SOIL SURVEY OF

Hartley County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some

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SOIL SURVEY OF HARTLEY COUNTY, TEXAS

By Richard W. Fox, Soil Conservation Service

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

HARTLEY COUNTY is in the northwestern part of Texas, at the western edge of the Texas Panhandle (fig. 1). The total area is 952,960 acres, or 1,489 square miles. Elevations range from about 3,200 feet in the southeastern part of the county to about 4,500 feet in the northwestern part.

The economy is based almost entirely on agriculture. Beef production is the main enterprise. About 70 percent of the county is in native range. Main crops of the county are dryland and irrigated wheat and grain sorghum. The number of smaller acreages of sugar beets, corn, alfalfa, and irrigated cool- and warm-season pastures is increasing.

Hartley County is in the southern part of the Great Plains. The northern part of the county is smooth tableland called High Plains, which is broken by a few indented playa basins, shallow drains, and Rita Blanca Canyon. The soils in this part of the county formed from Rocky Mountain outwash (*4*)[1] and overlying loess mantle (*7*). The southern part of the county is Rolling Plains. Geologic erosion in this area has formed a rough landscape which includes numerous small creeks and drainageways. The soils in this part of the county formed mainly from colluvium from the Ogallala formation of the High Plains and exposed Triassic red beds.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Hartley County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

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

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Dallam fine sandy loam, 1 to 3 percent slopes, is one of several phases within the Dallam series.

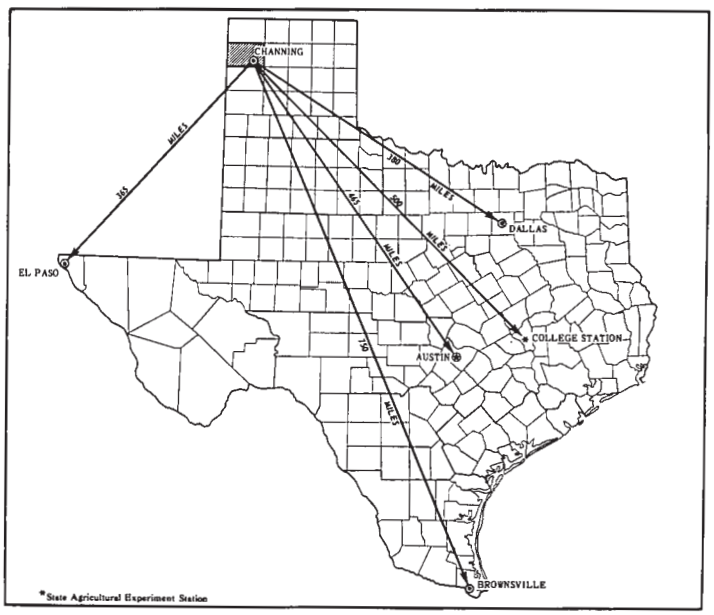


Figure 1.—Location of Hartley County in Texas.

[1] Italic numbers in parentheses refer to Literature Cited, p. 64.

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

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

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Hartley County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Glenrio-Knoco complex, 3 to 12 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually

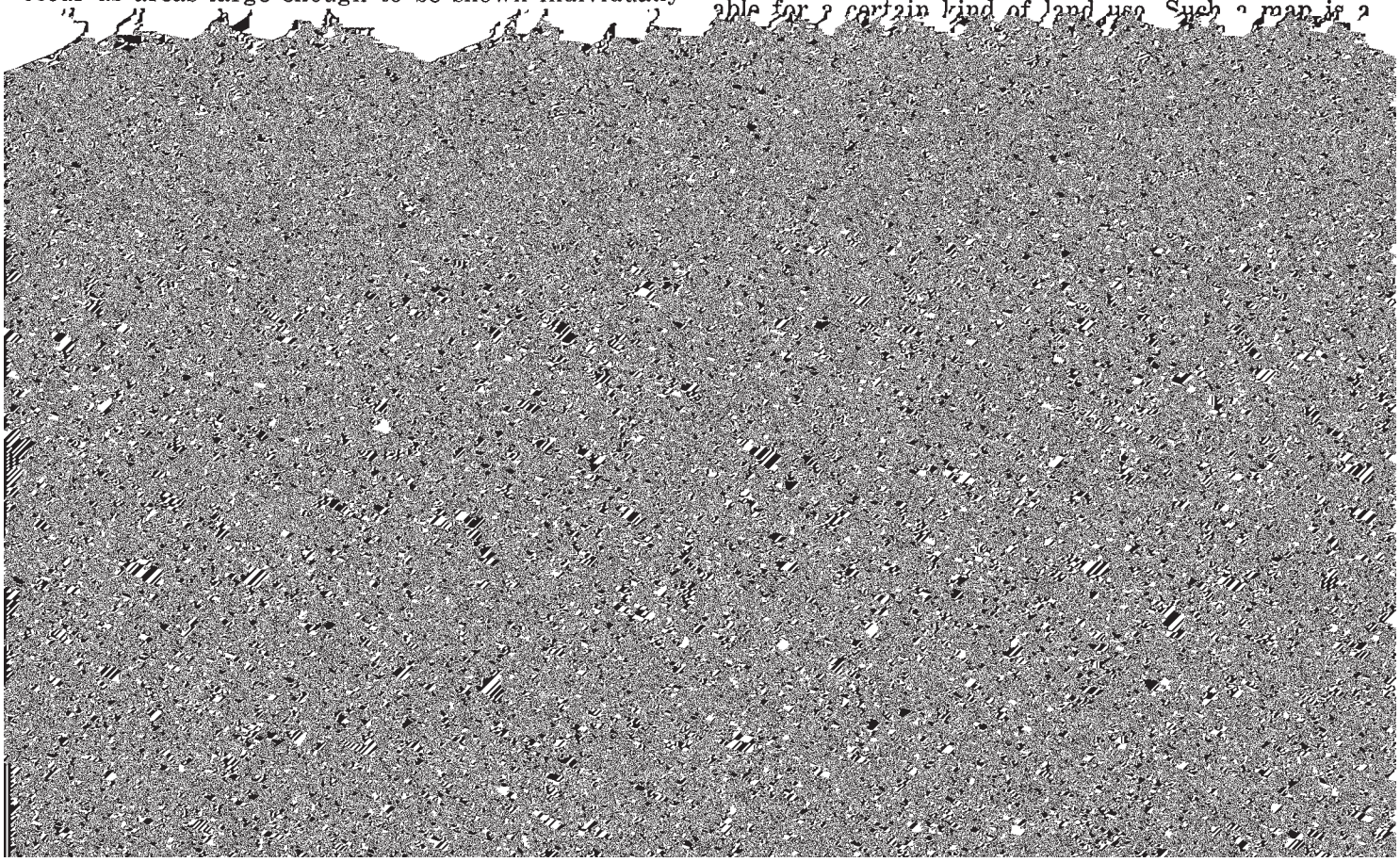
relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

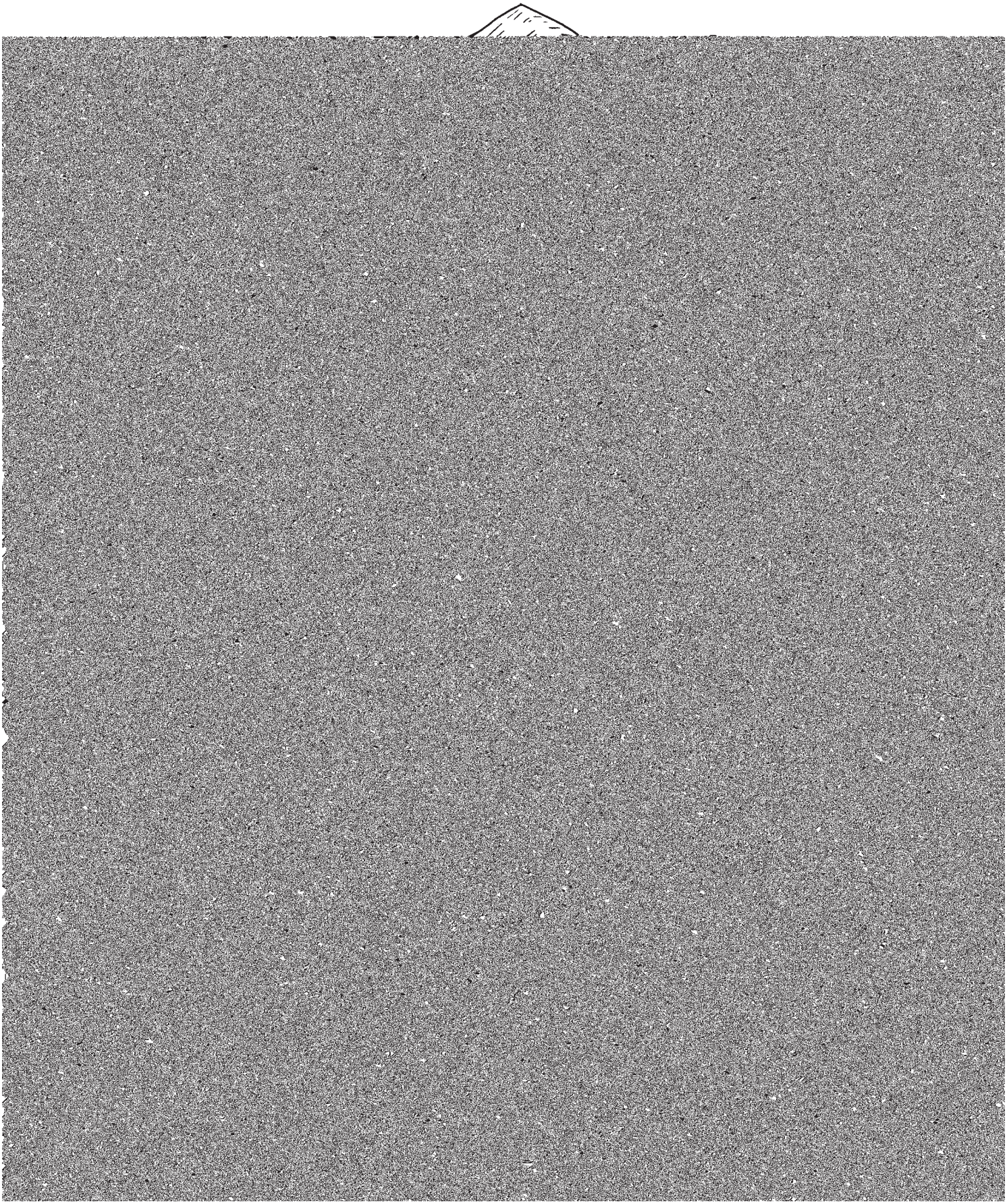
After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a





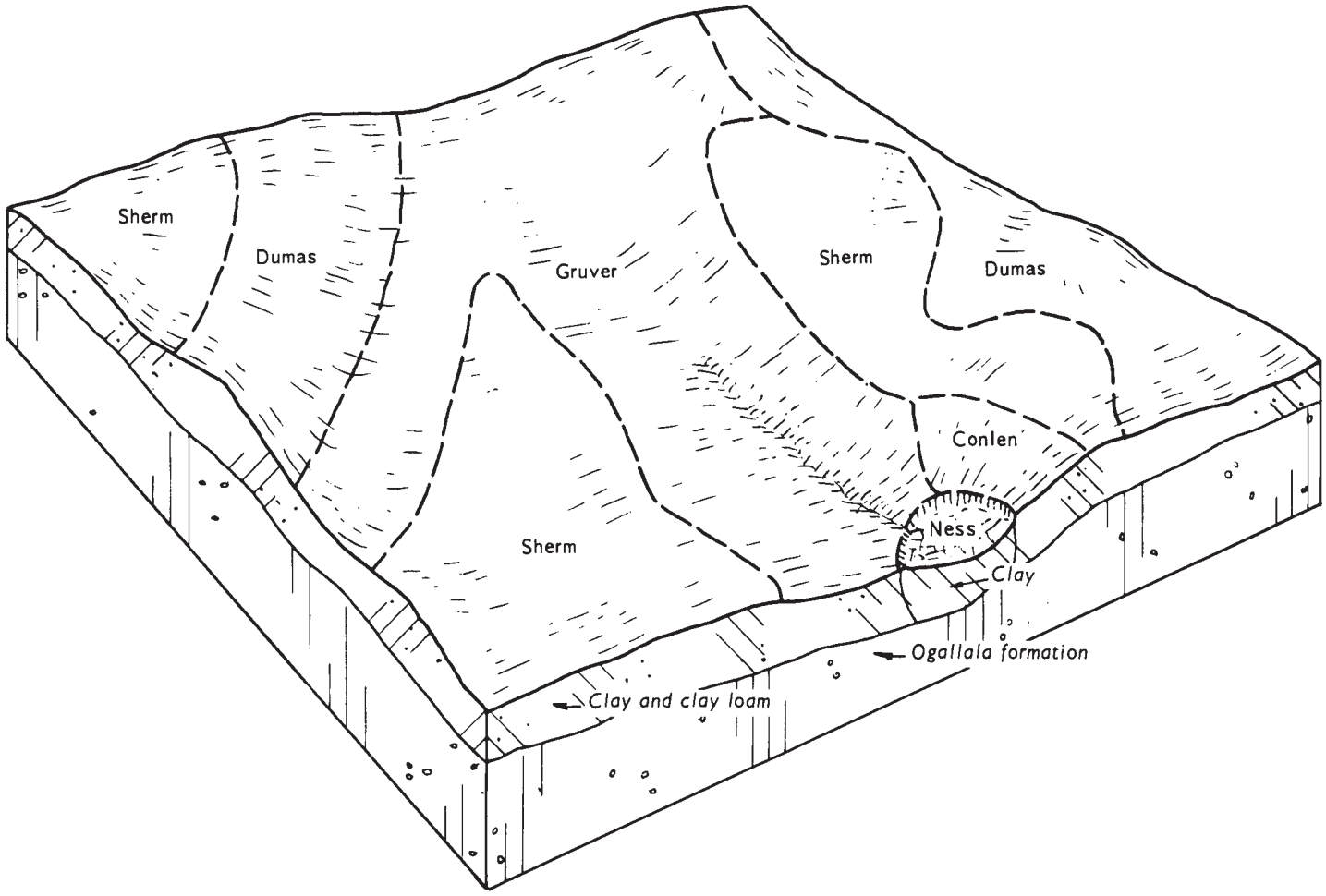


Figure 3.—**Relationship of soils in association 2.**

the county. Berda soils and very similar soils such as Mobeetie account for about 42 percent of the association, Veal soils about 20 percent; Potter soils about 10 percent; and less extensive areas of Bippus, Dallam, Guadalupe, Mobeetie, Perico, Spurlock, and Vingo soils the remaining 28 percent (fig. 4).

Berda soils have a surface layer of grayish brown loam about 5 inches thick. The next layer is yellowish brown sandy clay loam about 37 inches thick. This is underlain, to a depth of 60 inches, by light yellowish brown sandy clay loam.

Veal soils have a surface layer of brown fine sandy loam about 5 inches thick. The next layer is light brown sandy clay loam about 11 inches thick. The next lower layer is pinkish white sandy clay loam about 9 inches thick. This is underlain, to a depth of 60 inches, by light brown sandy clay loam.

Potter soils have a surface layer of brown loam about 8 inches thick. This is underlain, to a depth of 60 inches, by white caliche.

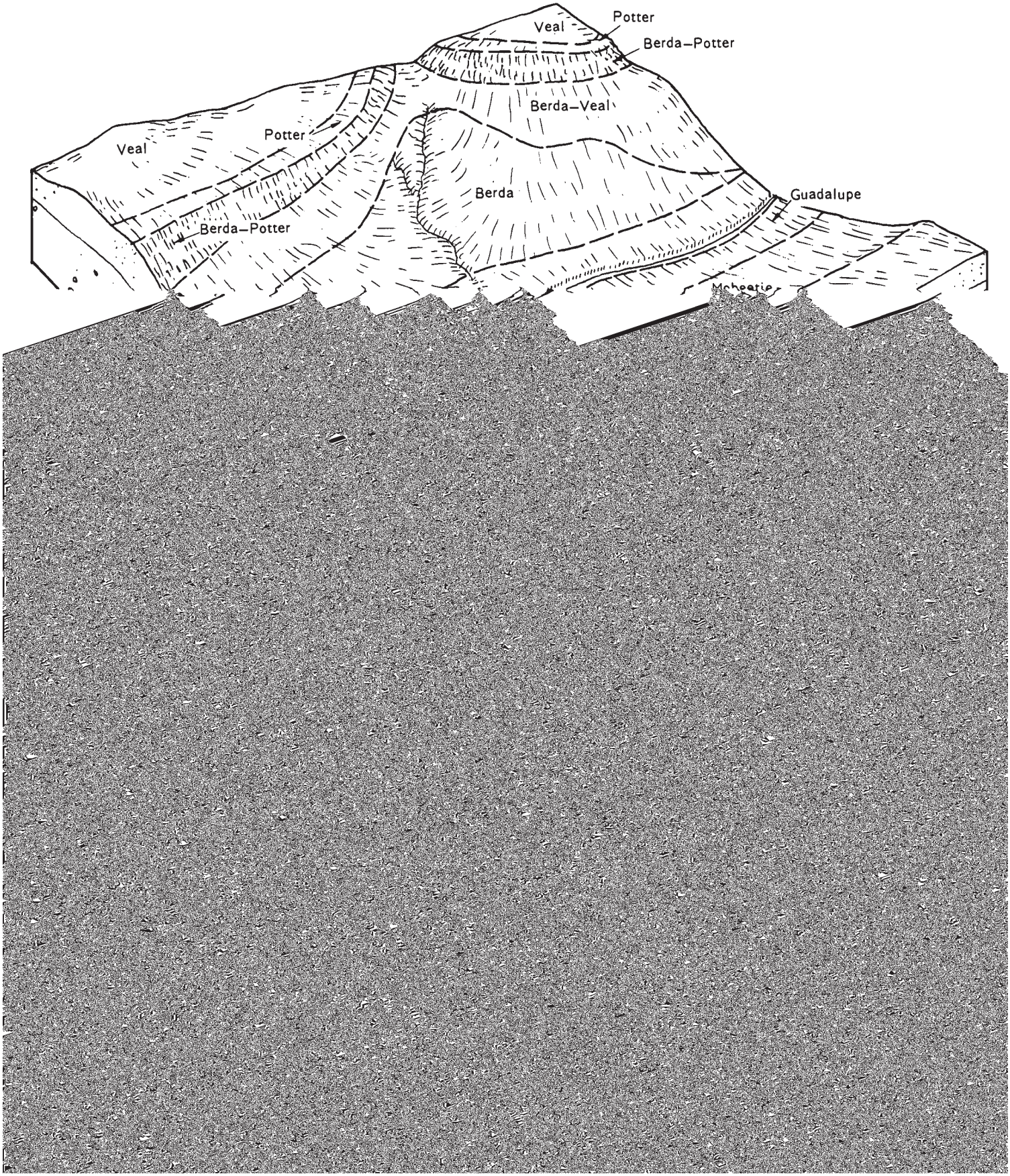
Most of this association is used for range, for which it is best suited. The soils of this association have a low potential for growing crops because of steep slopes, shallow soils, water erosion and soil blowing hazards, and a lack of irrigation water.

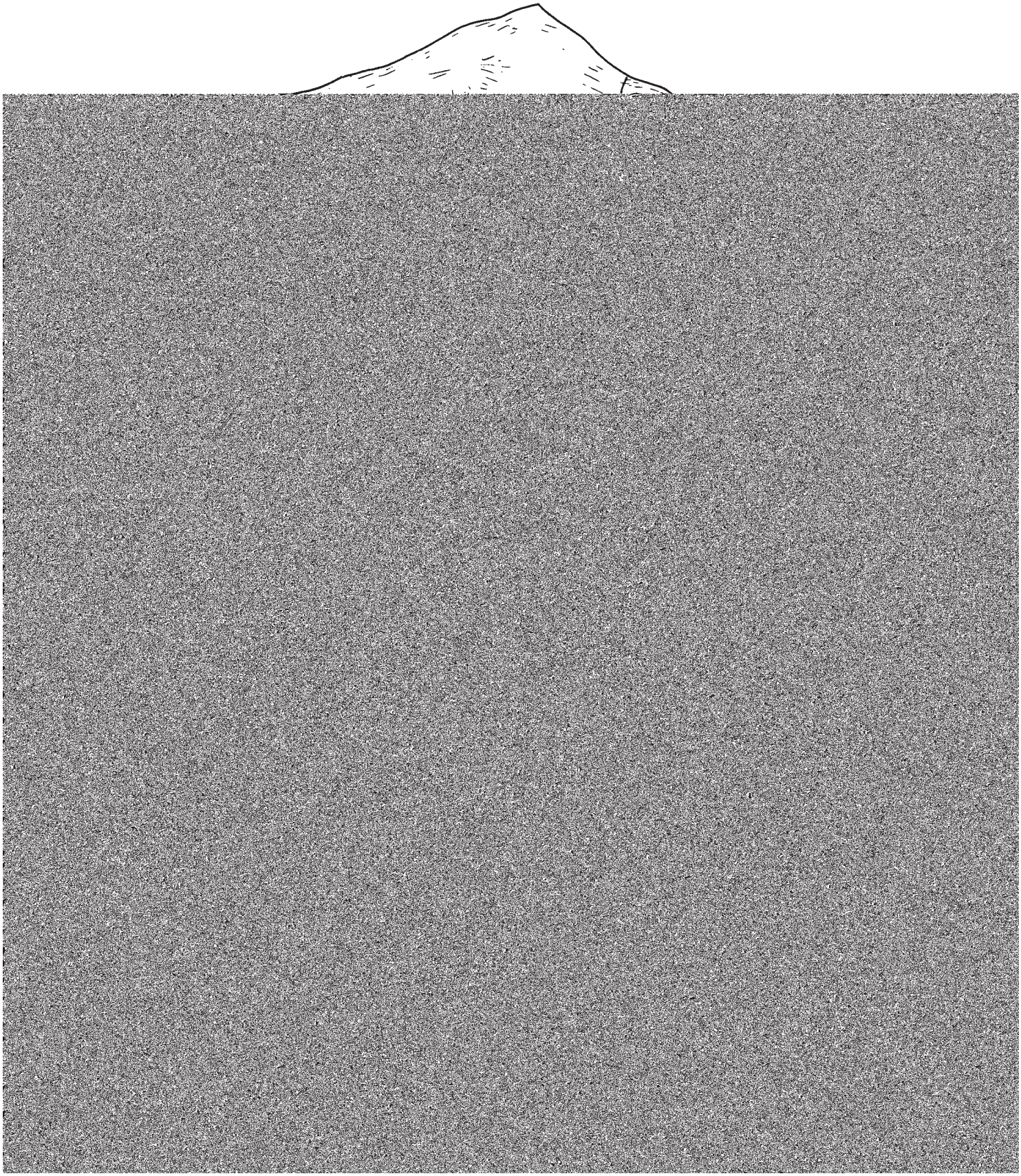
4. Dallam-Vingo-Spurlock Association

Deep, undulating, noncalcareous to calcareous, moderately to moderately rapidly permeable loamy fine sands to fine sandy loams

This association consists of areas of undulating soils. It makes up about 17 percent of the county. Dallam soils account for about 50 percent of the association; Vingo soils about 25 percent; Spurlock soils about 15 percent; and less extensive areas of Mobeetie, Perico, Rickmore, and Valentine soils and Dallam fine sandy loam the remaining 10 percent (fig. 5).

Dallam soils have a surface layer of brown loamy fine sand about 16 inches thick. The next layer is brown sandy clay loam about 19 inches thick. Below this is light brown sandy clay loam about 15 inches thick. The next layer is light reddish brown clay loam about 15 inches thick. This is underlain, to a depth of 95 inches, by yellowish red sandy clay loam.


Potter
Veal
Berda–Potter
Berda–Veal
Potter
Veal
Berda
Guadalupe
Berda–Potter
Mahoarie



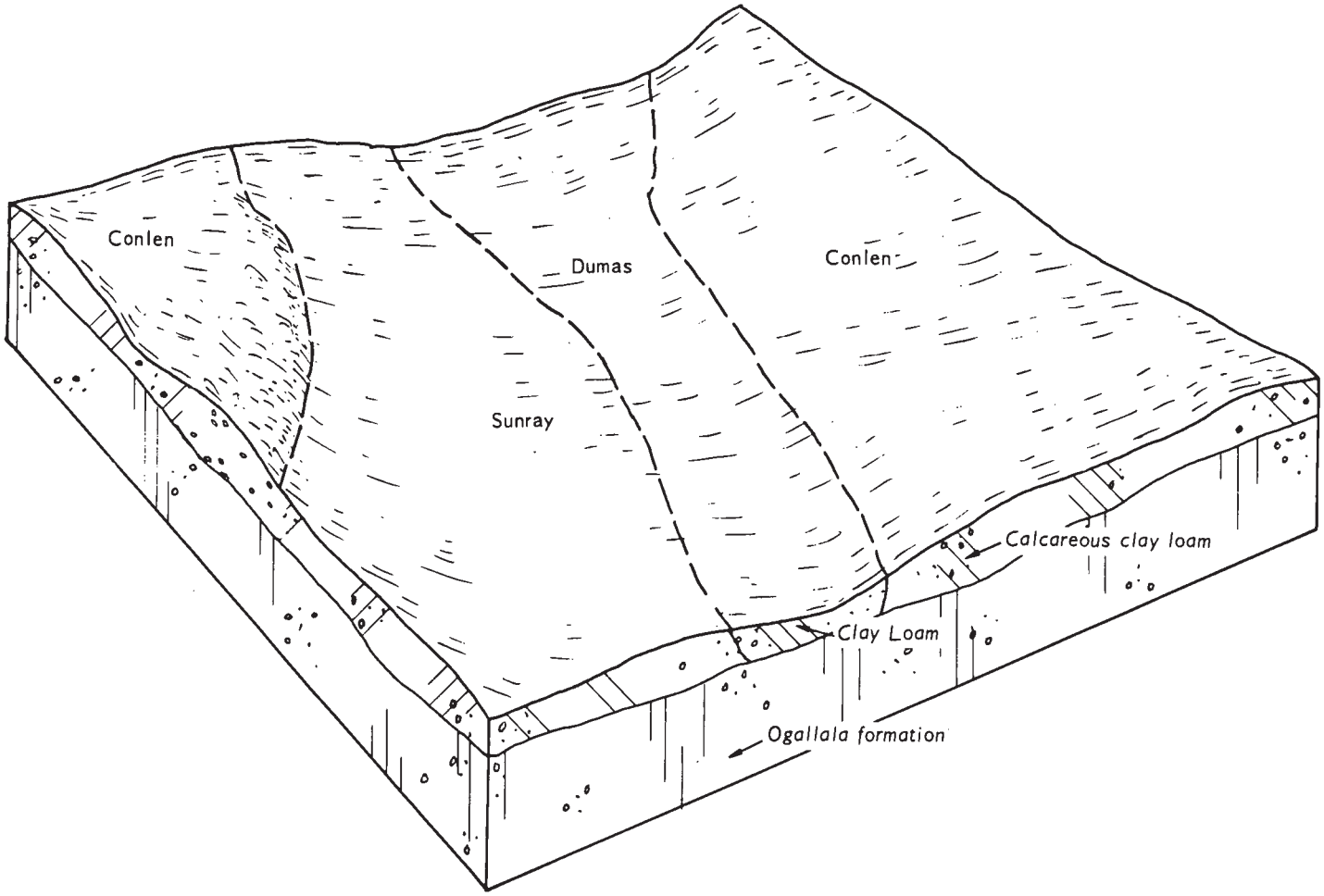


Figure 6.—**Relationship of soils in association 5.**

32 inches thick, is pink gravelly sandy loam. This is underlain, to a depth of 80 inches, by light brown gravelly sandy loam.

This association is used for range, for which it is best suited. It is a good source of gravel.

Descriptions of the Soils

In this section each soil series is described in detail and then, briefly, each mapping unit in that series. Unless stated otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers

a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit and range site in which the mapping unit has been placed. The page where each capability unit or range site is described is listed in the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil

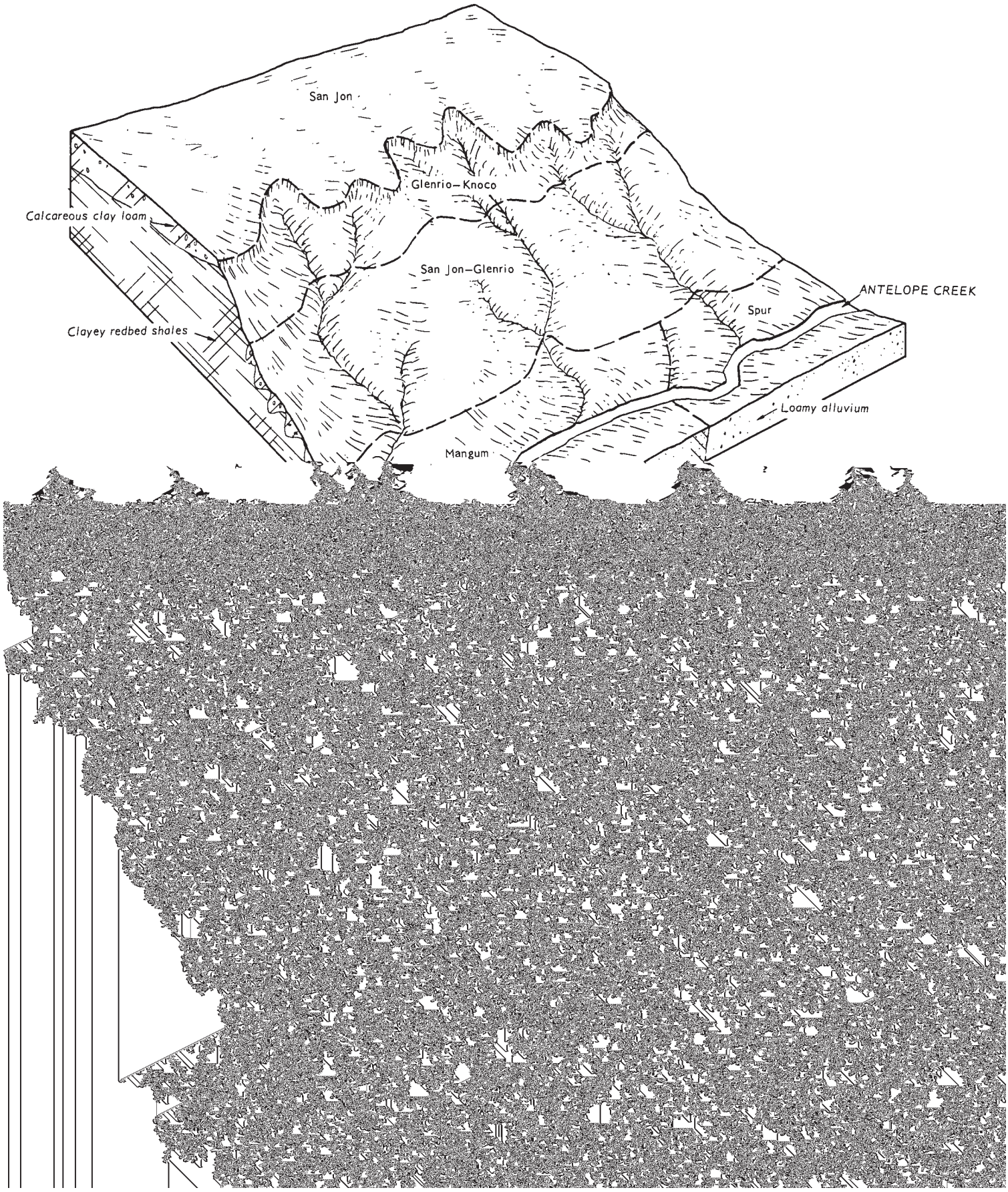

San Jon
Glenrio—Knoco
Calcareous clay loam
San Jon—Glenrio
ANTELOPE CREEK
Spur
Clayey redbed shales
Loamy alluvium
Mangum

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

Soil	Acres	Percent	Soil	Acres	Percent
BeC—Berda loam, 3 to 5 percent slopes	13,200	1.4	MVD—Mobeetie-Veal association, undulating	72,800	7.6
BeD—Berda loam, 5 to 8 percent slopes	5,600	.6	Ne—Ness clay	4,500	.5

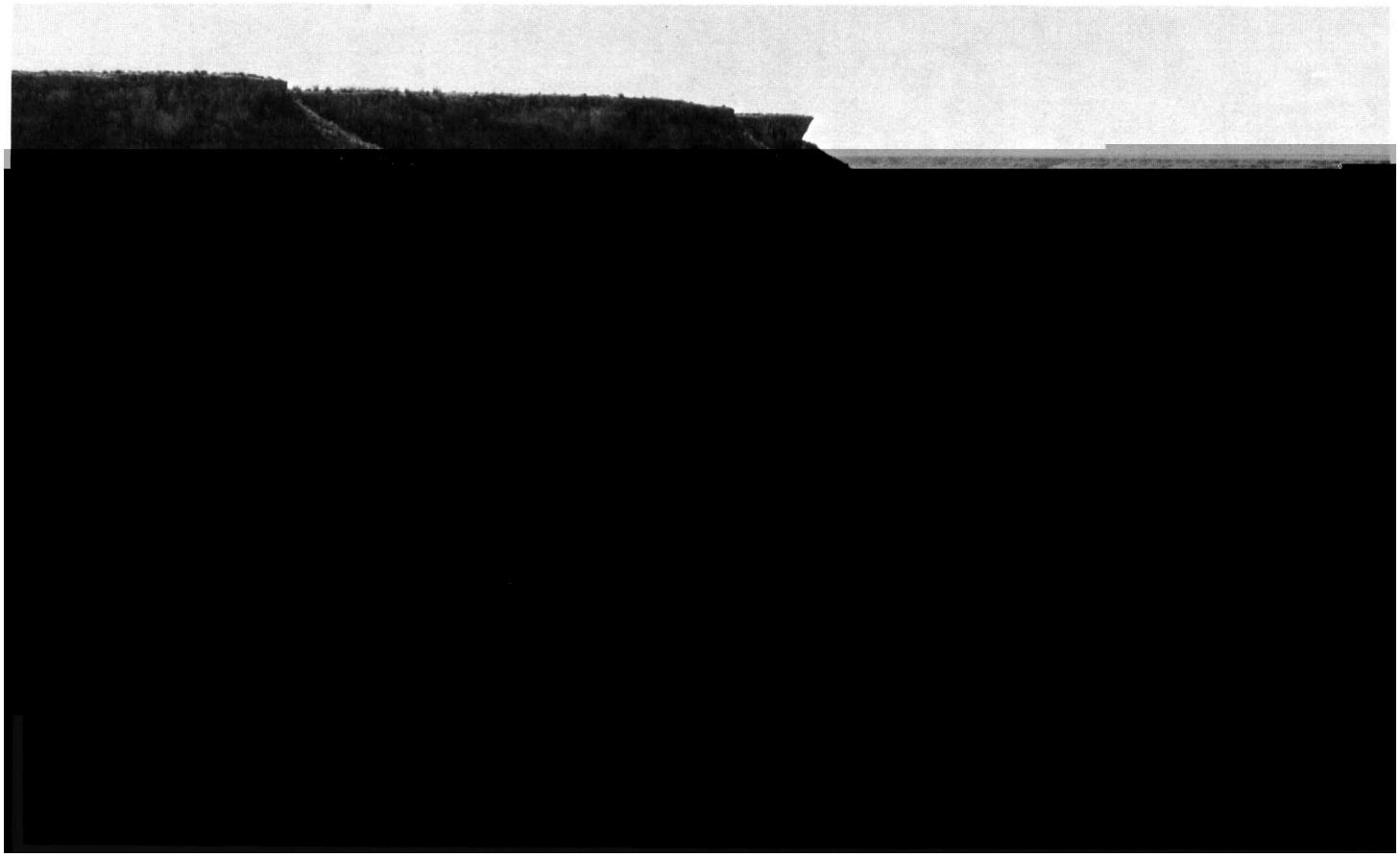


Figure 8.—**Landscape of Berda-Potter complex, 15 to 50 percent slopes.**

cause use and management are similar, separation is not justified. The delineations are larger and the composition more variable than most other units. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

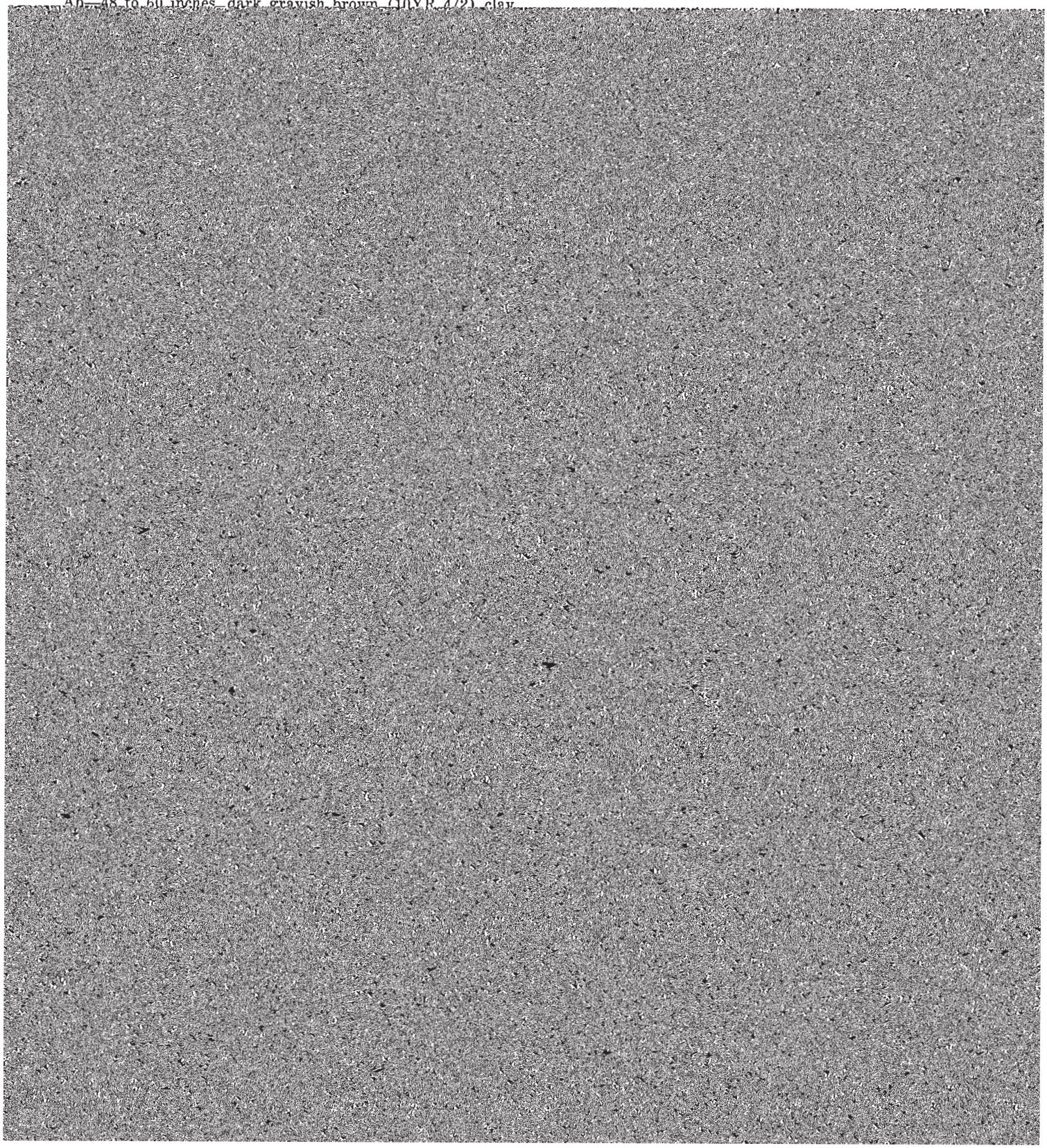
In a representative profile the surface layer is dark brown clay loam about 42 inches thick. The lower layers, to a depth of 72 inches, are stratified pale brown, dark grayish brown, and reddish yellow sandy clay loam and clay loam

B2—42 to 48 inches, pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; few thin strata of pebbles; calcareous, moderately alkaline; gradual smooth boundary.

Ab—48 to 60 inches, dark grayish brown (10YR 4/2) clay

and runoff. Capability unit IIIe-6 dryland and IIIe-1 irrigated; Draw range site.

Colorado Series



Conlen Series

The Conlen series consists of deep, well drained, nearly level to gently sloping soils on uplands. These soils formed in loamy material.

In a representative profile the surface layer is about 10 inches of brown loam over 5 inches of yellowish brown clay loam. The next layer is very pale brown clay loam about 15 inches thick. Below this, to a depth of 80 inches, is reddish yellow clay loam.

Permeability is moderate in these soils, and available water capacity is high. The hazard of soil blowing is severe. The high lime content causes chlorosis in some plants.

Conlen soils are suited to cultivation. About half of the areas of these soils are cultivated, and the other half are used for range.

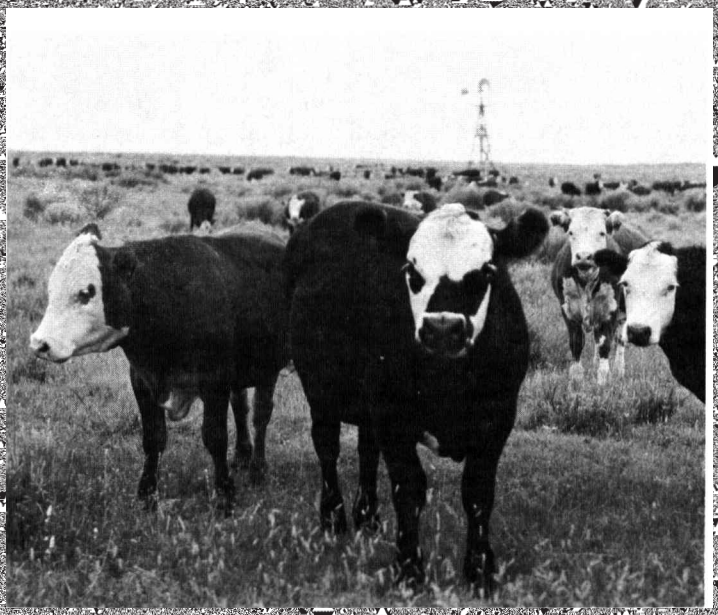
Representative profile of Conlen loam, 0 to 3 percent slopes, 12 miles east of Dalhart, from intersection of Farm Road 281 and U.S. Highway 87: 12 miles east on

helps to control soil blowing. Terraces and contour farming on the gently sloping areas slow water runoff and reduce water erosion. Plowing should be done in such a way that the lower layers that are high in lime are not mixed into the surface layer. Growing high residue crops helps conserve soil moisture in dry cropland areas. Capability unit IVe-2 dryland and IIIe-4 irrigated; Hardland Slopes range site.

Dallam Series

The Dallam series consists of deep, well drained, nearly level to gently sloping and undulating, sandy and loamy soils on uplands.

In a representative profile the surface layer is brown loamy fine sand about 16 inches thick. The next layer is brown sandy clay loam about 19 inches thick. The next lower layer is light brown sandy clay loam about 15 inches thick. Below this is light reddish brown clay



angular blocky; slightly hard, friable; few patchy clay films; many wormcasts; noncalcareous, mildly alkaline; gradual smooth boundary.

B22t—35 to 50 inches, light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; moderate medium and fine subangular blocky structure; hard, friable; few patchy clay films; calcareous, moderately alkaline; gradual wavy boundary.

B23tca—50 to 65 inches, light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist, with white coatings; moderate medium and fine subangular blocky structure; hard, friable; estimated 25 percent calcium carbonate as soft lumps and coatings; calcareous, moderately alkaline; gradual smooth boundary.

B24t—65 to 95 inches, yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium and fine subangular blocky structure; hard, friable; many films and threads of calcium carbonate; calcareous, moderately alkaline.

The solum is more than 80 inches thick. Depth to secondary carbonate ranges from 20 to 36 inches. The A horizon is brown, yellowish brown, or grayish brown loamy fine sand and fine sandy loam. It ranges from 6 to 19 inches in thickness. Reaction is neutral or mildly alkaline.

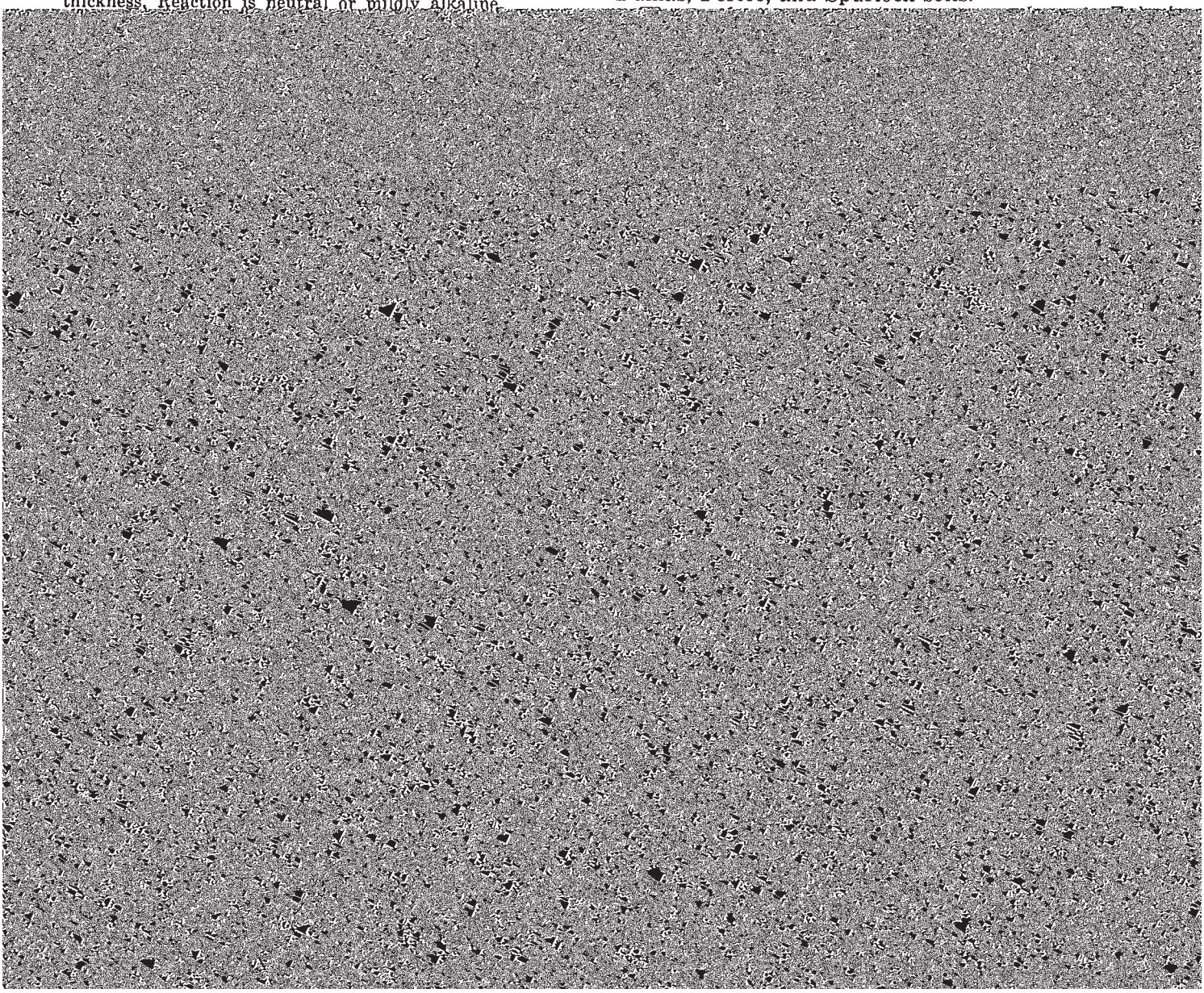
help to conserve moisture. Irrigated areas need a designed irrigation system that will assist in controlling soil and water losses.

Land leveling is needed in some areas where surface irrigation systems are used. If the crop grown does not leave enough residue, chiseling and listing are effective measures to help control soil blowing. Capability unit IIIe-1 dryland and IIe-3 irrigated; Sandy Loam range site.

DfB—Dallam fine sandy loam, 1 to 3 percent slopes. This gently sloping soil occupies smooth uplands throughout the county. Areas are irregular in shape and average about 100 acres in size.

The surface layer is brown fine sandy loam about 6 inches thick. The next layer is brown sandy clay loam 24 inches thick. Below this is yellowish red sandy clay loam 35 inches thick. The next layer, to a depth of 80 inches, is pink sandy clay loam.

Included with this soil in mapping are small areas of Dumas, Perico, and Spurlock soils.



loam about 29 inches thick. The lower layer, to a depth of 85 inches, is reddish yellow sandy clay loam.

Permeability is moderate in these soils, and the available water capacity is high. Runoff is slow to medium. The hazard of soil blowing is moderate.

The Dumas soils provide some of the best cropland in the county. Most of the acreage is cultivated. A few areas are in range.

Representative profile of Dumas loam, 0 to 1 percent slopes, 15 miles southwest and 4 miles west of Dalhart,

reddish yellow (5YR 7/6) moist; weak fine subangular blocky structure; hard, friable; about 35 percent by volume calcium carbonate; calcareous, moderately alkaline; gradual smooth boundary.

B25t—65 to 85 inches, reddish yellow (5YR 7/6) sandy clay loam, yellowish red (5YR 5/6) moist, with white coatings; weak fine subangular blocky structure; hard, friable; few old root channels; calcareous, moderately alkaline.

The solum is more than 60 inches thick. Depth to secondary carbonates ranges from 15 to 34 inches, and depth to the zone of maximum calcium carbonate accumulation ranges

blowing, conserve moisture, and maintain good soil tilth. Crop residue left on or near the surface helps to control soil blowing and maintain soil tilth. Where the soil is irrigated, fertilizers and high residue crops help to keep the soil in good condition. Good irrigation systems, properly used, conserve water and control erosion. Parallel terraces help to conserve moisture in dryfarmed areas. Grassed waterways are needed in places to remove excess water safely following high intensity rains. Tillage practices, such as chiseling or listing, that roughen the soil surface are emergency measures used to control soil blowing where crop residues do not control it adequately. Cover crops also help to control soil blowing. Capability unit IIIe-3 dryland and IIe-2 irrigated; Clay Loam range site.

DuB—Dumas loam, 1 to 3 percent slopes. This gently sloping soil is on smooth upland plains. Areas are 20 to 200 acres in size and are mainly long and narrow.

The surface layer is brown loam about 10 inches thick. The next layer is brown sandy clay loam about 9 inches thick. The underlying material, to a depth of 80 inches, is reddish yellow sandy clay loam that becomes yellowish red with depth.

Included with this soil in mapping are small areas of Dallam, Gruver, and Sunray soils.

Most areas of this Dumas soil are used for range. A few of the cultivated areas are in dryland and irrigated wheat and grain sorghum or in irrigated corn and alfalfa.

The main concerns of management are the control of soil blowing and water erosion. Crop residues left on the surface help to maintain tilth and control soil blowing. Diversions, terraces, and grassed waterways are needed to control water erosion where washing is a problem. These practices also help to conserve soil moisture in dryfarmed areas. Irrigated lands need a designed irrigation system that will assist in controlling soil erosion and runoff. If crop residues are inadequate to control soil blowing, chiseling or listing are effective emergency measures. Additions of fertilizers

Farm Road 767; 0.25 mile south of Farm Road 767 and 1.75 miles east of paved road leading to ranch headquarters:

A1—0 to 4 inches, reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, firm; calcareous, moderately alkaline; gradual smooth boundary.

B2—4 to 14 inches, reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, firm; calcareous, moderately alkaline; gradual smooth boundary.

C—14 to 60 inches, red (2.5YR 5/6), red bed shaly clay; structureless (massive).

The solum is 10 to 20 inches thick. The A horizon is red, reddish brown, or yellowish red clay, silty clay, or clay loam. The B2 horizon is red, reddish brown, or yellowish red. The C horizon is clayey or shaly red bed material in shades of red, olive, and gray. A few coarse fragments are on the surface in places.

GkD—Glenrio-Knoco complex, 3 to 12 percent slopes. The soils in this unit are gently sloping to strongly sloping. They are the result of backwashing and backcutting of local streams in the southern parts of the county. Most areas are irregular in shape and range from 50 to 500 acres in size.

The soils of this complex are in a pattern but are so intricately mixed or so small in size that they cannot be shown separately at the scale mapped. The composition of this mapping unit is about 30 percent Glenrio clay and 30 percent Knoco clay. The rest is small areas of San Jon, Mangum, and Berda soils, and some shale and rock outcrops.

The Glenrio soils are droughty and have shallow Knoco soils are on the more sloping, severely eroded slopes and knolls.

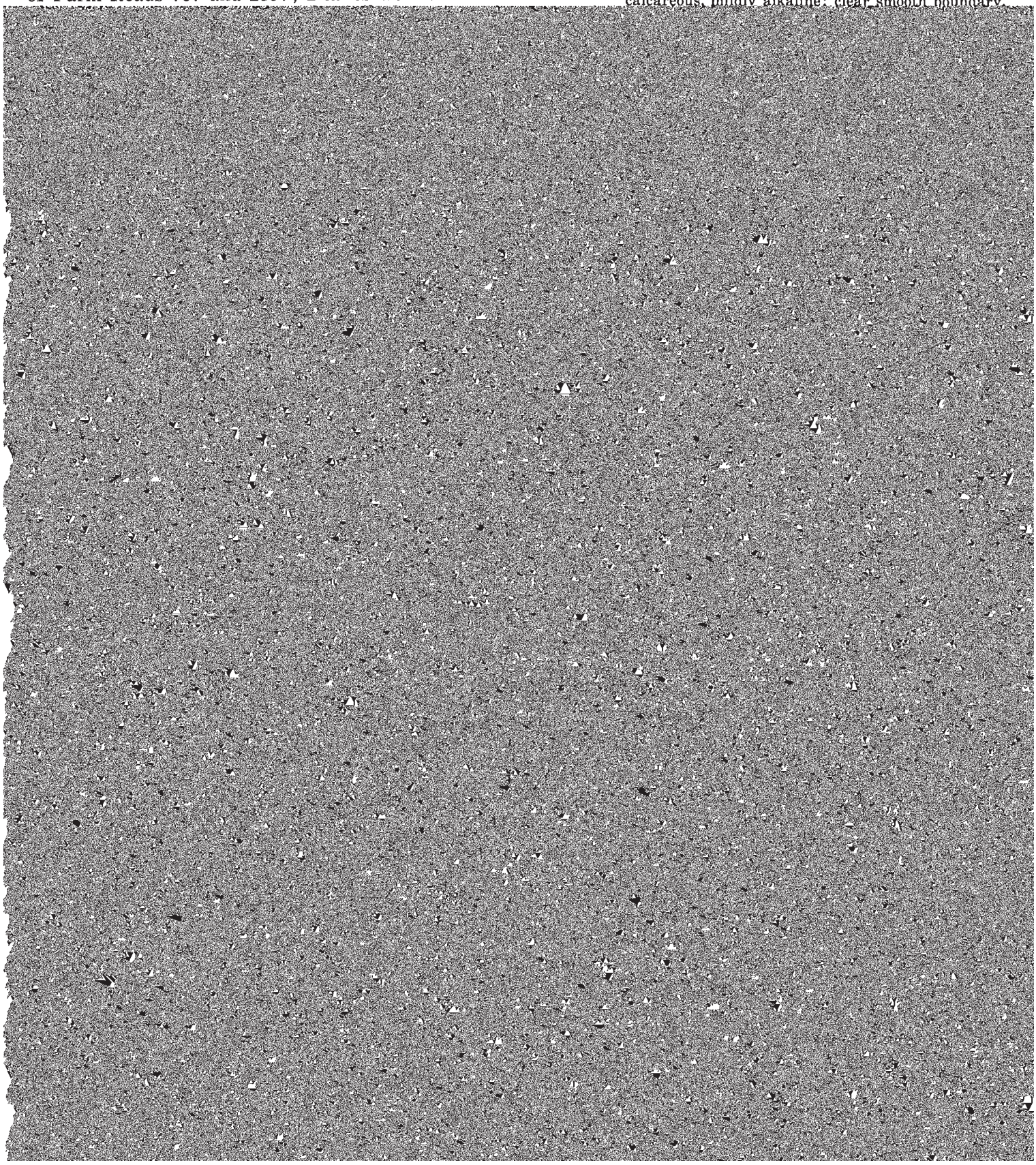
The profiles of Glenrio and Knoco soils are those described as representative for their respective series.

The soils of this mapping unit are used entirely for range.

The Glenrio soils are droughty and have shallow

Representative profile of Gracemore soils, 6 miles west and 1 mile north of Channing, from intersection of Farm Roads 767 and 2357; 2 miles west on Farm

brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; few wormcasts; many clay films; common pores; noncalcareous, mildly alkaline; clear smooth boundary.



use of crop residue does not control soil blowing, chiseling or listing are effective emergency measures. Cover crops also help to control soil blowing. Capability unit IIIe-3 dryland and IIe-2 irrigated; Clay Loam range site.

GrB—Gruver loam, 1 to 3 percent slopes. This gently sloping soil is on smooth upland plains and gently sloping areas above playa lakes. Most areas are long and narrow and 20 to 200 acres in size.

ture; slightly hard, friable; few thin loamy fine sand and sandy clay loam strata of various colors; calcareous, moderately alkaline; clear smooth boundary.

C—36 to 60 inches, light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; structureless (massive); slightly hard, friable; few thin loamy fine sand and sandy clay loam strata of various colors; calcareous, moderately alkaline.

The solum ranges from 30 to 50 inches in thickness. The soil is calcareous throughout. The upper 40 inches is 10 to

slightly hard, friable; calcareous, moderately alkaline.

Karde soils are more than 60 inches deep. The A horizon ranges from 4 to 16 inches in thickness. Colors are light brownish gray, gray, grayish brown, or dark grayish brown. Structure is weak coarse prismatic or weak coarse subangular blocky. Textures are sandy clay loam, loam, fine

Knoco Series

The Knoco series consists of very shallow, excessively drained, gently sloping to strongly sloping, clayey soils. These soils formed in clayey red beds.

In a representative profile the surface layer is red-

structureless (single grained); loose, very friable; calcareous, moderately alkaline.

These soils are calcareous and are loamy fine sand to a depth of 40 inches or more.

The colors of all horizons are light yellowish brown, yellowish brown, very pale brown, pale brown, brown, or light brown. The C horizon below a depth of 40 inches is fine sand or loamy fine sand.

Lk—Likes loamy fine sand. This undulating to hummocky soil is in sandy, calcareous areas mainly in the western and southern parts of the county. Slopes are 5 to 12 percent.

Included with the soil in mapping are small areas of Mobeetie, Valentine, and Veal soils.

This soil is not suited to cultivation. All areas are in range. Grazing must be managed properly or the soil will blow. Capability unit VIe-1 dryland; Loamy Sand range site.

Lincoln Series

The Lincoln series consists of deep, somewhat excessively drained, nearly level, sandy soils on bottom lands. These soils formed in sandy alluvium from local streams.

In a representative profile the surface layer is about 8 inches of dark yellowish brown loamy fine sand over 10 inches of very pale brown loamy fine sand. The underlying material, to a depth of 64 inches or more, is brown loamy fine sand that has thin strata of various colors and textures.

Permeability is rapid in these soils, and the available water capacity is low. Runoff is slow. Most areas are flooded occasionally. The hazard of soil blowing is

Rita Blanca Creeks, parallel to the creek beds. Slopes are 0 to 1 percent.

These soils are similar to the soil described as representative of the series. The texture of their surface layer varies, however, and includes fine sand or loamy fine sand.

Included with these soils in mapping are narrow, gravelly and sandy stream channels and small areas of Gracemore, Guadalupe, and Valentine soils.

All areas of these soils are range. The soils are not suited to crops. Capability unit Vw-1 dryland; Sandy Bottomland range site.

Mangum Series

The Mangum series consists of deep, well drained, nearly level, clayey soils on bottom land. These soils formed in clayey alluvium.

In a representative profile the surface layer is reddish brown clay about 10 inches thick. The next layer, 15 inches thick, is red clay that has thin, lighter colored strata. The lower layer, to a depth of 60 inches or more, is red silty clay that has thin, lighter colored strata.

Permeability is very slow in these soils, and the available water capacity is high. Runoff is slow. The hazard of soil blowing is slight.

Mangum soils are suited to crops, but all areas of these soils in this survey area are in range.

Representative profile of Mangum clay, 27 miles west of Channing, from intersection of Farm Road 767 and U.S. Highway 54; 11.0 miles east on Farm Road 767 to Romero Creek; 100 feet north of highway on east bank of creek:

erosion. Management of crop residues on the soil surface will help to maintain soil tilth and control soil blowing and water erosion. Irrigated lands need a designed irrigation system that will assist in controlling soil erosion and water losses. Capability unit IIIw-1 dryland and IIIw-1 irrigated; Clay Flat range site.

Mobeetie Series

The Mobeetie series consists of deep, well drained, gently sloping to sloping, loamy soils on side slopes above drainageways in uplands. These soils formed in loamy alluvium or collvuim.

In a representative profile the surface is reddish brown fine sandy loam about 6 inches thick. The next layer is reddish brown fine sandy loam about 24 inches thick. The underlying material, to a depth of 60 inches or more, is yellowish red fine sandy loam.

Permeability is moderately rapid in these soils, and runoff is slow to medium. The available water capacity

If this soil is cultivated, the main concerns of management are the control of erosion and the maintenance of soil productivity. Crop residue left on the surface helps to control soil blowing and to maintain soil productivity. Diversions, terraces, and grassed waterways help to control water erosion. Irrigated lands need a designed irrigation system that assists in controlling soil and water losses. Capability unit IIIe-5 dryland and IIIe-2 irrigated; Mixedland Slopes range site.

MoC—Mobeetie fine sandy loam, 3 to 5 percent slopes. This gently sloping soil is on the sides of major drainageways. Areas are long and narrow in shape and range from 15 to 200 acres in size.

The surface layer is brown fine sandy loam about 12 inches thick. The next layer is strong brown fine sandy loam 18 inches thick. The underlying material to a depth of 60 inches is reddish yellow fine sandy loam.

Included with this soil in mapping are small areas of Berda, Likes, Perico, and Veal soils.

Ness Series

The Ness series consists of deep, somewhat poorly drained, nearly level, clayey soils in playa lakes. These soils formed in clayey lacustrine material.

In a representative profile the upper layer, to a depth of 48 inches, is dark gray clay. The lower layer, to a depth of 80 inches, is gray clay.

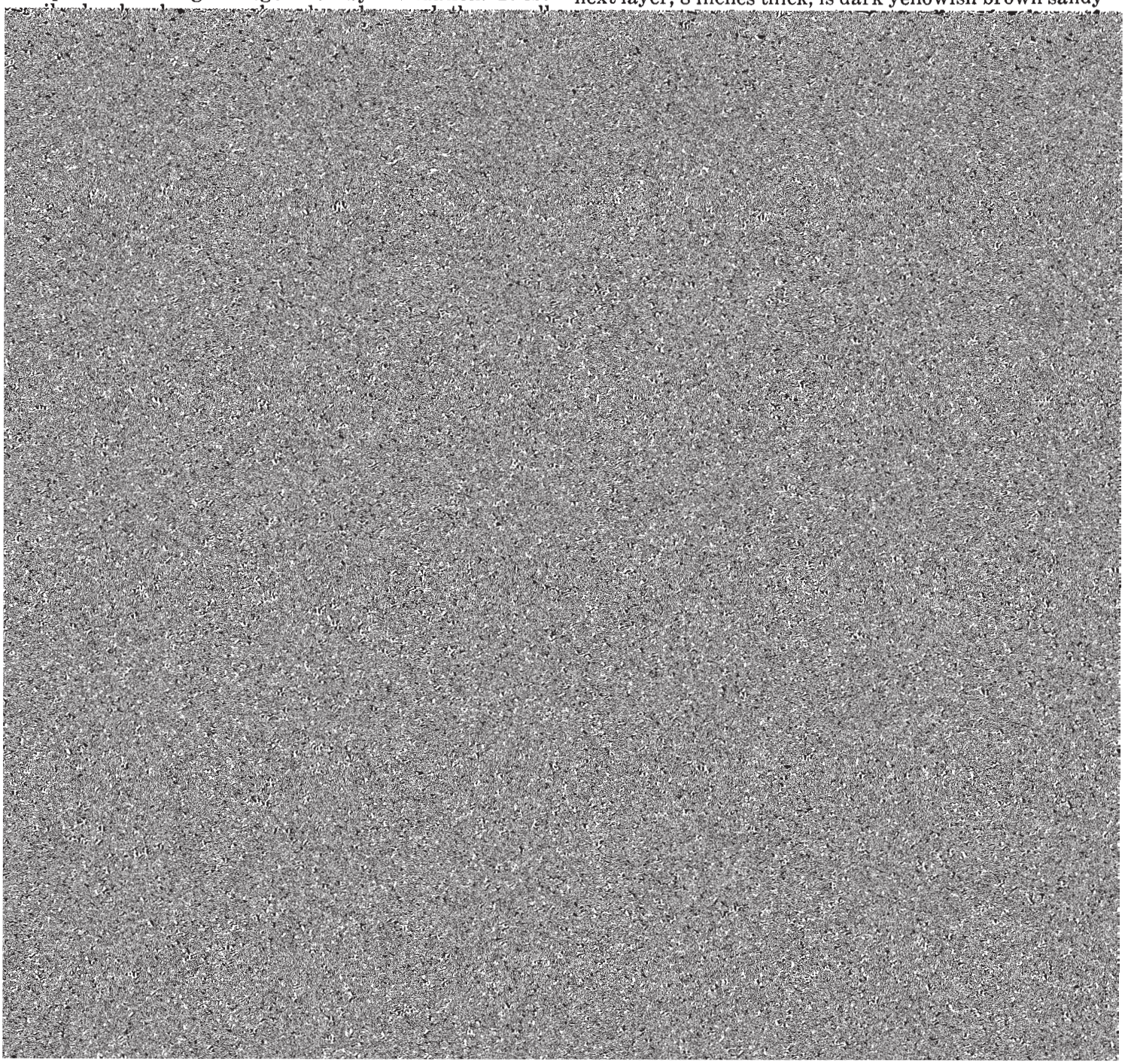
Most areas of these soils are inundated for a few weeks each year. Permeability is very slow and the available water capacity is high. Soil blowing is a severe hazard where the surface is barren as a result of previous killing of vegetation by inundation. These

remains on the surface helps to prevent soil blowing. Emergency chiseling is an effective measure where vegetative cover is lacking. Capability unit VIw-1 dryland. Included with surrounding range site.

Perico Series

The Perico series consists of deep, well drained, nearly level to gently sloping soils on uplands. These soils formed in loamy material.

In a representative profile the surface layer is yellowish brown fine sandy loam about 8 inches thick. The next layer, 8 inches thick, is dark yellowish brown sandy



clay loam 20 inches thick. Below this, to a depth of 80 inches, is reddish yellow clay loam.

Included with this soil in mapping are small areas of Dallam, Spurlock, and Vingo soils.

This Perico soil is used mostly for range. A few areas are farmed.

Soil blowing is the major hazard to overcome in managing this soil. Crop residues left on the surface are essential in controlling soil blowing. If the crop residues do not provide enough control, chiseling and listing are helpful measures. Irrigation water can be applied properly by the sprinkler method. Capability unit IVe-1 dryland and IIIe-3 irrigated; Loamy Sand range site.

PeA—Perico fine sandy loam, 0 to 1 percent slopes. This soil is nearly level. Areas are irregular in shape and average about 200 acres in size. The profile of this soil is the one described as representative for the series.

Included with this soil in mapping are small areas of Dallam, Spurlock, and Sunray soils.

This Perico soil is used for range and crops. Dry cropland areas are in grain sorghum and wheat. Irrigated areas are in wheat, grain sorghum, grazing sorghum, alfalfa, corn, and improved pasture.

The main concerns of management are soil blowing and loss of soil moisture. Crop residue needs to be left on the surface. Parallel terraces help to conserve moisture in dryfarmed areas. Irrigated areas need irrigation systems that are properly designed to reduce soil and water losses. If crop residues do not provide enough control of soil blowing, chiseling and listing are effective measures. Capability unit IIIe-1 dryland and IIe-3 irrigated; Mixedland Slopes range site.

PeB—Perico fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on ridges that are long and narrow. Areas average about 100 acres in size.

The surface layer is yellowish brown fine sandy loam about 7 inches thick. The next layer, 20 inches thick, is brown sandy clay loam that becomes light brown with depth. Below this, to a depth of 80 inches, is strong brown sandy clay loam.

Included with this soil in mapping are small areas of Dallam, Spurlock, and Sunray soils.

This Perico soil is used for range and crops. Dry cropland areas are in wheat and grain sorghum. Irrigated areas are in alfalfa, wheat, grain sorghum, improved pasture, and corn.

Practices that conserve soil moisture and control soil blowing are needed in managing this soil. Minimum tillage and stubble mulching leave residues on the soil surface and thus reduce soil blowing. Terracing and contour farming help to reduce runoff and enable water to soak into the soil. Properly designed irrigation systems are needed to prevent soil and water losses. Capability unit IIIe-5 dryland and IIIe-2 irrigated; Mixedland Slopes range site.

PeC—Perico fine sandy loam, 3 to 5 percent slopes. This gently sloping soil is on ridges and breaks along drains in the 'High Plains' parts of the county. Areas are mainly long and narrow and average about 80 acres in size.

The surface layer is reddish brown fine sandy loam about 6 inches thick. The next layer is yellowish red sandy clay loam 24 inches thick. Below this, to a depth of 80 inches, is pink sandy clay loam.

Included with this soil in mapping are small areas of Berda, Dallam, Spurlock, and Sunray soils.

This Perico soil is used mostly for range. A few small areas within larger fields are cultivated.

The main concern of management is the control of erosion. Crop residue left on the surface helps to control soil blowing. Diversions, terraces, and grassed waterways help to control water erosion. Irrigated areas need an irrigation system that is designed to assist in the control of soil and water losses. Capability unit IVe-3 dryland and IVe-2 irrigated; Mixedland Slopes range site.

Potter Series

The Potter series consists of very shallow, well drained, gently sloping to very steep soils on uplands and breaks (fig. 11). These soils formed in caliche beds. Soil areas are mainly very narrow and are on the edge of escarpments.

In a representative profile the surface layer is brown loam about 8 inches thick. The underlying material, to a depth of 60 inches or more, is white, weakly to strongly cemented caliche material.

Permeability is moderate in these soils. Runoff is medium to rapid. The available water capacity is very low.

All areas of the Potter soils are in range. These soils are not suited to crops.

Representative profile of Potter soils, 3 to 15 percent slopes, 2.5 miles west of Channing, from intersection of Farm Road 767 and Farm Road 2357; 1.75 miles east on Farm Road 767; 50 feet south of road:

A1—0 to 8 inches, brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak coarse prismatic structure; soft,

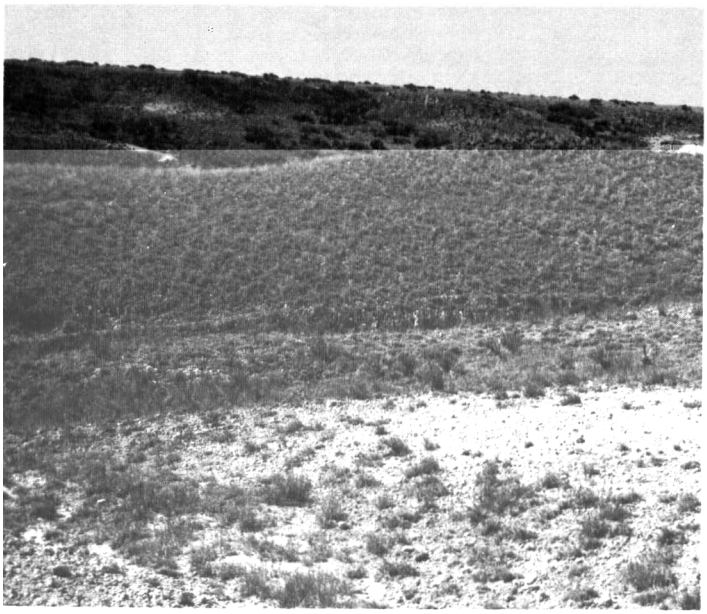


Figure 11.—**Landscape of Potter soils, 3 to 15 percent slopes.**

very friable; many fine roots; many calcium carbonate concretions; calcareous, moderately alkaline; clear smooth boundary.

C1ca—8 to 14 inches, white (10YR 8/2) caliche, light gray (10YR 7/2) moist; caliche consists of weakly to strongly cemented fragments; an estimated 75 percent calcium carbonate; calcareous, moderately alkaline; gradual smooth boundary.

C2ca—14 to 60 inches, white (10YR 8/2) caliche, an estimated 90 percent calcium carbonate as soft masses and concretions.

The A horizon ranges from 6 to 10 inches in thickness. It

grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; extremely hard, firm; many clay films; calcareous, moderately alkaline; gradual smooth boundary.

B24t—38 to 48 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; extremely hard, friable; few patchy clay films, calcareous, moderately alkaline; gradual smooth boundary.

B25t—48 to 70 inches, yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6)) moist; moderate medium and fine subangular blocky structure; hard, friable; few films and threads of calcium carbon-

San Jon Series

The San Jon series consists of moderately deep, well drained, gently sloping soils on uplands. These soils formed in loamy or clayey red beds.

In a representative profile the surface layer is reddish brown clay loam about 6 inches thick. The next layer, 14 inches thick, is reddish brown clay loam. The next lower layer is red clay loam about 12 inches thick. The underlying material, to a depth of 60 inches or more, is slightly altered red beds of red clay loam.

Permeability is moderately slow in these soils, and runoff is medium to rapid. The available water capacity is medium. Soil blowing is a moderate hazard.

San Jon soils are suited to cultivation if they are irrigated. All areas are in range. Mesquite is invading many areas of rangeland (fig. 12).

Representative profile of San Jon clay loam, 1 to 3 percent slopes, 26 miles west of Channing, from intersection of Farm Road 767 and U.S. Highway 54; 10 miles east on Farm Road 767; 100 feet south of road:

A1—0 to 6 inches, reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, friable; common wormcasts; calcareous, moderately alkaline; gradual smooth boundary.

B21—6 to 20 inches, reddish brown (2.5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) moist; weak coarse prismatic structure that parts to weak coarse subangular blocky; slightly hard, friable; many wormcasts; calcareous, moderately alkaline; gradual smooth boundary.

B22ca—20 to 32 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, friable; many wormcasts; an estimated 15 percent calcium car-

The A horizon is reddish brown, red, yellowish red, or brown. The B2 horizon is sandy clay loam, silty clay loam, or clay loam. Colors are yellowish red, reddish brown, reddish yellow, or red. The B22ca horizon is 5 to 30 percent calcium carbonate.

SaB—San Jon clay loam, 1 to 3 percent slopes. This gently sloping soil occupies uplands in the rolling plains of the county. Areas are irregular in shape and average about 200 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Berda, Dumas, Glenrio, and Sunray soils. All areas of this soil are in range. The soil is suited to irrigated crops. If the soil were cultivated, crop residues left on the surface would help to control soil blowing. An irrigation system that will control soil and water losses is needed. Capability unit VIe-5 dryland and IIIe-1 irrigated; Clay Loam range site.

SgD—San Jon-Glenrio complex, 3 to 8 percent slopes. This gently sloping to sloping complex is on uplands in the rolling plains part of the county. Soil areas are irregular in shape and average about 400 acres in size. The soils of this complex are in a pattern, but they are so intricately mixed or the areas are so small in size that they cannot be shown separately at the scale mapped.

The gently sloping San Jon soils make up about 55 percent of the unit. The more sloping Glenrio soils occur as knolls and make up about 30 percent of the areas mapped.

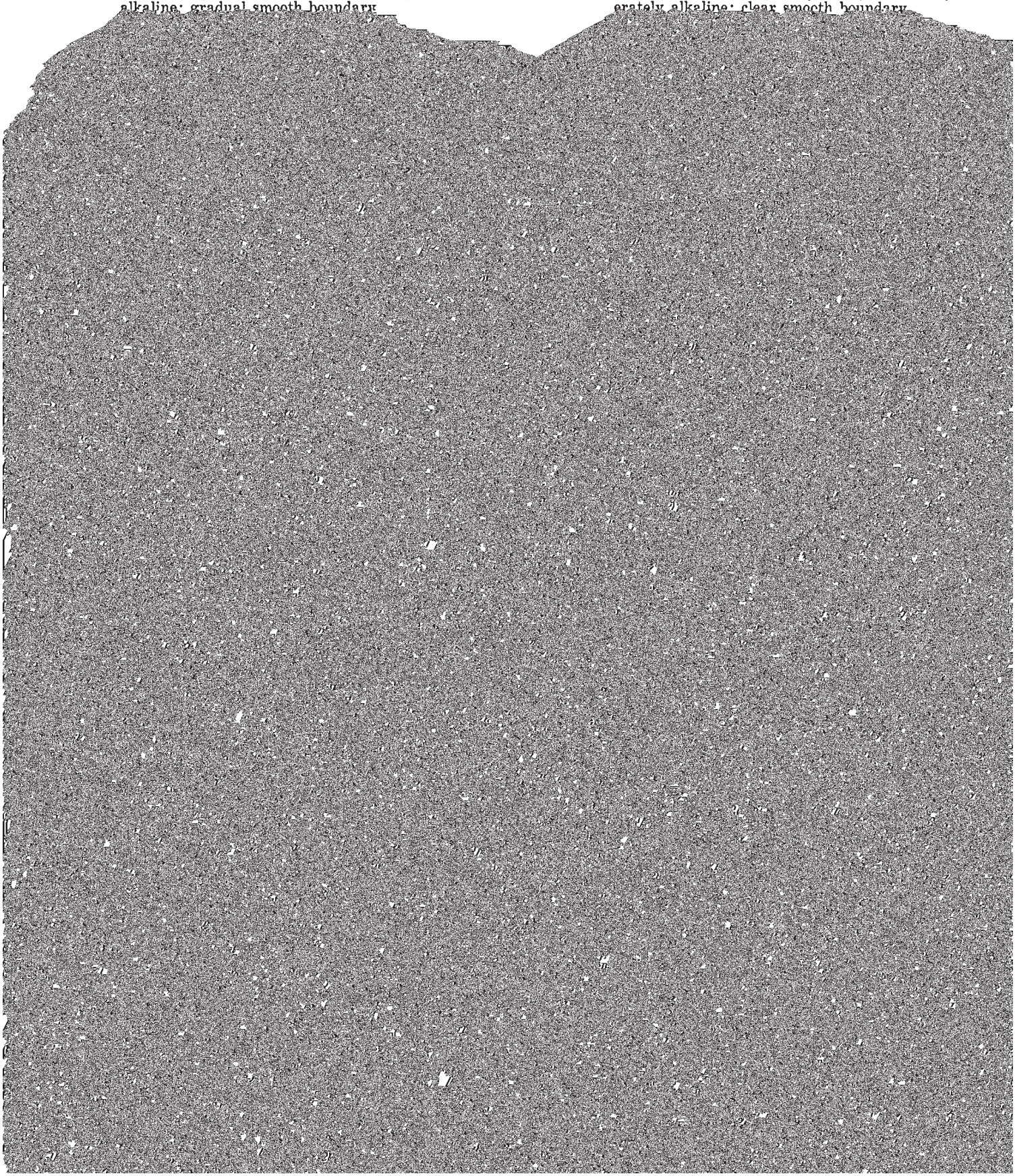
Included with these soils in mapping are small areas of Berda and Knoco soils.

San Jon soils have a reddish brown clay loam surface layer about [illegible] inches thick. The next lower 20

Representative profile of Sherm clay loam, 0 to 1 is irrigated, fertilizers and high residue crops help to

many roots; few wormcasts; calcareous, moderately alkaline; gradual smooth boundary.

blocky; hard, friable; many roots; calcareous, moderately alkaline; clear smooth boundary.



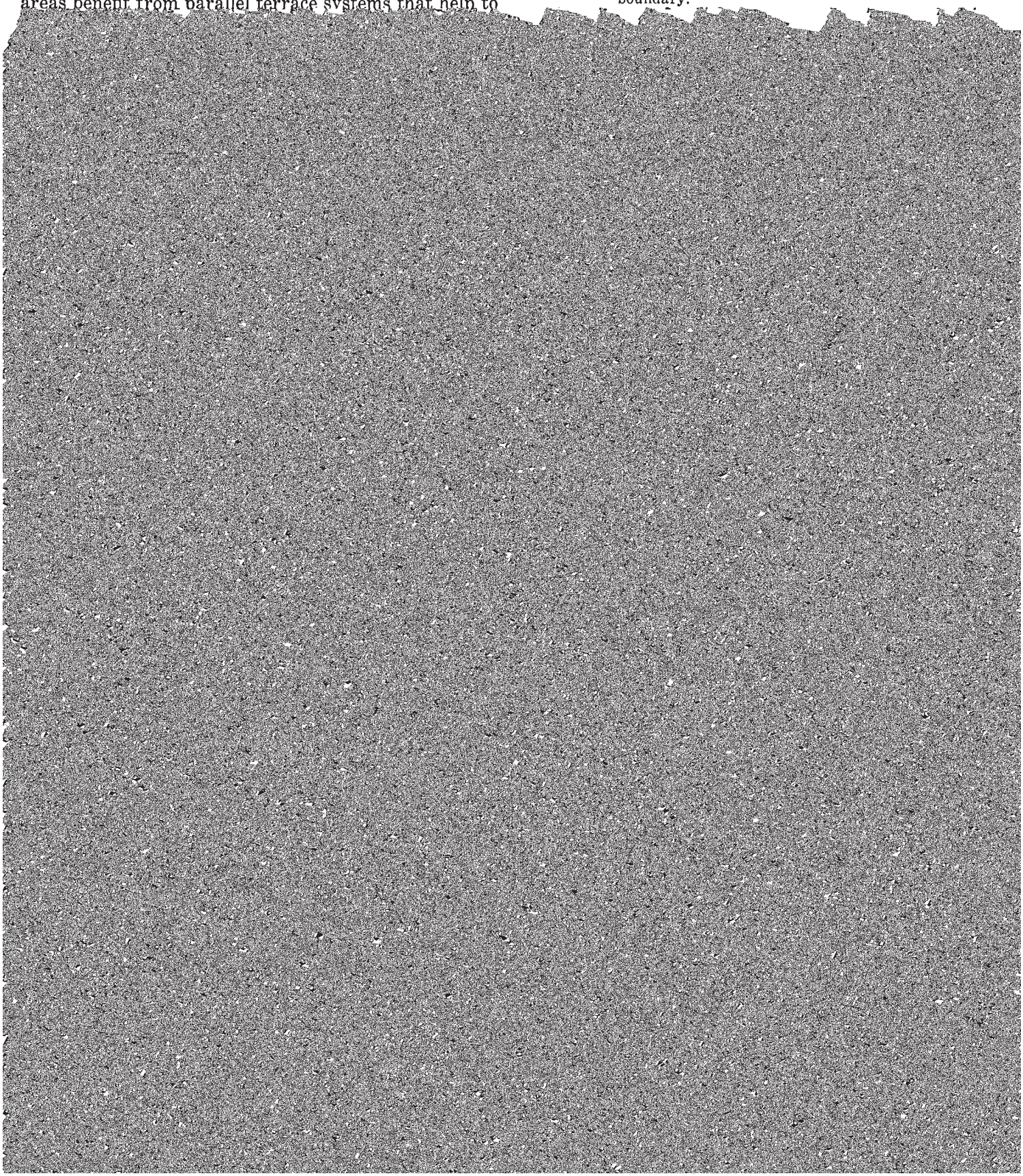
SrB—Spurlock soils, undulating. These undulating, eroded soils are on gently sloping and hummocky uplands. Soil areas are mainly rectangular, are the shape

careous, moderately alkaline; gradual wavy boundary.

B23tca—30 to 43 inches, pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; weak fine subangular blocky

sist in controlling soil and water losses. Dry farmed areas benefit from parallel terrace systems that help to

careous, moderately alkaline; gradual smooth boundary.



Included with this soil in mapping are small areas of Likes and Vingo soils.

This Valentine soil is entirely in range. It is not suited to cultivation. Capability unit VIIe-2 dryland; Sand Hills range site.

VcE—Valentine-Spurlock complex, hummocky. This hummocky unit consists of alternating billowy, deep sands and bare areas where the soil is severely eroded. Mapped areas of this unit are blown out and duned and

All areas of this complex are in range. The soils are not suited to crops. Vegetation is sparse and reseeding has not been successful because of low moisture content and low fertility (fig. 15). Capability unit VIIe-2 dryland; Sand Hills range site.

Veal Series

The Veal series consists of deep, well drained, up

A1—0 to 5 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, friable; calcareous, moderately alkaline; gradual smooth boundary.

B21—5 to 16 inches, light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; slightly hard, friable; calcareous, moderately alkaline; gradual smooth boundary.

B22ca—16 to 25 inches, pinkish white (7.5YR 8/2) sandy clay loam, pink (7.5YR 7/4) moist; weak subangular blocky structure; slightly hard, friable; about 60 percent calcium carbonate as soft and hard masses; calcareous, moderately alkaline; gradual smooth boundary.

B23ca—25 to 60 inches, light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; slightly hard, friable; about 30 percent calcium carbonate; calcareous, moderately alkaline.

Depth to the B2ca horizon ranges from 12 to 20 inches. The B22ca horizon is an estimated 15 to 60 percent visible calcium carbonate.

The A horizon is brown, light brown, yellowish brown, and reddish brown. The B horizon is sandy clay loam or clay loam.

Veal soils are mapped only with Berda or Mobeetie soils.

Vingo Series

The Vingo series consists of deep, well drained, noncalcareous, undulating sandy soils on uplands. These soils formed in sandy eolian material.

The Bt horizon is fine sandy loam in the upper part and fine sandy loam or sandy clay loam in the lower part. The B22t and B23t horizons are calcareous or noncalcareous. Depth to calcareous material ranges from 40 to more than 80 inches. A weak ca horizon is present in some profiles.

VDD—Vingo-Dallam association, undulating. This mapping unit is made up of undulating and hummocky soils in irregularly shaped areas that average about 600 acres in size. Slopes range from 3 to 8 percent.

The landscape is made up of alternating ridges and low areas. The ridges make up about 55 percent of the mapped areas. They are about 10 feet high and have short side slopes. Ridges are about 300 feet from crest to crest. Vingo soils occupy these ridges. The low areas between the ridges make up about 40 percent of the mapped areas. They are occupied by Dallam loamy fine sand. Small areas of Rickmore soils are also included.

These soils could be mapped separately; but because use and management are similar, separation is not justified. The delineations are larger and the composition more variable than most other units in the county. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

The profile for the Vingo soil of this mapping unit is the one described as representative of the Vingo series.

Dallam soils have a surface layer of brown loamy fine sand about 18 inches thick. The next layer, 18 inches thick, is brown sandy clay loam. The lower lay-

These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops, the risk of damage when these soils are farmed, and the way they respond to treatment. The

the choice of plants or require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion unless protected.

Unit IIe-1 Dryland. Deep, moderately permeable, nearly level, calcareous loams and clay loams on flood plains.

meable, gently sloping to sloping, calcareous loams and fine sandy loams on uplands.

Unit IIIe-6 Dryland. Deep, moderately to slowly permeable, gently sloping, neutral to calcareous loams and clay loams on uplands.

Subclass IIIw. Soils severely limited to cultivation because of excess water.

Unit IIIw-1 Dryland. Deep, very slowly permeable, nearly level, calcareous clays on flood plains.

Unit IIIw-1 Irrigated. Deep, very slowly permeable, nearly level, calcareous clays on flood plains.

Class IV. Soils have very severe limitations that reduce the choice of plants requiring careful [illegible]

Unit VIe-1. Deep, moderately rapidly permeable, gently sloping to hummocky, neutral to calcareous loamy fine sands on uplands.

Unit VIe-2. Deep and moderately deep, moderately permeable, strongly sloping, calcareous fine sandy loams on uplands.

Unit VIe-3. Deep, moderately permeable, sloping, calcareous loams on uplands.

Unit VIe-4. Deep and moderately deep, moderately permeable, strongly sloping, calcareous loams on uplands.

Unit VIe-5. Deep and moderately deep, moderately slowly and very slowly permeable, [illegible]

TABLE 2.—*Predicted average yields of principal crops on dryland and irrigated arable soils under a high level of management*

[Absence of figure indicates that crop is not generally grown on the soil named]

Soil	Wheat		Grain sorghum		Corn	Alfalfa
	Dryland	Irrigated	Dryland	Irrigated	Irrigated	Irrigated
	Bu per acre	*Bu per acre*	*Lb per acre*	*Lb per acre*	*Bu per acre*	*Tons per acre*

wheat or sorghums. Several ranches in the county have irrigated grasses for both warm season and cool season grazing.

Livestock operations include cow-calf and stocker cattle enterprises. The most common livestock operation is for stocker cattle. Stocker calves are bought and are run on grazing lands for 4 to 8 months. Then they are placed in feedlots for finishing. Interest in feedlot operations is growing. The cow-calf type of operation consists of raising calves that are marketed at weaning time.

Several kinds of grassland are in the county. The most abundant is the Loamy Sand site, which produces mid and tall grasses. Two kinds of grassland are in areas of more sloping soils of the county: the Hardland Slopes site, which produces mid and short grasses, and the Mixedland Slopes site, which produces mid and tall grasses. Other grassland in the county is made up of steep and shallow soils which support sparse vegetation. Small areas of bottom land adjacent to stream courses produce tall grasses.

Range sites and condition classes

Soils differ in their capacity to produce grass and other plants for grazing. The soils that produce about the same kind and amount of vegetation, if the range is in similar condition, make up a range site.

Range sites are kinds of rangeland that have the capability to produce the same kind and amount of climax vegetation. Throughout the prairie and the plains areas, the climax vegetation consists of the plants that were growing when the region was first settled. If cultivated crops are not to be grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax plant community that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax plant community that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter then decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. They come in and grow along with increasers after the climax vegetation has been altered by grazing. Many of the invaders are annual weeds; some are shrubs that have some grazing value; but others have little value for grazing.

Four range condition classes indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep the rangeland in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. Recognizing important changes in the kind of cover on a range site is difficult. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods, under the supervision of a careful manager, may have a deteriorated appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following pages, the soils of the range sites of Hartley County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air dry herbage for each site when the site is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

CLAY FLAT RANGE SITE

This site consists of deep, well drained, very slowly permeable, nearly level, calcareous clayey soils on bottom land. The hazards of soil blowing and water erosion are slight. The surface becomes hard and massive after heavy trampling during wet weather.

The climax vegetation is dominantly short grasses and a few perennial forbs. The composition by weight of the climax vegetation is 45 percent galletagrass; 15 percent blue grama; 15 percent buffalograss; 10 percent sideoats grama; 5 percent alkali sacaton; 5 percent western wheatgrass and vine-mesquite; and 5 percent perennial forbs.

If this site is in excellent condition, the total annual yield of air-dry herbage is about 2,000 pounds per acre in favorable years and about 800 pounds in unfavorable years. Cattle use these species at various seasons.

Continued heavy grazing by cattle on this site results in a decrease of sideoats grama, blue grama, western wheatgrass, and vine-mesquite. Other species, includ-

to rapid. The hazards of soil blowing and water erosion are slight to moderate. In many places the intake of moisture is reduced by surface crusting, and downward movement is slowed by compacted layers, or "hoofpans."

The climax vegetation is dominantly short grass and a few mid grasses. The composition by weight of the climax vegetation is about 50 percent blue grama; 20 percent buffalograss; 5 percent sideoats grama; 5 percent galleta or tobosagrass; 5 percent western wheatgrass; 5 percent vine-mesquite; 5 percent silver bluestem; and 5 percent perennial forbs.

If this site is in excellent condition, the total annual yield of air dry herbage is about 2,000 pounds per acre in favorable years and about 1,000 pounds in unfavorable years. Cattle graze almost all of these plants during various periods of the year.

Continuous heavy grazing by cattle on this site results in a decrease of blue grama, sideoats grama, western wheatgrass, and vine-mesquite, or these plants are grazed out. Other species, including buffalograss, perennial threeawn, sand dropseed, and annual weeds, increase under heavy grazing. Mesquite, cholla, pricklypear, and some yucca invade the deteriorated site.

DRAW RANGE SITE

This site consists of deep, well drained, moderately permeable, nearly level and gently sloping, calcareous clay loams and loams on bottom land and in valleys that seldom flood. Runoff is slow to medium, and available water capacity is high. The hazard of soil blowing is moderate, and the hazard of water erosion is moderate to severe.

The climax vegetation is dominantly short and mid grasses. The composition by weight of the climax vegetation is 20 percent blue grama; 15 percent vine-mesquite; 15 percent buffalograss; 10 percent sideoats grama; 10 percent western wheatgrass; 5 percent alkali sacaton; 5 percent other perennial grasses; 10 percent woody plants; and 10 percent perennial forbs.

If this site is in excellent condition, the total annual yield of air dry herbage is about 2,600 pounds per acre in favorable years and about 1,800 pounds in unfavorable years. Cattle graze the herbage during various periods of the year.

Continuous heavy grazing by cattle on this site results in a decrease of sideoats grama, blue grama, vine-mesquite, and western wheatgrass. Other species, including buffalograss, threeawn, and silver bluestem, increase under heavy grazing. Mesquite, pricklypear, and annual weeds invade the deteriorated site.

GRAVELLY RANGE SITE

This site is in rolling landscape near stream channels. The significant soils are well drained, and moderately permeable gravelly loams. Runoff is rapid, and available water capacity is low.

The climax vegetation is dominantly mid grasses and some tall and short grasses. The composition by weight of the climax vegetation is 30 percent sideoats grama; 15 percent black grama; 10 percent hairy grama; 10 percent little bluestem; 5 percent indiangrass; 5 percent sand bluestem; 5 percent blue grama; 5 percent other perennial grasses; 5 percent catclaw: 5 percent other woody plants; and 5 percent perennial forbs.

If this site is in excellent condition the total annual yield of air dry herbage is about 1,800 pounds per acre in favorable years and about 1,100 pounds in unfavorable years. Cattle graze all grasses and forbs and browse the woody species during certain seasons.

Continued heavy grazing on this site results in a decrease of sand bluestem, sideoats grama, little bluestem, indiangrass, and black grama. Blue grama, buffalograss, hairy grama, threeawn, and yucca increase under heavy grazing. Juniper and annual weeds invade the deteriorated site.

HARDLAND SLOPES RANGE SITE

This site consists of moderately permeable, nearly level to sloping, calcareous loamy soils on uplands. The available water capacity is high. Runoff is medium to rapid.

The climax vegetation is a mixture of mid and short grasses and a small amount of yucca and forbs. The composition by weight of the climax vegetation is 35 percent sideoats grama; 25 percent blue grama; 5 percent vine-mesquite; 5 percent little bluestem, 5 percent buffalograss; 5 percent silver bluestem; 5 percent Wright threeawn; 5 percent sand dropseed; 5 percent woody plants; and 5 percent perennial forbs.

If this site is in excellent condition, the total annual yield of air dry herbage is about 2,200 pounds per acre in favorable years and about 1,400 pounds in unfavorable years. Cattle graze the grasses and forbs and will browse the woody species in certain seasons.

Continued heavy grazing by cattle and antelope on this site results in a decrease of sideoats grama, blue grama, vine-mesquite, and little bluestem. Buffalograss, silver bluestem, sand dropseed, Wright threeawn, and yucca increase under heavy grazing. Mesquite and annual weeds invade the deteriorated site.

HIGH LIME RANGE SITE

This site consists of deep, moderately permeable, gently sloping, calcareous loamy soils on uplands. The soils are associated with playas on the High Plains. The available water capacity is high. Water erosion is a slight to moderate hazard. High amounts of calcium carbonate in the surface layer create a severe hazard of soil blowing.

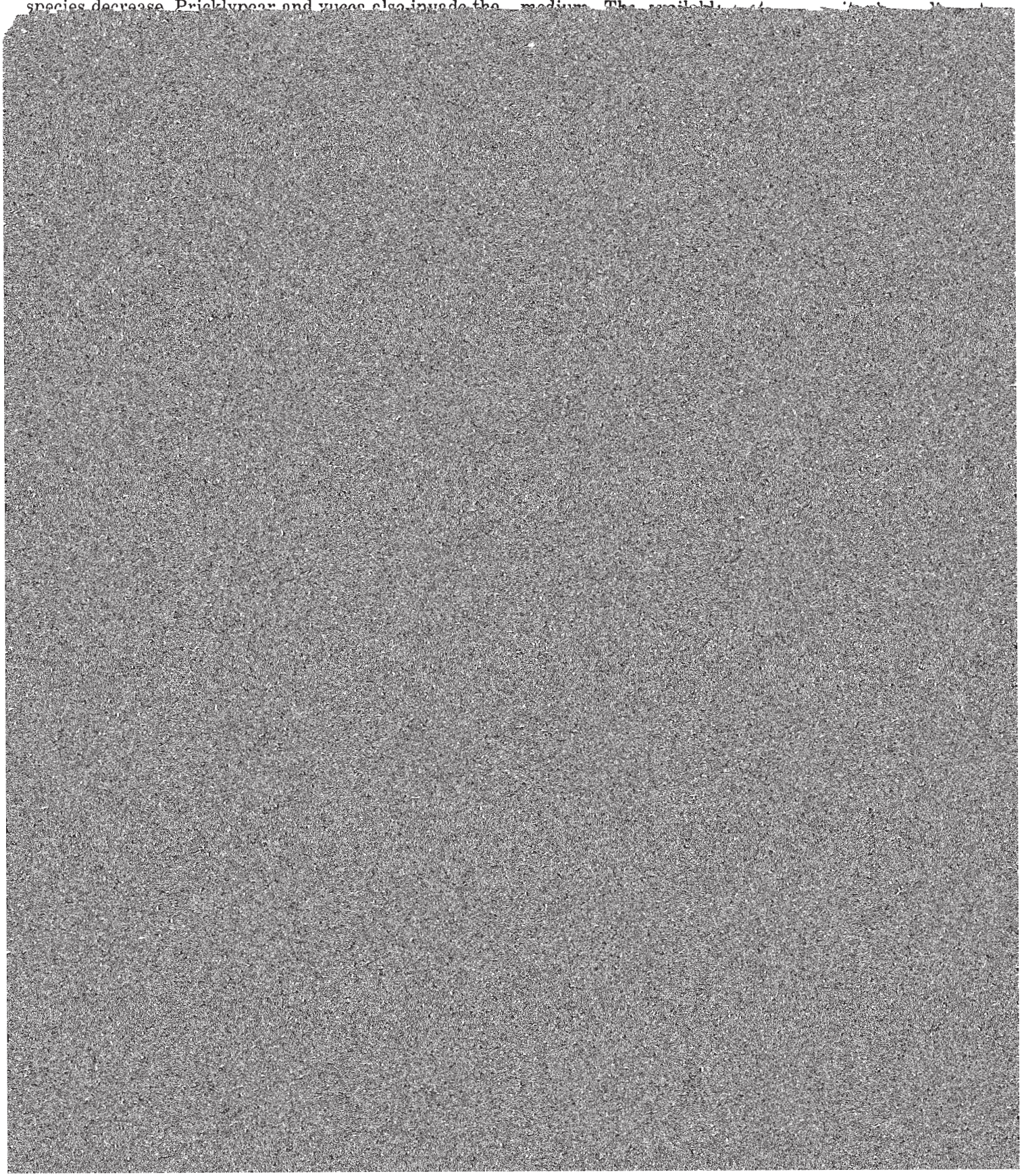
The climax vegetation is dominantly short and mid grasses. The composition by weight of this vegetation is 30 percent sideoats grama; 20 percent blue grama; 15 percent buffalograss; 5 percent switchgrass; 5 percent little bluestem; 5 percent other perennial grasses; 10 percent woody plants; and 10 percent perennial forbs.

If this site is in excellent condition, the total annual yield of air dry herbage is about 1,800 pounds per acre in favorable years and about 1,100 pounds in unfavorable years. Cattle graze the grasses and forbs and, on occasion, the woody species.

Continuous heavy grazing by cattle on this site results in a decrease or a disappearance of sideoats grama, blue grama, switchgrass, and little bluestem. Other species, including buffalograss, threeawn, sand

dropseed, and annual weeds increase as the other species decrease. Pricklypear and yucca also invade the

fine sandy loams on smooth uplands. Runoff is slow to medium. The available



15 percent little bluestem; 10 percent sand bluestem; 10 percent sideoats grama; 10 percent big sandreed; 5 percent switchgrass; 5 percent indiangrass; 5 percent sand dropseed; 5 percent needleandthread; 5 percent hairy grama; 5 percent perennial threeawn; 15 percent woody plants; and 10 percent perennial forbs.

If this site is in excellent condition, the total annual yield of air dry herbage is about 4,000 pounds per acre in favorable years and about 1,500 pounds in unfavorable years. Cattle graze most species of this herbage to some degree.

Continued heavy grazing by cattle on this site results in a decrease of switchgrass, indiangrass, little bluestem, and big sandreed. Other species, including sand dropseed, perennial threeawn, hairy grama, sand sagebrush, and annual forbs, increase under heavy grazing. Yucca invades the deteriorated site.

SANDY BOTTOMLAND RANGE SITE

This site consists of deep, rapidly permeable, nearly

yield of air dry herbage is about 2,400 pounds per acre in favorable years and about 1,600 pounds in unfavorable years. Cattle graze most species of this herbage to some degree.

Continued heavy grazing by cattle on this site results in a decrease of sideoats grama, blue grama, little bluestem, sand bluestem, indiangrass, and switchgrass. Other species, including buffalograss, sand dropseed, silver bluestem, hairy grama, threeawn, catclaw, sand sagebrush, and annual forbs, increase under heavy grazing. Mesquite, catclaw, and some annuals invade the deteriorated site.

SHALLOW CLAY RANGE SITE

This site consists of rolling land or gently sloping gullied land in redbed formations. Permeability is very slow. The soils are clayey and are very shallow and shallow. The site is very slow to recover, even under the best of management.

The climax vegetation is dominantly mid and short

increase under heavy grazing. Hairy tridens, redberry juniper, and some annuals invade the deteriorated site.

WET BOTTOMLAND RANGE SITE

This site consists of nearly level, moderately rapidly permeable soils along streambeds. Some areas are subject to frequent flooding and deposition. A high water table is at a depth of 8 to 14 inches most of the time.

Excellent vegetation is common when the site is properly managed. The climax vegetation is dominantly tall grasses and a small percentage of mid grasses. The composition by weight of the climax vegetation is 15

Production of fish is limited mainly to Rita Blanca Lake. Punta De Agua Creek and Rita Blanca Creek have several waterholes that contain various species of fish.

Soil ratings for wildlife habitat.—Soils directly influence kinds and amounts of vegetation and amounts of water available; and, in this way, they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are thickness of soil useful to crops, surface texture, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, flood hazard, slope,

TABLE 3.—*Interpretations of the soils for elements of wildlife habitat and for kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow water develop-ments	Openland	Rangeland	Wetland

TABLE 3.—*Interpretations of the soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow water developments	Openland	Rangeland	Wetland
Valentine: VA, VcE. For Spurlock part of VcE, see Spurlock series.	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Poor	Very poor.
Veal. Mapped in association with Berda and Mobeetie soils.	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Vingo: VDD. For Dallam part, see Dallam series.	Good	Good	Good	Poor	Very poor	Very poor	Good	Fair	Very poor.

create, improve, or maintain habitats on soils in this category.

The significance of each subheading in table 3 under "Elements of wildlife habitat" and "Kinds of wildlife" is given in the following paragraphs.

Elements of wildlife habitat.—In table 3 each soil is rated according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribu-

Submerged and floating aquatics are not included in this category.

Shallow water developments. These developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; other are permanent impoundments that grow submersed aquatics.

Kinds of wildlife.—In table 3 soils are rated according to their suitability as habitat for the three kinds of wildlife in the county—openland, rangeland, and wetland. These ratings are related to ratings made for the

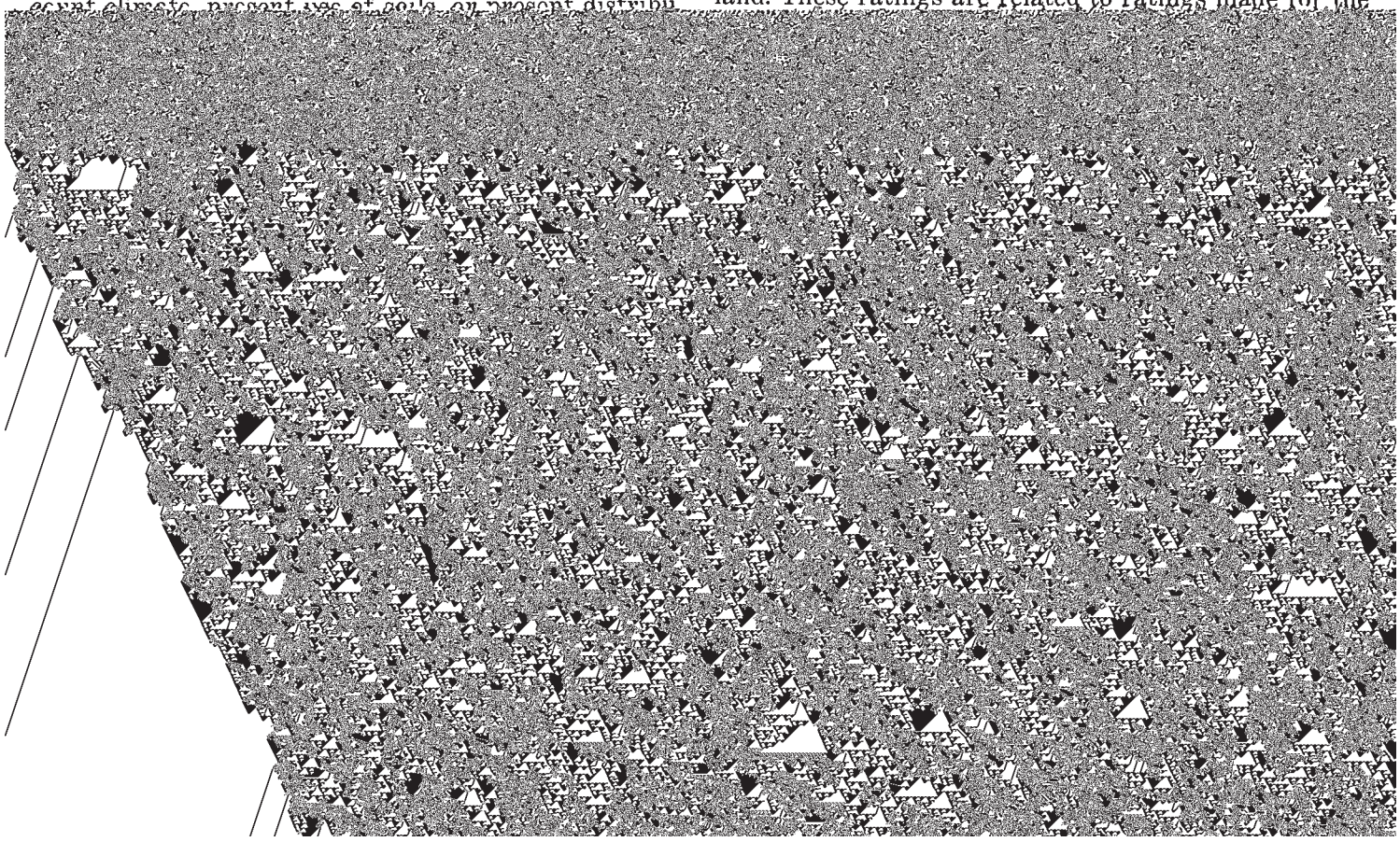


TABLE 4.—*Limitations of the soils for recreational development*

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Berda:				
BeC, BeD, BRD	Slight	Slight	Moderate: slope	Slight.
BpG For Veal part of BRD, see Veal series. For Potter part of BpG, see Potter series.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Bippus: BuA, BuB	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.
Colorado: Co	Severe: flooding	Moderate: flooding	Severe: flooding	Slight.
Conlen: CoB	Slight	Slight	Slight	Slight.
Dallam:				
DaB	Moderate: too sandy	Moderate: too sandy	Severe: too sandy	Moderate: too sandy.
DfA	Slight	Slight	Slight	Slight.
DfB, DfC	Slight	Slight	Moderate: slope	Slight.
Dumas:				
DuA	Slight	Slight	Slight	Slight.
DuB	Slight	Slight	Moderate: slope	Slight.
Glenrio: GkD For Knoco part, see Knoco series.	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Gracemore: Gm	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
Gruver: GrA, GrB	Moderate: percs slowly	Slight	Moderate: percs slowly	Slight.
Guadalupe: Gu	Severe: flooding	Moderate: flooding	Moderate: flooding	Slight.
Karde: KaB, KaC	Moderate: dusty	Moderate: dusty	Moderate: dusty, slope.	Moderate: dusty.
Knoco Mapped only in a complex with Glenrio soils.	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Likes: Lk	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
Lincoln: Ln	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
Mangum: Ma	Severe: flooding, too clayey.	Severe: too clayey	Severe: flooding, too clayey.	Severe: too clayey.

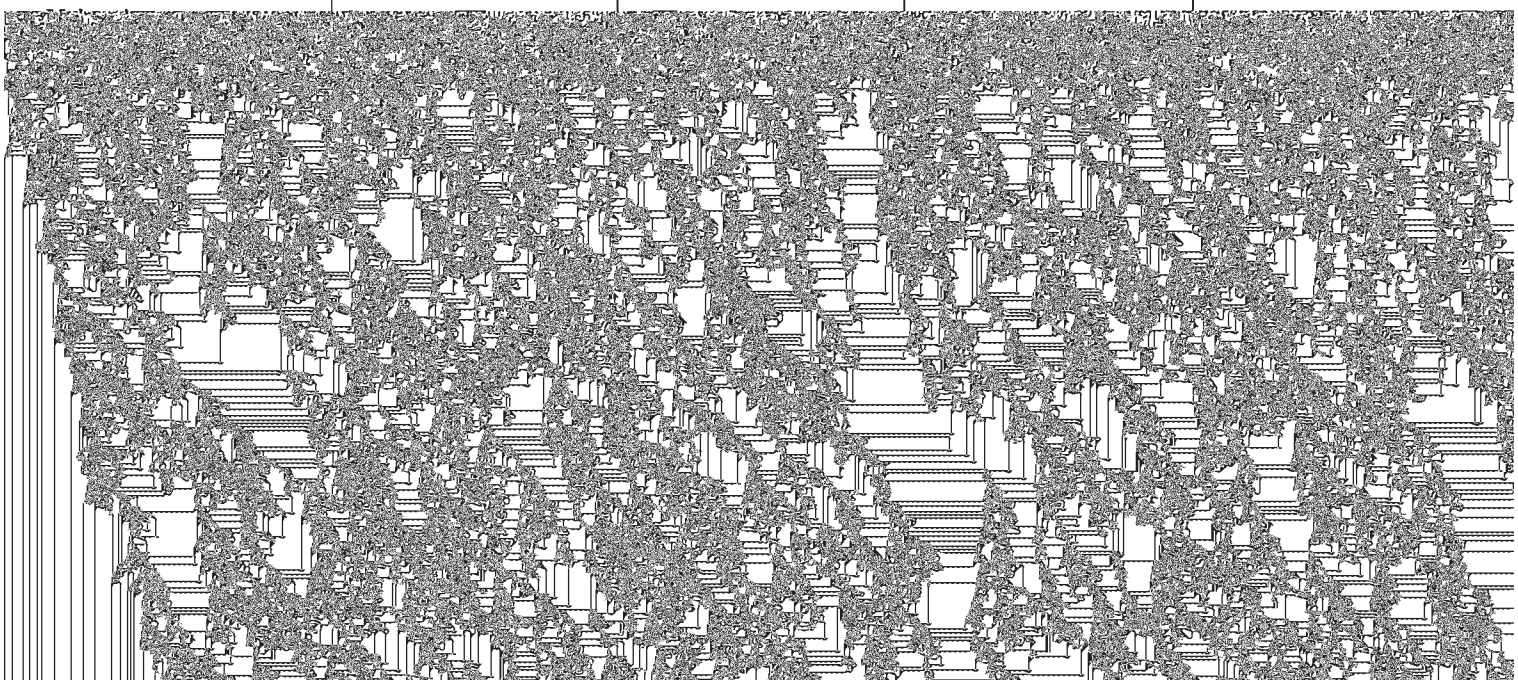
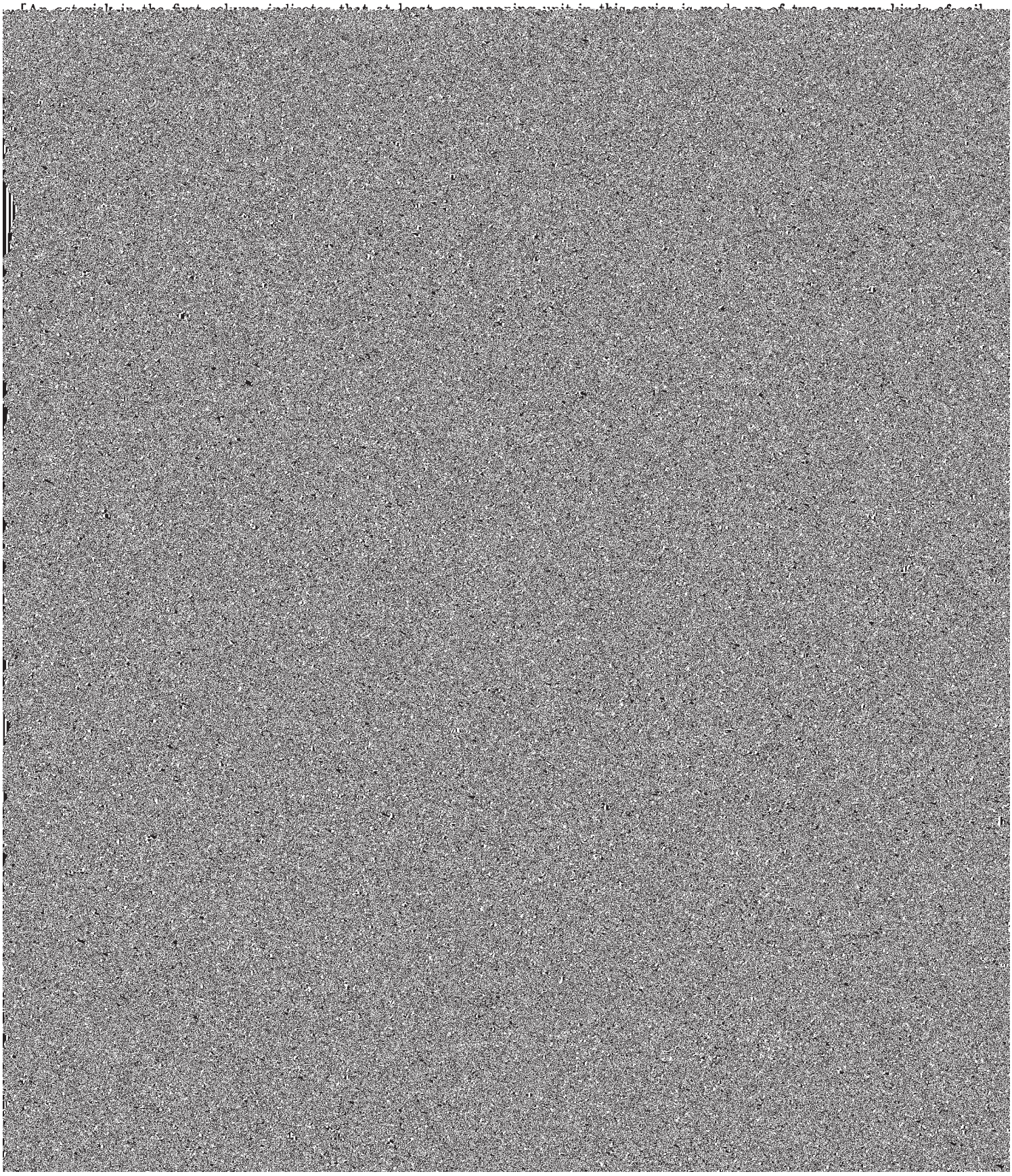


TABLE 4.—*Limitations of the soils for recreational development*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sunray: SuA, SuB	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.
Tascosa: TaE	Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
Valentine: VaE	Severe: too sandy	Severe: too sandy	[illegible]	[illegible]

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil



significant to engineering

The soils in such mapping units have different properties and limitations, and for this reason it is necessary to follow carefully a column indicates that characteristics are too variable for the material to be classified. < means less than]

Percentage passing seive—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
						Inches per hour	*In per in of soil*	*pH*		
90–100	85–100	80–95	36–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
95–100	95–100	80–95	38–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
100	95–100	85–98	40–80	22–40	8–20	0.6–2.0	0.15–0.20	7.9–8.4	Moderate	Moderate.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth from surface	USDA texture	Classification	
				Unified	AASHTO
Perico:					
PcB	B	0–8	Loamy fine sand	SM, or SM–SC	A–2–4 or A–4
		8–28	Sandy clay loam	CL or SC	A–6
		28–80	Clay loam	CL or SC	A–6
PeA, PeB, PeC	B	0–8	Fine sandy loam	SM or SM–SC	A–2 or A–4
		8–16	Sandy clay loam	CL or SC	A–6
		16–84	Clay loam	CL or SC	A–6
Potter: PoE	C	0–8	Loam	ML or CL, CL–ML	A–4 or A–6
		8–60	Caliche	GM, GC, SM, SC, SM–SC, GM–GC	A–2, A–4 or A–6
Rickmore:					
RcB	C	0–8	Loamy fine sand	SM or SM–SC	A–2–4 or A–4
		8–18	Sandy clay loam	CL	A–6 or A–7–6
		18–80	Clay loam	CL	A–6 or A–7–6
RkA	C	0–8	Fine sandy loam	SM or SM–SC	A–2 or A–4
		8–16	Sandy clay loam	CL	A–6 or A–7–6
		16–48	Clay loam	CL	A–6 or A–7–6
		48–85	Sandy clay loam	CL	A–6 or A–7–6
*San Jon: SaB, SgD. For Glenrio part of SgD, see Glenrio series.	B	0–60	Clay loam	CL, SC, CL–ML, or SM–SC	A–4 or A–6
Sherm: ShA	D	0–6	Clay loam	CL	A–6 or A–7–6
		6–36	Clay	CL or CH	A–7–6
		36–90	Clay loam	CL	A–6 or A–7–6
Spur: Sm	B	0–60	Loam	CL	A–6
Spurlock: SpB, SpC, SrB	B	0–10	Fine sandy loam	SM or SM–SC	A–2–4 or A–4
		10–16	Sandy clay loam	CL	A–4 or A–6
		16–88	Clay loam	CL	A–6
Sunray: SuA, SuB	B	0–18	Clay loam	CL	A–4 or A–6
		18–85	Clay loam	CL	A–6 or A–7–6
Tascosa: TaE	B	0–18	Gravelly loam, very gravelly	SP–SM, SM, GM, GC	A–1 or A–2

significant to engineering—Continued

Percentage passing seive—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
100	96–100	60–90	20–40	<20	NP–5	2.0–6.0	0.06–0.10	7.9–8.4	Very low	Moderate.
98–100	96–100	80–100	45–75	25–40	11–25	0.6–2.0	0.14–0.20	7.9–8.4	Moderate	Moderate.
98–100	96–100	80–100	45–75	25–40	11–25	0.6–2.0	0.14–0.20	7.9–8.4	Moderate	Moderate.
100	96–100	20–90	30–50	<25	NP–6	2.0–6.0	0.10–0.14	7.9–8.4	Low	Moderate.
98–100	96–100	80–100	45–75	25–40	11–25	0.6–2.0	0.14–0.20	7.9–8.4	Low	Moderate.
98–100	96–100	80–100	45–75	25–40	11–25	0.6–2.0	0.14–0.20	7.9–8.4	Low	Moderate.
80–95	70–90	60–85	51–70	25–40	5–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
80–90	65–75	30–60	12–50	25–40	5–15	0.6–2.0	0.01–0.04	7.9–8.4	Low	Moderate.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. instructions for referring to other series that appear in the first column of this table. "Shrink-swell"

Soil series and map symbols	Degree and kind of limitations for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills	Local roads and streets
*Berda:						
BeC, BeD	Slight	Moderate: slope; seepage.	Slight	Slight	Slight	Slight: low strength.
BpG	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
For interpretations of Potter part of BpG, see Potter series.						
BRD	Slight	Moderate: slope; seepage.	Slight	Slight	Slight	Slight
For interpretations of Veal part of BRD, see Veal series.						
Bippus:						
BuA	Slight	Moderate: seepage.	Moderate: cutbanks cave.	Moderate: low strength.	Moderate: too clayey.	Moderate: low strength.
BuB	Slight	Moderate: seepage.	Moderate: cutbanks cave.	Moderate: low strength.	Moderate: too clayey.	Moderate: low strength.
Colorado: Ca	Severe: floods	Moderate: seepage.	Severe: floods	Severe: floods	Severe: floods	Severe: floods
Conlen: CoB	Slight	Moderate: seepage.	Slight	Slight	Moderate: too clayey.	Moderate: low strength.
Dallam:						
DaB	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
DfA	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
DfB, DfC	Slight	Moderate: seepage; slope.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
Dumas:						
DuA	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
DuB	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
*Glenrio: GkD	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
For interpretations of Knoco part of GkD, see Knoco series.						
Gracemore: Gm	Severe: floods	Severe: floods; seepage.	Severe: floods	Severe: floods	Severe: floods	Severe: floods
Gruver:						
GrA	Moderate: percs slowly.	Slight	Moderate: too clayey.	Moderate: low strength; shrink-swell.	Moderate: too clayey.	Severe: low strength.

properties of the soils

The soils in such mapping units have different properties and limitations and for this reason it is necessary to follow carefully the and some of the other terms that describe restrictive soil features are defined in the Glossary]

Degree and kind of limitations for—Continued		Suitability as source of—		Soil features affecting—		
Pond reservoir areas	Dikes, levees and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Slope: erodes easily.	Favorable	Erodes easily.
Moderate: seepage.	Moderate: piping; erodes easily.	Poor: slope	Poor: slope	Slope: erodes easily.	Slope	Slope.
Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Slope: erodes easily.	Favorable	Erodes easily.
Moderate:	Moderate: pip-	Fair: low	Fair: too	Favorable	Favorable	Favorable

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills	Local roads and streets
GrB	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Moderate: low strength; shrink-swell.	Moderate: too clayey.	Severe: low strength.
Guadalupe: Gu	Severe: floods	Severe: floods; seepage.	Severe: floods	Severe: floods	Severe: floods	Moderate: floods.
Karde: KaB, KaC	Moderate: percs slowly.	Moderate: slope.	Slight	Moderate: shrink-swell.	Moderate: too clayey.	Moderate: shrink-swell.
*Knoco Mapped in complex with Glenrio soils.	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Likes: Lk	Slight	Severe: seepage.	Severe: cutbanks cave.	Slight	Severe: too sandy; seepage.	Slight
Lincoln: Ln	Severe: floods	Severe: floods; seepage.	Severe: floods; cutbanks cave.	Severe: floods	Severe: floods; seepage.	Severe: floods
Mangum: Ma	Severe: floods; percs slowly.	Severe: floods.	Severe: too clayey; floods.	Severe: floods; shrink-swell.	Severe: floods; too clayey.	Severe: floods; shrink-swell.
*Mobeetie:						
MoB, MoC	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.	Moderate: low strength.
MoD, MVD For Veal part of MVD, see Veal soils.	Slight	Severe: seepage.	Slight	Slight	Severe: seepage.	Moderate: low strength.
Ness: Ne	Severe: floods; percs slowly.	Severe: floods.	Severe: floods; too clayey.	Severe: floods; shrink-swell.	Severe: too clayey; floods.	Severe: shrink-swell.
Perico:						
PcB	Slight	Moderate: seepage; slope.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
PeA	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
PeB, PeC	Slight	Moderate: seepage; slope.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
Potter:						
PoE	Moderate: slope.	Severe: seepage.	Severe: cemented pan.	Moderate: low strength.	Severe: cemented pan.	Moderate: cemented pan; seepage.
Potter part of BpG	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Rickmore:						
RcB	Moderate: percs slowly.	Slight	Moderate: too clayey.	Moderate: low strength; shrink-swell.	Moderate: too clayey.	Moderate: low strength; shrink-swell.
RkA	Moderate: percs slowly.	Slight	Moderate: too clayey.	Moderate: low strength; shrink-swell.	Moderate: too clayey.	Moderate: low strength; shrink-swell.
*San Jon: SaB, SgD For interpretations of Glenrio part of SgD, see Glenrio series.	Moderate: percs slowly.	Moderate: seepage.	Slight	Moderate: shrink-swell.	Moderate: too clayey.	Moderate: shrink-swell.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as source of—		Soil features affecting—		
Pond reservoir areas	Dikes, levees and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Moderate:	Moderate:	Poor: low	Fair: too	Slope	Favorable	Favorable

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills	Local roads and streets
Sherm: ShA	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
Spur: Sm	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods
Spurlock: SpB, SpC, SrB	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Slight	Moderate: low strength.
Sunray:						
SuA	Slight	Moderate: seepage.	Slight	Moderate: low strength.	Moderate: too clayey.	Moderate: low strength.
SuB	Slight	Moderate: seepage; slope.	Slight	Moderate: low strength.	Moderate: too clayey.	Moderate: low strength.
Tascosa: TaE	Moderate: slope.	Severe: seepage; slope.	Severe: small stones.	Moderate: slope.	Moderate: slope.	Moderate: slope.
*Valentine: Va, VcE. For interpretations of Spurlock part of VcE, see Spurlock series.	Moderate: slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Slight
*Veal. Mapped in association with Berda and Mobeetie soils.	Slight	Severe: seepage.	Slight	Slight	Slight	Moderate: low strength.
*Vingo: VDD. For interpretations of Dallam part of VDD, see Dallam series.	Slight	Severe: slope; seepage.	Slight	Slight	Severe: seepage.	Moderate: low strength.

overlie nearly impervious material. These soils have a very slow rate of water transmission and a high runoff potential.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semi-solid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semi-solid to a plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in mmhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete. Salinity is not a concern in any of the soils in Hartley County.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, or the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to main-

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as source of—		Soil features affecting—		
Pond reservoir areas	Dikes, levees and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Fair: too clayey.	Slow intake	Favorable	Favorable.
Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Good	Floods	Not needed	Not needed.
Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: excess lime.	Slope: excess lime.	Pipng; erodes easily.	Slope; erodes easily.
Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Favorable	Erodes easily	Erodes easily.
Moderate: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Fair: too clayey.	Slope	Erodes easily	Erodes easily.
Severe: seepage.	Moderate: piping.	Good	Poor: small stones.	Not suited	Not suited	Not suited.
Severe: [illegible]	Severe: erodes [illegible]	Good	Poor: too [illegible]	Fast intake	Not suited	Not suited.

TABLE 7.—*Engineering*

[Tests performed by Texas Highway Department in accordance with standard procedures of the American Association of State

Soil name and location	Parent material	Texas report no.	Depth from surface	Shrinkage			Mechanical analysis [1]				
							Percentage passing sieve—				
				Limit	Linear	Ratio	2 in.	1¼ in.	⅞ in.	⅝ in.	⅜ in.
			Inches	*Percent*	*Percent*						
Berda loam: 2 miles south of Dalhart; 800 feet southeast of Rita Blanca Lake Dam. (Modal)	Calcareous loamy materials.	72–52–R	10–25	15	5.5	1.90	------	------	------	------	100
Conlen loam: 12 miles east of Dalhart; from intersection of Farm Road 281 and U.S. Highway 87; 12 miles east on Farm Road 281; 1 mile south and 0.25 mile west; then 100 feet north of railroad. (Modal)	Calcareous loamy materials.	72–53–R	0–10	15	8.8	1.85	------	------	------	------	------
		72–54–R	15–30	20	6.1	1.73	------	------	------	100	99
		72–55–R	30–80	13	10.2	1.95	------	------	------	------	------
Dallam fine sandy loam: In Dalhart from intersection of Farm Road 281 and U.S. Highway 87; 8.5 miles southeast on U.S. Highway 87; then 0.25 mile east on dirt road and 200 feet south of road. (Modal)	Calcareous loamy materials.	72–56–R	0–9	15	2.7	1.87	------	------	------	------	------
		72–57–R	9–28	15	7.6	1.89	------	------	------	------	------
		72–58–R	48–80	14	11.4	1.92	------	------	------	------	------
Dumas loam: 15 miles southwest and 4 miles west of Dalhart; from intersection of Farm Road 694 and U.S. Highway 54; 11 miles southwest on U.S. Highway 54; 4 miles west on county road and 100 feet north of road. (Modal)	Calcareous loamy materials.	72–62–R	0–10	15	6.0	1.85	------	------	------	------	------
		72–63–R	10–17	14	8.8	1.90	------	------	------	------	------
		72–64–R	22–36	14	7.4	1.93	------	------	------	------	------
		72–65–R	36–65	14	8.2	1.02	------	------	------	100	99
		72–66–R	65–85	13	7.3	1.95	------	------	------	------	100
Gruver loam: 4 miles west of Dalhart; from intersection of Farm Road 998 and U.S. Highway 54; 2.9 miles south on Farm Road 998 and 100 feet west of highway. (Modal)	Calcareous loamy and clayey materials.	72–67–R	0–8	15	7.9	1.87	------	------	------	------	------
		72–68–R	8–19	14	10.7	1.93	------	------	------	------	------
		72–69–R	60–78	15	7.7	1.86	------	------	------	------	------
		72–70–R	78–98	12	8.7	2.01	------	------	------	------	------

test data

Highway and Transportation Officials (AASHTO) (*1*). Absence of an entry indicates that no determination was made]

Mechanical analysis—Continued									Liquid limit [2]	Plasticity index [2]	Classification	
Percentage passing sieve—Continued					Percentage smaller than—							
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (.42 mm.)	No. 60 (.25 mm.)	No. 200 (.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHTO [3]	Unified [4]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 7.—*Engineering*

Soil name and location	Parent material	Texas report no.	Depth from surface	Shrinkage			Mechanical analysis [1]				
							Percentage passing sieve—				
				Limit	Linear	Ratio	2 in.	1¼ in.	⅞ in.	⅝ in.	⅜ in.
			Inches	*Percent*	*Percent*						
Guadalupe fine sandy loam: 13 miles south of Dalhart; from the intersection of Farm Road 998 and U.S. Highway 54; 13 miles south and 2.5 miles east on Farm Road 998 50 feet south of highway, 50 feet east of Rita Blanca Creek Channel. (Modal)	Calcareous loamy alluvium.	72–59–R	0–10	18	2.2	1.74	------	------	------	------	------
		72–60–R	10–21	16	5.3	1.85	------	------	------	------	------
		72–61–R	21–36	16	3.2	1.82	------	------	------	------	------
Spurlock fine sandy loam: 6.5 miles northeast of Channing; from intersection of U.S. Highway 385 and Farm Road 722; 0.8 mile east on Farm Road 722 and 100 feet north of road. (Modal)	Calcareous loamy materials.	72–79–R	0–8	15	3.8	1.85	------	------	------	------	------
		72–80–R	18–36	14	8.7	1.92	------	------	------	------	100
		72–81–R	54–88	12	9.0	1.98	------	------	------	------	------
Sunray clay loam: 1.5 miles west of Exum; from intersection of Farm Road 281 and Farm Road 2577; 4.5 miles east on Farm Road 281 and 100 feet south of road. (Modal)	Calcareous loamy materials.	72–71–R	0–8	15	5.5	1.90	------	------	------	------	------
		72–72–R	18–30	16	8.7	1.86	------	------	------	------	------
		72–73–R	30–43	13	7.5	1.96	------	------	------	------	100
		72–74–R	43–52	13	13.0	1.96	------	------	------	------	100
		72–75–R	52–85	12	7.4	2.00	------	------	------	------	------
Tascosa gravelly loam: 13 miles west and 4.5 miles south of Channing; from intersection of Farm Road 767 and Farm Road 2357; 9 miles west on Farm Road 767, then 4.5 miles south on ranch road and 0.5 mile west on ridge. (Modal)	Gravelly outwash materials.	72–76–R	0–6	25	7.7	1.56	100	80	68	64	56
		72–77–R	18–50	22	6.2	1.66	100	83	65	57	50
		72–78–R	50–80	19	5.5	1.75	100	93	87	76	60

[1] Mechanical analysis according to the AASHTO Designation T88 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service(SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size

test data—Continued

Mechanical analysis—Continued									Liquid limit [2]	Plasticity index [2]	Classification	
Percentage passing sieve—Continued					Percentage smaller than—							
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (.42 mm.)	No. 60 (.25 mm.)	No. 200 (.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHTO [3]	Unified [4]
------	100	99	85	17	11	------	6	4	21	4	A-2-4(0)	SM-SC
------	100	98	86	40	32	------	20	14	25	10	A-4(1)	SC
------	100	97	82	28	22	------	13	9	22	5	A-2-4(0)	SM-SC
------	100	98	------	24	------	------	------	------	21	5	A-2-4(0)	SM-SC
99	97	95	------	72	------	------	------	------	31	17	A-6(10)	CL
100	99	98	------	72	------	------	------	------	29	17	A-6(10)	CL
------	100	97	------	52	------	------	------	------	24	9	A-4(3)	CL
100	99	96	------	63	------	------	------	------	32	17	A-6(8)	CL
99	98	93	------	54	------	------	------	------	26	14	A-6(5)	CL
98	98	97	------	77	------	------	------	------	40	26	A-6(14)	CL
------	100	98	------	51	------	------	------	------	25	14	A-6(5)	CL
46	39	30	------	18	------	------	------	------	42	13	A-2-7(0)	GM
41	35	24	------	12	------	------	------	------	35	13	A-2-6(0)	GP-GC
48	41	18	------	6	------	------	------	------	30	12	A-2-6(0)	GP-GC

fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[2] Laboratory test procedures may cause minor discrepancies in shrinkage limit, liquid limit, and the computed plasticity index.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO designation M 145-49.

[4] Based on the Unified Soil Classification System (*2*).

depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow on effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor; and it has sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones and content of or

for these structures provides outlets for runoff and is not difficult to vegetate.

Waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Soil test data

Table 7 contains engineering test data for some of the major soil series in Hartley County. These tests

Living organisms

Plants, micro-organisms, earthworms, and other forms of animal life are important in the formation of soils. The kinds and amounts of plants are determined partly by the climate and parent material. The vegetation in this county is mostly grass, but there are some brushy plants. The grasses are tall or short, depending on the kind of parent material. Vingo soils, which have sandy parent material, support tall grasses; and Sherm clay loam, which has a parent material much higher in clay content, supports short grasses.

Time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. A long time generally is required for the formation of well-defined, genetically related horizons. Gruver and Dumas soils are examples of those soils that have been in place a long time and have approached equilibrium with their environment. They are mature soils and show marked horizon differentiation. Examples of young soils that have a weakly developed profile are Colorado soils on bottom lands and Berda soils on slopes below the caprock escarpment.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics, assemble knowledge about them, see their relationship to one another and to the whole environment, and develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land (*14*).

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and range; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was readers interested in developments of the current system should search for the latest literature available.

The current system of classification has six categories (*16*). Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties (*15*) that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. In table 8, the soil series of Hartley County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates.

The six orders to which the soils of Hartley County belong are Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols have a light-colored surface layer low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent.

Aridisols have a light-colored surface layer low in organic matter, and have inadequate moisture to mature a crop without irrigation in most years.

Entisols have little or no evidence of development of pedogenic horizons.

Inceptisols have a light-colored surface layer low in

organic matter, and have a base saturation of more than 50 percent.

Vertisols are clayey soils that have deep, wide cracks part of each year in most years.

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties

8.37 inches fell. Warm-season rainfall occurs most frequently as a result of thunderstorms. In exceptionally wet years, a significant proportion of the total rainfall may be in the form of excessive downpours that run off rapidly and erode the soil. In an average year, thunderstorms occur on 50 days.

Winds are south to southwesterly throughout the year, but in winter northerly winds predominate. The mean relative humidity at noon is estimated at 45 percent in January, 35 percent in April, 42 percent in July, and 37 percent in October. The mean percentage of total possible sunshine is estimated at 69 percent in winter, 71 percent in spring, 77 percent in summer, and 74 percent in fall. In an average year, free water evaporation exceeds precipitation by 44 inches.

In winter Hartley County is subject to sharp drops in temperature when cold polar Canadian air masses sweep southward across the level plains. Sometimes these air mass changes are accompanied by strong northerly winds. Although temperatures are low oc-

TABLE 9.—*Temperature and*

[Data from Dalhart, Texas; elevation

	Temperature					Precipitation	
						Probability, in percent, of receiving	

precipitation data

3,989 feet. Period of record 1949–69]

Precipitation—Continued									
Probability, in percent, of receiving selected amounts during month—Continued					Mean number of days			Snow, sleet	
3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more	0.10 inch or more [2]	0.50 inch or more [2]	1.00 inch or more [2]	Mean total [1]	Maximum monthly [1]	Greatest depth [3]

million acres from the Oklahoma State line to near ... (7) Johnston, C. S. and D. E. Savage. 1955-56. A survey of

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate

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. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Dryfarming. Production of crops that require some tillage in a

material is sandy, loamy, or clayey and is cemented by iron

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.

Inherited soil characteristic. Any characteristic of a soil that results directly from the nature of the soil material from which it formed, as contrasted to characteristics that are wholly or partly the result of soil-forming processes acting on parent material. For example, some soils are red because the parent material was red, but the color of most red soils is the result of the soil-forming processes.

Intensive cropping. Maximum use of the land through the frequent growing of harvested crops.

Intermittent stream. A stream or part of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources.

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

Invasion (ecology). The movement of a plant or group of plants from one area into another and their establishment in the new area. The process involves migration, establishment, and finally, competition.

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.

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.

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

Land leveling. The reshaping of the ground surface to make for a more uniform application of irrigation water.

Landscape. All the characteristics that distinguish a certain kind of area on the earth's surface and give it a distinguishing pattern, in contrast to other kinds of areas. Any one kind of soil is said to have a characteristic natural land-

Mature soil. Any soil with well-developed soil horizons having characteristics produced by the natural processes of soil formation and in near equilibrium with its present environment.

Mechanical analysis (soils). The percentage of the various sizes of individual mineral particles, or separates, in the soil. Also, a laboratory method of determining soil texture.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Micro-organisms. Forms of life that are either too small to be seen with the unaided eye or are barely discernible.

Microrelief. Minor surface configurations of the land.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when wet.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Normal soil. A soil having a profile near equilibrium with its environment; developed under good but not excessive drainage from parent material of mixed mineral, physical, and chemical composition. Its characteristics show the full effects of the forces of climate and living matter.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium. calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Organic matter. A general term for plant and animal material, in or on the soil in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of decomposition.

Overgrazing. Grazing so heavy as to impair future forage production and to deteriorate plants or soil, or both. Contrasts with undergrazing.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permanent pasture. Pasture that is on the soil for a long time, in contrast to rotation pasture, which is on the soil only a year or two because it is grown in rotation with other crops.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the 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 to 2.0 inches), moderately rapid. (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore space. That fraction of the total space in a soil that is not occupied by solid particles.

Porosity, soil. The degree to which the soil mass is permeated

Rotation grazing. Grazing two or more pastures, or parts of a range, in regular order, with definite recovery periods between grazing periods. Contrasts with continuous grazing.

Row crop. A crop planted in rows, generally 2 to 4 feet apart, so as to allow cultivation between rows during the growing season.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

in mature 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 other plant and animal life characteristics of the soil are largely confined to the solum.

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

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

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

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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, to provide protection 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.

Subgrade (engineering). The substratum, consisting of in-place material or fill material, that is prepared for highway construction; does not include stabilized base course or actual paving material.

Subgrade modulus (engineering). The resistance of soil material to unit area displacement under load, expressed in pounds per square inch. Hence, if a load of 1,000 pounds, on 100 square inches of surface, penetrates 1 inch, the modulus is 10.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface tillage. Tillage with a sweeplike plow or blade that does not turn over the surface cover or incorporate it into the lower part of the surface soil.

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

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, 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. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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

Unstable fill. Risk of caving or sloughing in banks of fill material.

Value (color). One of the three variables of color. Value increases as the relative intensity of reflected light increases. See Munsell notation.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windbreak. Any shelter that protects from the wind. A vegetative windbreak is a strip of closely spaced trees that is planted primarily to deflect wind currents and thereby reduce soil blowing, control snow drifting, conserve moisture, and protect crops, orchards, livestock, and buildings.

Wind stripcropping. Growing crops in strips that run crosswise to the general direction of prevailing wind and without adherence to the contour of the land.

Yield, sustained. The yield obtained when the productive capacity of soils is maintained through management.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, read the description then check its mapping unit for recommendations on use and management. For information about a range site, read the range site description and the introduction to the range section on pages 33 to 38. For facts about wildlife and recreation, turn to the sections beginning on pages 38 and 40, respectively. Absence of data in the column on irrigated capability units means the soil is not suited to irrigation.

Map symbol	Mapping unit	Page	Capability unit Dryland Symbol	Capability unit Irrigated Symbol	Range site Name
BeC	Berda loam, 3 to 5 percent slopes	8	IVe-4	IVe-2	Hardland Slopes
BeD	Berda loam, 5 to 8 percent slopes	9	VIe-4	------	Hardland Slopes
BpG	Berda-Potter complex, 15 to 50 percent slopes	9	VIIe-1	------	Rough Breaks
BRD	Berda-Veal association, undulating	9	VIe-4	------	----------
	Berda part	--	------	------	Hardland Slopes
	Veal part	--	------	------	Mixedland Slopes
BuA	Bippus clay loam, 0 to 1 percent slopes	11	IIe-1	IIe-1	Draw
BuB	Bippus clay loam, 1 to 3 percent slopes	11	IIIe-6	IIIe-1	Draw
Ca	Colorado loam	11	IIe-1	IIe-1	Loamy Bottomland
CoB	Conlen loam, 0 to 3 percent slopes	12	IVe-2	IIIe-4	Hardland Slopes
DaB	Dallam loamy fine sand, 0 to 3 percent slopes	13	IVe-1	IIIe-3	Loamy Sand
DfA	Dallam fine sandy loam, 0 to 1 percent slopes	13	IIIe-1	IIe-3	Sandy Loam
DfB	Dallam fine sandy loam, 1 to 3 percent slopes	13	IIIe-5	IIIe-2	Sandy Loam
DfC	Dallam fine sandy loam, 3 to 5 percent slopes	13	IVe-3	IVe-2	Sandy Loam
DuA	Dumas loam, 0 to 1 percent slopes	14	IIIe-3	IIe-2	Clay Loam
DuB	Dumas loam, 1 to 3 percent slopes	15	IIIe-6	IIIe-1	Clay Loam
GkD	Glenrio-Knoco complex, 3 to 12 percent slopes	15	VIIs-1	------	Shallow Clay
Gm	Gracemore soils	16	Vw-1	------	Wet Bottomland
GrA	Gruver loam, 0 to 1 percent slopes	16	IIIe-3	IIe-2	Clay Loam
GrB	Gruver loam, 1 to 3 percent slopes	17	IIIe-6	IIIe-1	Clay Loam
Gu	Guadalupe fine sandy loam	17	IIIe-2	IIe-4	Loamy Bottomland
KaB	Karde soils, 1 to 3 percent slopes	18	IVe-5	IIIe-5	High Lime
KaC	Karde soils, 3 to 5 percent slopes	18	VIe-3	IIIe-5	High Lime
Lk	Likes loamy fine sand	19	VIe-1	------	Loamy Sand
Ln	Lincoln soils	19	Vw-1	------	Sandy Bottomland
Ma	Mangum clay	19	IIIw-1	IIIw-1	Clay Flat
MoB	Mobeetie fine sandy loam, 1 to 3 percent slopes	20	IIIe-5	IIIe-2	Mixedland Slopes
MoC	Mobeetie fine sandy loam, 3 to 5 percent slopes	20	IVe-3	IVe-2	Mixedland Slopes
MoD	Mobeetie fine sandy loam, 5 to 8 percent slopes	20	VIe-2	------	Mixedland Slopes
MVD	Mobeetie-Veal association, undulating	20	VIe-2	------	Mixedland Slopes
Ne	Ness clay	21	VIw-1	------	(1/)
PcB	Perico loamy fine sand, 0 to 3 percent slopes	21	IVe-1	IIIe-3	Loamy Sand
PeA	Perico fine sandy loam, 0 to 1 percent slopes	22	IIIe-1	IIe-3	Mixedland Slopes
PeB	Perico fine sandy loam, 1 to 3 percent slopes	22	IIIe-5	IIIe-2	Mixedland Slopes
PeC	Perico fine sandy loam, 3 to 5 percent slopes	22	IVe-3	IVe-2	Mixedland Slopes
PoE	Potter soils, 3 to 15 percent slopes	23	VIIs-1	------	Very Shallow
RcB	Rickmore loamy fine sand, 0 to 3 percent slopes	23	IVe-1	IIIe-3	Loamy Sand
RkA	Rickmore fine sandy loam, 0 to 1 percent slopes	23	IIIe-1	IIe-3	Sandy Loam
SaB	San Jon clay loam, 1 to 3 percent slopes	24	VIe-5	IIIe-1	Clay Loam
SgD	San Jon-Glenrio complex, 3 to 8 percent slopes	24	VIe-5	------	----------
	San Jon part	--	------	------	Clay Loam
	Glenrio part	--	------	------	Shallow Clay
ShA	Sherm clay loam, 0 to 1 percent slopes	25	IIIe-4	IIs-1	Clay Loam
Sm	Spur loam	26	IIe-1	IIe-1	Draw
SpB	Spurlock fine sandy loam, 0 to 3 percent slopes	26	IVe-2	IIIe-4	Mixedland Slopes
SpC	Spurlock fine sandy loam, 3 to 5 percent slopes	26	IVe-4	IVe-3	Mixedland Slopes
SrB	Spurlock soils, undulating	27	IVe-2	IIIe-4	Mixedland Slopes
SuA	Sunray clay loam, 0 to 1 percent slopes	27	IIIe-3	IIe-2	Clay Loam
SuB	Sunray clay loam, 1 to 3 percent slopes	28	IIIe-6	IIIe-1	Clay Loam

GUIDE TO MAPPING UNITS--Continued

Map		Capability unit		Range site
		Dryland	Irrigated	
		Symbol	Symbol	Name

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