			
Hedville	0-12	8-22	1.35-1.50	0.6-2.0	0.14-0.20	5.6-7.3	<2	Low	0.32	2	3	1-4
	12	---	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
Mc------------------ McCook	0-12	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low---------	0.32	5	4L	2-4
	12-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low---------	0.43			
Mr------------------ Munjor	0-9	7-15	1.30-1.40	2.0-6.0	0.14-0.20	7.4-8.4	<2	Low---------	0.24	5	3	.5-1
	9-60	7-15	1.30-1.40	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low---------	0.24			
Ns------------------ Nibson	0-7	15-27	1.25-1.35	0.6-2.0	0.20-0.24	7.4-9.0	<2	Low---------	0.32	2	4L	---
	7-18	18-35	1.30-1.40	0.6-2.0	0.18-0.22	7.9-9.0	<2	Moderate	0.32			
	18	---	---	---	---	---	---	-----------	----			
Nu------------------ Nuckolls	0-6	20-30	1.10-1.30	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low---------	0.32	5	6	2-3
	6-46	22-32	1.20-1.30	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	46-60	20-32	1.20-1.30	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.43			
Nx------------------ Nuckolls	0-5	20-30	1.10-1.30	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low---------	0.32	5	6	2-3
	5-60	20-32	1.20-1.30	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.43			
Rb------------------ Roxbury	0-26	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low---------	0.32	5	4L	2-4
	26-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Rc, Rf------------- Roxbury	0-26	18-27	1.30-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low---------	0.32	5	4L	2-4
	26-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Wb, Wc------------- Wakeen	0-9	18-27	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low---------	0.32	4	4L	1-3
	9-31	18-35	1.35-1.50	0.6-2.0	0.18-0.23	7.4-9.0	<2	Moderate	0.43			
	31	---	---	---	---	---	---	-----------	----			
Ws------------------ Wells	0-8	18-24	1.35-1.50	0.6-2.0	0.20-0.22	6.1-7-8	<2	Low---------	0.28	5	6	1-4
	8-60	10-30	1.35-1.60	0.6-2.0	0.12-0.18	6.1-8.4	<2	Low---------	0.28			

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

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare" and "very brief" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

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				
Ae, Ag------------ Armo	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Bo---------------- Bogue	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Cc, Cd------------ Corinth	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Cr---------------- Crete	D	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
De---------------- Detroit	C	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Do, Dr------------ Dorrance	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Es*:												
Edalgo------------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
Rock outcrop.												
Et---------------- Eltree	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Hb, Hc------------ Harney	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Hu---------------- Humbarger	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low------	Low.
Iv---------------- Inavale	A	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
Lc---------------- Lancaster	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low------	Moderate.
Lh*:												
Lancaster---------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low------	Moderate.
Hedville----------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	Low------	Moderate.
Mc---------------- McCook	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Mr---------------- Munjor	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic 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				
Ns----------------- Nibson	D	None---------	---	---	>6.0	---	---	10-20	Soft	Moderate	Low-------	Low.
Nu, Nx------------- Nuckolls	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
Rb----------------- Roxbury	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Rc----------------- Roxbury	B	Frequent-----	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Rf----------------- Roxbury	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Wb, Wc------------- Wakeen	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate	Low.
Ws----------------- Wells	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.

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

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Armo	Fine-loamy, mixed, mesic Entic Haplustolls
Bogue	Very fine, montmorillonitic, mesic Udorthentic Pellusterts
Corinth	Fine, mixed, mesic Typic Ustochrepts
Crete	Fine, montmorillonitic, mesic Pachic Argiustolls
Detroit	Fine, montmorillonitic, mesic Pachic Argiustolls
Dorrance	Sandy, mixed, mesic Entic Haplustolls
Edalgo	Fine, mixed, mesic Udic Argiustolls
Eltree	Fine-silty, mixed, mesic Pachic Haplustolls
Harney	Fine, montmorillonitic, mesic Typic Argiustolls
Hedville	Loamy, mixed, mesic Lithic Haplustolls
Humbarger	Fine-loamy, mixed, mesic Cumulic Haplustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Lancaster	Fine-loamy, mixed, mesic Udic Argiustolls
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
Nibson	Loamy, carbonatic, mesic, shallow Entic Haplustolls
Nuckolls	Fine-silty, mixed, mesic Typic Haplustolls
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
Wakeen	Fine-silty, carbonatic, mesic Entic Haplustolls
Wells*	Fine-loamy, mixed, mesic Udic Argiustolls

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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