

# SOIL SURVEY

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## **Jim Hogg County Texas**

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UNITED STATES DEPARTMENT OF AGRICULTURE  
Soil Conservation Service  
In Cooperation with  
TEXAS AGRICULTURAL EXPERIMENT STATION  
Issued November 1974

Major fieldwork for this soil survey was done in the period 1958-68. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Monte Mucho Soil and Water Conservation District.

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

## HOW TO USE THIS SOIL SURVEY

**T**HIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

### Locating Soils

All the soils of Jim Hogg County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

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

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability.

For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites and capability groups.

*Ranchers and others* can find under "Use of the Soils as Range," groupings of the soils according to their suitability for range and the names of many of the plants that grow on each range site.

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

*Community planners and others* can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Engineering Uses of the Soils."

*Engineers and builders* can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

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

*Newcomers in the county* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the sections, "Additional Facts About the County."

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# SOIL SURVEY OF JIM HOGG COUNTY, TEXAS

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

**J**IM HOGG COUNTY is in the southern part of Texas (fig. 1). It has a total area of 1,145 square miles, or 732,800 acres. The population is about 5,000. Hebbronville, the county seat, has about 4,000 people. Average annual rainfall is about 18.5 inches, and average annual temperature is about 73 degrees.

This county is in the Rio Grande Plains. The soils of the county are mostly nearly level to gently sloping and gently undulating.

Ranching is of foremost importance. Cattle are the main kind of livestock. Deer, quail, dove, javelinas, and some turkeys are common on rangeland.

About 10,000 acres of the county is cultivated. About 2,000 acres of this is used for irrigated farming, and the rest is dry farmed. Watermelons, grain sorghum, and forage sorghum are the main crops grown.

Production of oil and natural gas contributes much to the economy of the county.

Potential land use probably will remain about the same as at present use unless more irrigation water becomes available.

## *How This Survey Was Made*

Soil scientists made this survey to learn what kinds of soil are in Jim Hogg 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 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, in arrangement, and in 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. Hebbronville and Randado, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the natural undisturbed landscape.

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not

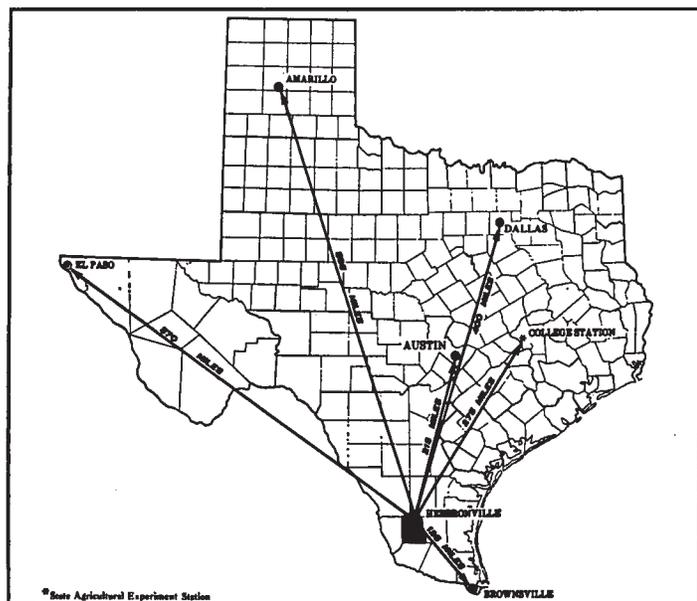


Figure 1.—Location of Jim Hogg County in Texas.

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. Two such kinds of mapping units are shown on the soil map of Jim Hogg County. These are soil associations and undifferentiated groups.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort needed to delineate them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Nueces-Sarita association is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the name of the dominant soil. Tela soils is an example.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Dune land is a land type in Jim Hogg County.

In Jim Hogg County the soil survey is a survey of undifferentiated soil groups and soil associations rather than soil phases. The number of observations made in the survey was fewer than in most surveys.

## General Soil Map

The general soil map at the back of this survey shows the soil associations in Jim Hogg 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 the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The seven soil associations in this county are described in the following pages. The terms for texture used in the title for the associations apply to the surface layer.

### 1. *Delmita association*

*Nearly level to gently sloping and gently undulating, moderately deep fine sandy loams and loamy fine sands*

This association is in broad, irregular areas (fig. 2) and makes up about 35 percent of the county. Delmita soils account for about 80 percent of this association. Less extensive areas of the Comititas, Cuevitas, Delfina, Nueces, Sarita, and Tela soils make up about 20 percent.

The Delmita soils have a surface layer of yellowish-red and reddish-brown, neutral fine sandy loam that is about 13 inches thick. The next layer is yellowish-red fine sandy loam that is about 10 inches thick. Beneath this is a layer of yellowish-red sandy clay loam about 8 inches thick. The underlying material is indurated white caliche.

Most of the Delmita association is used for range. It is suited to wildlife and produces many kinds of desirable forage for deer, quail, and dove. A small part of this association is cultivated to both dryland and irrigated crops. Soil blowing is a problem in cultivated areas. The thick caliche under these soils is used in roadbuilding, both as road base and as roadbed.

### 2. *Nueces-Sarita association*

*Nearly level and gently undulating, deep fine sands*

This association is in broad, irregular areas (fig. 3) and makes up about 34 percent of the county. Nueces soils account for about 45 percent of the association, and Sarita soils about 33 percent. Less extensive areas of Delmita and Falfurrias soils and Dune land make up about 22 percent.

Nueces soils have 34 inches of fine sand that is brown in the upper part and light yellowish brown in the lower part. The lower layers are grayish-brown and light brownish-gray sandy clay loam.

Sarita soils have a layer of fine sand about 46 inches deep. The upper 14 inches is brown, the next 21 inches is light brown, and the lower 11 inches is very pale brown. The next lower layer, extending to a depth of 75 inches, is sandy clay loam. It is light brownish gray in the upper part and light brown in the lower part.

All of this association is in range. It produces many kinds of desirable forage for livestock, deer, dove, and quail.

### 3. *Falfurrias-Sarita association*

*Nearly level to gently sloping and gently undulating, deep fine sands*

This association occupies broad, irregular and elongated areas and makes up about 7 percent of the county. Falfurrias soils form about 66 percent of this association, and Sarita soils 24 percent. Dune land and Nueces soils account for about 10 percent.

Falfurrias soils have a grayish-brown and light brownish-gray fine sand surface layer about 20 inches thick. The next layer is light brownish-gray fine sand about 14 inches thick. The underlying material, extending to a depth of 90 inches, is very pale brown fine sand.

Sarita soils have a fine sand layer about 46 inches thick. The upper 14 inches is brown, the next 21 inches is light brown, and the lower 11 inches is very pale brown. The next layer is sandy clay loam that is 29 inches thick. It is light brownish gray in the upper part

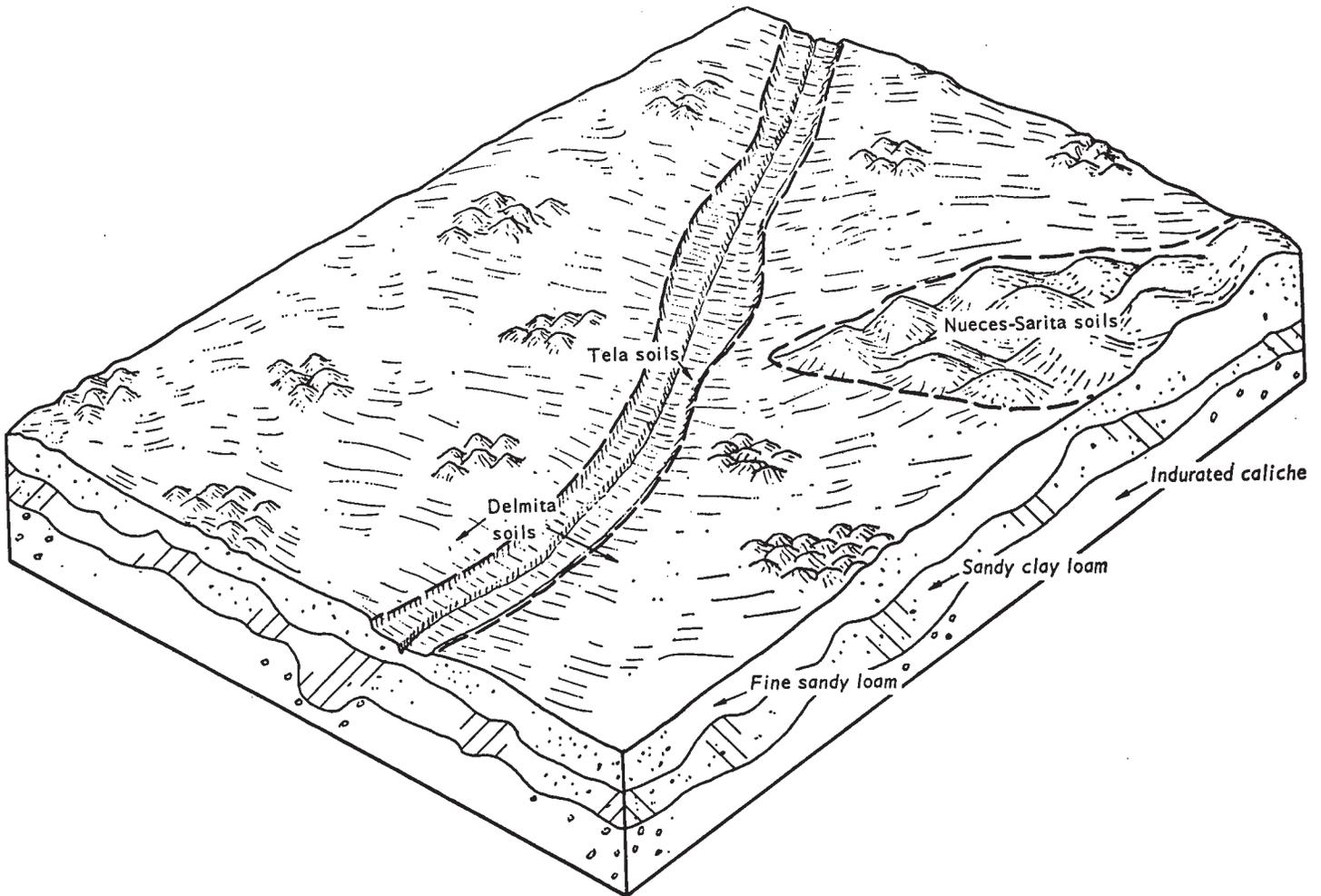


Figure 2.—Relation of soils and underlying material in the Delmita association.

and light brown in the lower part. The underlying material, extending to a depth of 90 inches, is very pale brown fine sandy loam.

All of this association is in range. It produces many kinds of desirable forage for livestock, deer, dove, quail, and a few turkeys.

#### 4. Brennan-Hebbronville association

*Nearly level to gently sloping and gently undulating, deep fine sandy loams and loamy fine sands*

This association is in irregular areas and makes up about 6 percent of the county. Brennan soils account for about 70 percent of this association, and Hebbronville soils about 15 percent. The other 15 percent is made up of Comitas and Copita soils.

The Brennan soils have a grayish-brown and dark grayish-brown fine sandy loam surface layer about 12 inches thick. The lower layers are sandy clay loam. They are grayish brown in the upper part, yellowish brown in the middle part, and very pale brown in the lower part.

Hebbronville soils have a surface layer of pale-brown and brown loamy fine sand that is about 15 inches thick. The lower layers are fine sandy loam. They are brown

in the upper part, light yellowish brown in the middle part, and very pale brown in the lower part.

Most of this association is used for range; only a small part is cultivated. It is suited to wildlife and produces many kinds of desirable forage for deer, quail, and dove.

#### 5. Copita-Brennan association

*Nearly level to gently sloping, deep fine sandy loams*

This association occupies irregular areas (fig. 4) and accounts for 6 percent of the county. Copita soils make up about 60 percent of this association, Brennan soils 30 percent, and less extensive areas of the Hebbronville, Tela, and Zapita soils about 10 percent.

Copita soils have a 16-inch surface layer of brown fine sandy loam. The next lower layer, about 17 inches thick, is brown sandy clay loam. The next lower layer is light yellowish-brown fine sandy loam.

Brennan soils have a surface layer of grayish-brown and dark grayish-brown fine sandy loam that is about 12 inches thick. The lower layers are sandy clay loam. They are grayish brown in the upper part, yellowish brown in the middle part, and very pale brown in the lower part.

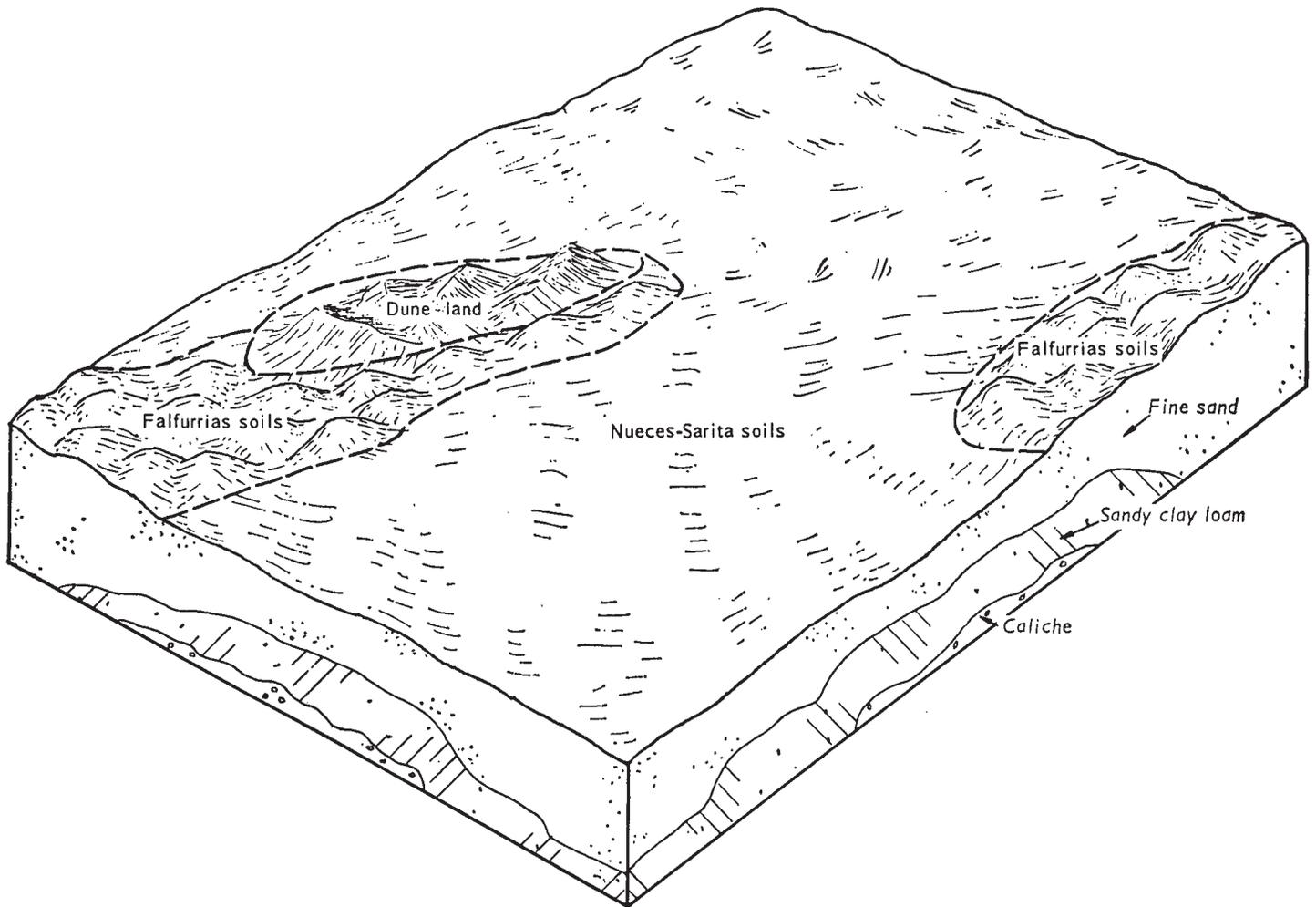


Figure 3.—Relation of soils and underlying material in the Nueces-Sarita association.

Although a small part of this association is cultivated, most of it is used for range. It is suited to wildlife and produces many kinds of desirable forage for deer, quail, and dove.

#### 6. Cuevitas-Randado-Zapata association

*Nearly level to gently sloping and gently undulating, very shallow to shallow fine sandy loams*

This association is in irregular to elongated areas that make up about 6 percent of the county. Cuevitas soils account for about 36 percent of this association, Randado soils 29 percent, and Zapata soils 12 percent. Soils of the Copita and Delmita series form the other 23 percent.

Cuevitas soils have a surface layer of brown and reddish-brown fine sandy loam about 9 inches thick. The underlying material is indurated white caliche.

Randado soils have an 8-inch surface layer of reddish-brown fine sandy loam. The next layer, about 8 inches thick, is yellowish-red fine sandy loam. The underlying material is indurated caliche.

Zapata soils have a surface layer of grayish-brown

and brown fine sandy loam and sandy clay loams about 8 inches thick. Below this is indurated caliche.

All of this association is in range. It is suited to wildlife and produces some desirable forage for deer and quail. The thick caliche underlying these soils is used in roadbuilding, both as road base and as roadbed.

#### 7. Comitas association

*Nearly level to gently sloping and gently undulating, deep loamy fine sands*

This association is in irregular to elongated areas that make up about 6 percent of the county. Comitas soils make up about 80 percent of the association. Less extensive soils of the Delfina, Hebronville, Nueces, and Sarita series make up 20 percent.

Comitas soils have a 31-inch surface layer of brown loamy fine sand. The next layer, extending to a depth of 87 inches, is fine sandy loam that is brown in the upper part and light brown in the lower part.

Most of this association is in range, but a small part is cultivated to dryland and irrigated crops. It is suited to wildlife and produces many kinds of desirable forage for deer, quail, and dove.

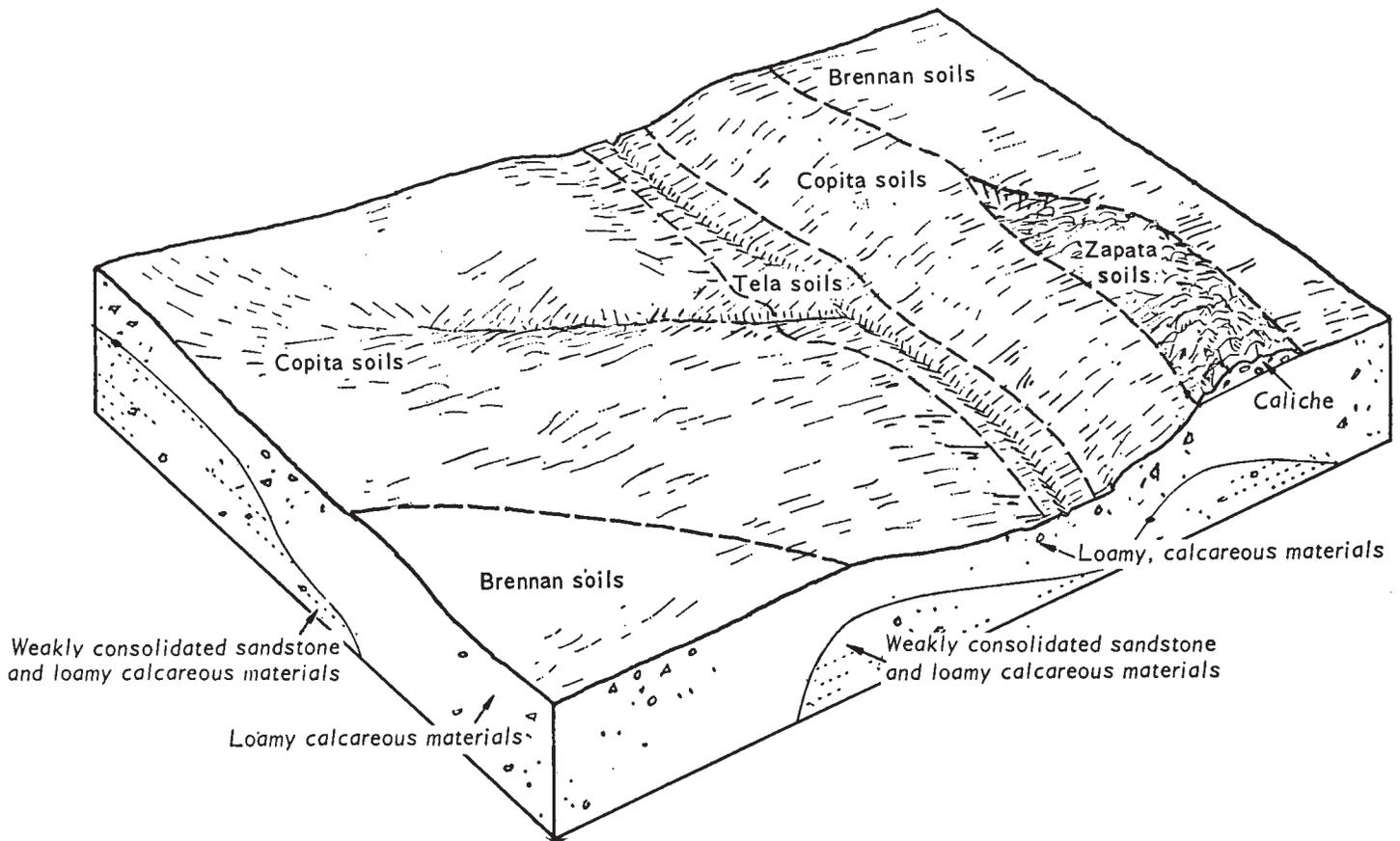


Figure 4.—Relation of soils and underlying material in the Copita-Brennan association.

## Descriptions of the Soils

In this section the soils of Jim Hogg County are described in detail and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, information 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 from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described for the soil series is representative for the mapping units in that series. Colors are for dry soil unless otherwise noted. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil

series. Dune land, for example, does not belong to a soil series, but it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit is the capability unit and range site in which the mapping unit has been placed. The "Guide to Mapping Units" at the back of this survey gives the page for the description of each range site.

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 Survey Manual.<sup>1</sup>

## Brennan Series

The Brennan series consists of deep, nearly level to gently sloping soils that formed in loamy, calcareous material.

In a representative profile, the surface layer is grayish-brown and dark grayish-brown fine sandy loam about 12 inches thick. Below this layer, in sequence, are about

<sup>1</sup> United States Department of Agriculture. 1951. *Soil Survey Manual*. U.S. Dept. Agr. Handbook 18, 503 pp. illus.

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

Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>
Brennan soils.....	51,174	7.0
Comitas soils.....	40,257	5.5
Copita soils.....	36,914	5.0
Cuevitas-Randado association.....	29,156	4.0
Delfina association.....	6,061	.8
Delmita soils.....	116,761	15.9
Delmita association.....	115,982	15.8
Dune land.....	5,665	.8
Falfurrias association, gently sloping.....	53,707	7.3
Garceno soils.....	5,520	.7
Hebbronville soils.....	7,161	1.0
Nueces-Sarita association.....	236,640	32.3
Oil-waste land.....	467	.1
Randado-Delmita association.....	12,939	1.8
Tela soils.....	9,647	1.3
Zapata soils, gently sloping.....	4,749	.7
Total.....	732,800	100.0

14 inches of grayish-brown, friable sandy clay loam, and 25 inches of yellowish-brown, calcareous sandy clay loam. The next lower layer is very pale brown sandy clay loam 14 inches thick. The underlying material, extending to a depth of 80 inches, is very pale brown, calcareous fine sandy loam.

These soils are well drained and have a high available water capacity. They are moderately permeable.

Representative profile of Brennan fine sandy loam, in an area of Brennan soils, 2 miles west of Randado on Texas Highway 16, and 50 feet west of its intersection with Farm Road 649, then 100 feet south in range.

A11—0 to 3 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; slightly hard, friable; many roots; neutral; gradual, smooth boundary.

A12—3 to 12 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; slightly hard, friable; many roots; neutral; gradual, wavy boundary.

B21t—12 to 26 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; many roots; common pores; sand grains coated and bridged with clay; few films and soft spots of powdery secondary carbonates in lower part; neutral; gradual, wavy boundary.

B22t—26 to 51 inches, yellowish-brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; common roots; common fine pores; sand grains coated and bridged with clay; common films and soft spots of powdery secondary lime; calcareous; moderately alkaline; clear, wavy boundary.

B3ca—51 to 58 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; weak, fine and medium, subangular blocky structure; hard, friable; common fine pores; few soft calcium carbonate accumulations; 5 percent rounded siliceous pebbles; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—58 to 65 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist;

massive; hard, friable; few roots; common fine pores; 3 percent soft lumps and concretions of calcium carbonate; few siliceous pebbles and small shell fragments; calcareous; moderately alkaline; clear, wavy boundary.

C2—65 to 80 inches, very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; few fine pores; few siliceous pebbles; few small shell fragments; calcareous; moderately alkaline.

The A horizon ranges from 8 to 16 inches in thickness and from dark grayish brown or grayish brown to brown in color. Its texture is mainly fine sandy loam but ranges to loamy fine sand.

The Bt horizon ranges from 12 to 45 inches in thickness and from grayish brown or dark grayish brown to brown or yellowish brown in color. This horizon ranges from fine sandy loam to sandy clay loam in texture, from 18 to about 25 percent in clay content, and from weak to moderate in distinctness of structure. Depth to the zone of lime accumulation ranges from 15 to 34 inches.

The B3ca horizon begins at depths ranging from 30 to about 61 inches. Its color ranges from pale brown to very pale brown, and texture from fine sandy loam to sandy clay loam. Concretions of calcium carbonate are soft and range from few to many. Content of gravel 2 inches or less in diameter ranges from 2 to 5 percent.

The C horizon is 50 to about 70 inches from the surface. It ranges from pale brown to very pale brown in color and from fine sandy loam to sandy clay loam in texture. It contains few to many fine concretions and soft lumps of calcium carbonate.

**Brennan soils (Br).**—These are mostly nearly level to gently sloping soils in broad, irregular areas that range to as much as several hundred acres in size. Slopes are mainly less than 1 percent, but some are as great as 3 percent.

Included with these soils in mapping are less extensive areas of Copita, Hebbronville, Tela, and Zapata soils. These inclusions are not in all areas of Brennan soils. Copita and Hebbronville soils, where present, are in the higher parts of the landscape, and Tela soils are along small, scattered drainageways. Zapata soils are along slope breaks. Included soils account for about 16 percent of the acreage of these Brennan soils.

Brennan soils are used mainly for range, but a few small areas are cultivated. Crop residue kept on the surface helps to control erosion and soil blowing, to conserve moisture, and to maintain or to improve soil tilth. A good cropping system needs to include crops that produce large amounts of residue. These soils are best suited to sprinkler irrigation. Capability unit IIIc-1, dryland; I-1, irrigated; Sandy Loam range site.

## Comitas Series

The Comitas series consists of deep, nearly level to gently sloping and gently undulating soils that formed in loamy and sandy materials (fig. 5).

In a representative profile, the surface layer is brown loamy fine sand about 31 inches thick. The next layer, which extends to a depth of 87 inches, is friable fine sandy loam that is brown in the upper part and light brown in the lower part. The underlying material is pink, calcareous sandy clay loam that extends to a depth of 112 inches.

These soils are moderately rapidly permeable, are well drained, and have low available water capacity.



Figure 5.—Profile of Comitas loamy fine sand.

Representative profile of Comitas loamy fine sand, in an area of Comitas soils, 3.15 miles east of Hebbronville on Texas Highway 285, then 300 feet south of the highway along a private road, then 75 feet east.

- Ap—0 to 5 inches, brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; single grain; slightly hard, very friable; common fine roots; neutral; abrupt, smooth boundary.
- A12—5 to 31 inches, brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; slightly hard, very friable; common fine roots and pores; neutral; clear, smooth boundary.
- B2t—31 to 59 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic and weak, fine, subangular blocky structure; hard, friable; few roots, common fine pores; few thin clay films on prism faces and in pores; neutral; gradual, wavy boundary.
- B3—59 to 87 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; common fine pores; few, fine, soft films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.
- C1ca—87 to 110 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; massive; hard, friable; 5 percent, by volume, soft lumps and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.
- C2—110 to 112 inches, pink (7.5YR 8/4) sandy clay loam, pink (7.5YR 7/4) moist; massive; hard, friable; calcareous; moderately alkaline.

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The A horizon ranges from 20 to 40 inches in thickness, from dark grayish brown to brown in color, and from loamy fine sand to fine sand in texture. Reaction of this horizon ranges from slightly acid to neutral.

The Bt horizon ranges from 20 to 30 inches in thickness, from brown to pale brown or reddish brown in color, and from fine sandy loam to sandy clay loam in texture. Reaction of the Bt horizon ranges from slightly acid to neutral.

The C horizon starts at 55 to about 96 inches below the surface: It is pink to light reddish-brown or very pale brown, loamy fine sand to sandy clam loam.

**Comitas soils (Cm).**—These are nearly level to gently sloping and gently undulating soils. They are mainly in irregular or elongated areas 50 to more than 1,000 acres in size. Slopes range up to 3 percent.

Included with these soils in mapping are areas of Delfina, Hebbronville, Nueces, and Sarita soils, but these inclusions are not in all areas of Comitas soils. Where Delfina soils are included, they are in small, rounded depressional areas. The Hebbronville soils are nearly level, and Nueces and Sarita soils are on the higher, elongated parts of the landscape. These inclusions account for about 17 percent of the acreage.

Most areas of these Comitas soils are used for range, but a few areas are in crops.

Crop residue left on the surface helps to control soil blowing, to conserve moisture, and to maintain or to improve soil tilth. The cropping system needs to include crops that produce large amounts of residue. These soils are suited to sprinkler irrigation. Capability unit IIIe-1, dryland; IIIs-1, irrigated; Loamy Sand range site.

### Copita Series

The Copita series consists of deep, nearly level to gently sloping soils. These soils formed in loamy, calcareous material that overlies sandstone.

In a representative profile, the surface layer is dark-brown calcareous fine sandy loam about 16 inches thick. The next lower layer is brown, friable, calcareous sandy clay loam that is about 17 inches thick. The next layer, extending to a depth of about 43 inches, is light yellowish-brown, friable, calcareous fine sandy loam. The underlying material is very pale brown, weakly consolidated, fine sandy loam that extends to a depth of 68 inches.

These soils are well drained. They are moderately permeable and have a high available water capacity.

Representative profile of Copita fine sandy loam, in an area of Copita soils, 18 miles south of Randado on Farm Road 649, then 100 feet west on a county road.

- A1—0 to 16 inches, brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; slightly hard, friable; common fine roots; common pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.
- B2—16 to 33 inches, brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable; many roots; many small pores; few dark streaks of soil material from the A horizon deposited along root channels; few small shells and shell fragments; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.
- B3—33 to 43 inches, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak, fine, subangular blocky structure; hard, fri-

able; few lime splotches, films, and threads; few siliceous pebbles; few partially weathered sandstone fragments in lower part; calcareous; moderately alkaline; gradual, wavy boundary.

C1—43 to 62 inches, very pale brown (10YR 7/4), weakly consolidated fine sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly brittle; few soft limy splotches; 15 to 20 percent moderately cemented sandstone fragments that are dark yellowish brown (10YR 4/4) moist; calcareous; moderately alkaline; gradual, wavy boundary.

C2—62 to 68 inches, very pale brown (10YR 7/3) weakly consolidated fine sandy loam, pale brown (10YR 6/3) moist; massive; few weakly cemented sandstone fragments; calcareous; moderately alkaline.

The A horizon ranges from 10 to 16 inches in thickness, from grayish brown or brown to light brown in color, and from fine sandy loam to sandy clay loam in texture.

The B2 horizon ranges from 11 to 18 inches in thickness, from brown to pale brown in color, and from fine sandy loam to sandy clay loam in texture. The clay content of this horizon is 18 to 25 percent.

The C horizon is 25 to about 50 inches below the surface. It is pale brown or light yellowish brown to very pale brown in color and fine sandy loam to sandy clay loam in texture. This horizon is from a few to as much as 30 percent moderately to weakly cemented sandstone fragments.

**Copita soils (Ct).**—These are mostly nearly level to gently sloping soils in broad, irregular areas that are 50 to more than 1,000 acres in size. Slopes are mostly less than 2 percent but range to 3 percent in some places.

Mapped with these soils are areas of Brennan, Garceno, Tela, and Zapata soils. These inclusions are not in all areas of Copita soils. Brennan and Garceno soils are in the nearly level areas of the landscape, and Tela soils are along the small, intermittent drainageways. Zapata soils are on slope breaks and on the higher parts of the landscape. These included soils form about 11 percent of the acreage.

These Copita soils are used for range. Capability unit VIc-1, dryland; Gray Sandy Loam range site.

## Cuevitas Series

The Cuevitas series consists of very shallow to shallow, nearly level to gently sloping soils. These soils formed in loamy material.

In a representative profile, the surface layer is fine sandy loam. It is brown in the upper 1 inch and reddish brown in the other 8 inches. The underlying material is indurated white caliche that is about 7 inches thick. Below this, the thick beds of caliche are weakly cemented.

These soils are well drained and moderately permeable. They have a low available water capacity.

Representative profile of Cuevitas fine sandy loam, in an area of Cuevitas soils, 17 miles south and west of Hebronville on Texas Highway 16 and Farm Road 3073, then 300 feet south on a private road.

A11—0 to 1 inch, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, medium, platy structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A12—1 to 9 inches, reddish-brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/2) moist; weak, fine, subangular blocky structure; hard, friable; many roots; many fine pores; neutral; abrupt, wavy boundary.

Ccam—9 to 16 inches, white (10YR 8/2) indurated caliche; laminar to a depth of 3 to 4 inches; hardness rating of more than 3 on Mohs' scale.

The A horizon ranges from 7 to 14 inches in thickness, from reddish brown and yellowish red to brown in color, and from loamy fine sand to fine sandy loam in texture. The clay content of this horizon ranges from 12 to 16 percent, and reaction ranges from neutral to mildly alkaline.

The Ccam horizon is several feet thick. The upper 2 to 8 inches is indurated. Below this, it is weakly cemented.

**Cuevitas-Randado association (Cu).**—This mapping unit is made up of nearly level to gently sloping and gently undulating soils in irregular to oblong areas that are mostly more than 100 acres in size. Slopes range from 0 to 3 percent, but are dominantly about 1 percent.

About 55 percent of this mapping unit is Cuevitas soils, 35 percent is Randado soils, and 10 percent is Delmita and Zapata soils and a few spots of rock outcrops. Randado soils are on the more level parts of the landscape.

The Cuevitas and Randado soils in this association have the same profile as that described as representative for each of the series.

This mapping unit is used for range. Some areas have been mined for caliche used in road building. Capability unit VI-1, dryland; Shallow Sandy Loam range site.

## Delfina Series

The Delfina series consists of deep, nearly level to gently sloping and gently undulating soils. These soils formed in loamy material.

In a representative profile, the surface layer is brown and dark brown and about 19 inches thick. The upper 7 inches is loamy fine sand, and the lower 12 inches is fine sandy loam. The next lower layers are brown sandy clay loam about 5 inches thick; brownish-yellow sandy clay loam about 15 inches thick; and brown sandy clay loam about 10 inches thick. The next lower layer, extending to a depth of 76 inches, is very pale brown, calcareous sandy clay loam. Below this, extending to a depth of 90 inches, is calcareous, brownish-yellow sandy clay loam.

These soils are moderately well drained and moderately slowly permeable. They have high available water capacity.

Representative profile of Delfina loamy fine sand, in an area of Delfina association, 13.7 miles south and west of Hebronville on Texas Highway 16 and Farm Road 3073, then 1 mile north on a private road, and 25 feet west of the road in range.

A11—0 to 7 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grain; soft, very friable; neutral; abrupt, smooth boundary.

A12—7 to 19 inches, dark-brown (7.5YR 4/2) fine sandy loam; dark brown (7.5YR 3/2) moist; weak, medium, subangular blocky structure; slightly hard, friable; mildly alkaline; abrupt, smooth boundary.

B21t—19 to 24 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common, fine, distinct reddish-brown and yellowish-brown mottles; moderate, medium, blocky structure; very hard, firm; common distinct clay films; few dark streaks along old root channels or cracks; mildly alkaline; clear, smooth boundary.

B22t—24 to 39 inches, brownish-yellow (10YR 6/6) sandy clay loam, brownish yellow (10YR 6/6) moist; common, fine, distinct, light brownish-gray (10YR 6/2) mottles, grayish brown (10YR 5/2) moist; moderate, medium, blocky structure; very hard, very firm; common distinct clay films; few dark streaks

along old root channels or cracks; mildly alkaline; gradual, wavy boundary.

B3t—39 to 49 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; few, fine, faint grayish-brown (10YR 5/2) mottles, dark grayish brown (10YR 4/2) moist; weak, medium, blocky structure; very hard, very firm; few clay films; mildly alkaline; gradual, wavy boundary.

C1ca—49 to 76 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles and streaks; massive; very hard, firm; few hard and few soft calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C2—76 to 90 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; few, fine, faint, very pale brown (10YR 8/4) mottles and common, fine, distinct, red (2.5YR 5/6) mottles; massive; hard, firm; 5 to 10 percent lime-coated, waterworn gravel 1 inch or less in diameter; calcareous; moderately alkaline.

The A horizon ranges from 12 to 19 inches in thickness, from dark grayish brown to brown or dark brown in color, and from fine sandy loam to loamy fine sand in texture.

The Bt horizon ranges from 15 to 22 inches in thickness and from grayish brown or brown to yellow or strong brown in color. This horizon has few to many mottles that are faint to distinct.

The B3t horizon is 10 to 15 inches thick and grayish brown to brown or pale brown.

The C1ca horizon is 20 to 35 inches thick and pale brown to very pale brown or brownish yellow.

The C horizon is 45 to 55 inches below the surface. This horizon is very pale brown to brownish yellow or pink. It contains visible calcium carbonate that ranges from a few concretions to many soft or hard lumps. Lime-coated, waterworn gravel makes up from less than 1 percent to as much as 10 percent of this horizon.

**Delfina association (Df).**—This mapping unit is made up of soils that mostly are in small rounded or irregular areas less than 50 acres in size. Some areas range to as much as 150 acres in size. Slopes are mainly less than 1 percent but range from 0 to 2 percent.

Delfina fine sandy loam accounts for 12 percent of this mapping unit and is in slightly depressed, rounded areas within areas of Delfina loamy fine sand. Other soils in this unit are Comitas, Nueces, and Sarita. These soils occupy the higher parts of the landscape and make up about 10 percent of the acreage.

Most of this Delfina association is used for range, although a few small areas are used for crops. Crop residues kept on the surface of the soil help control soil blowing, conserve moisture, and maintain or improve tilth. Thus, where these soils are cultivated, the cropping system needs to include crops that produce a large amount of residue. Capability unit IIIe-1, dryland; Tight Sandy Loam range site.

## Delmita Series

The Delmita series consists of moderately deep, nearly level to gently sloping and gently undulating soils that formed in loamy material.

In a representative profile, the surface layer is yellowish-red and reddish-brown fine sandy loam about 13 inches thick. The next layer is yellowish-red fine sandy loam about 10 inches thick. Below this, and extending to a depth of 31 inches, is yellowish-red sandy clay loam. The underlying material is white indurated caliche (fig. 6).

These Delmita soils are moderately permeable, and their available water capacity is low. They are well drained.

Representative profile of Delmita fine sandy loam, in an area of Delmita association, 16.1 miles west of Hebbronville, on Farm Road 3073, then 100 feet north of the roadway in range.

A11—0 to 7 inches, yellowish-red (5YR 5/6) fine sandy loam, dark reddish brown (5YR 3/4) moist; surface crust; massive; hard, friable; neutral; diffuse, smooth boundary.

A12—7 to 13 inches, reddish-brown (5YA 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; compound weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; common fine roots; many fine pores; neutral; diffuse, smooth boundary.

B21t—13 to 23 inches, yellowish-red (5YR 5/6) fine sandy loam; yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; hard, friable; common fine roots; many fine pores; few clay films in pores; few worm casts; neutral; diffuse, wavy boundary.

B22t—23 to 31 inches, yellowish-red (5YR 4/6) dry and moist, sandy clay loam; weak, fine, subangular blocky structure; very hard, friable; common fine roots; common fine pores; few thin clay films on ped surfaces and in pores; few dark spots above caliche layer; neutral; abrupt, wavy boundary.

IICcam—31 to 33 inches, white (10YR 8/2) indurated caliche that has a hardness factor of 3 on Mohs' scale; less cemented and massive with depth.

The A horizon ranges from 8 to 18 inches in thickness, from reddish brown to yellowish red in color, and from fine sandy loam to loamy fine sand in texture.

The Bt horizon ranges from 12 inches to 22 inches in thickness, from red to yellowish red or reddish brown in color, and from fine sandy loam to sandy clay loam in texture. The clay content is from 18 to 25 percent. In some places, few to common, coarse mottles in shades of red or yellowish brown occur in the lower few inches of the Bt horizon.

The IICcam horizon is 20 to 40 inches below the surface. This caliche layer is indurated to strongly cemented and has a wavy to irregular upper boundary.

**Delmita soils (D).**—These nearly level to gently undulating soils are in broad, irregular areas 25 to several hundred acres in size. Slopes are less than 3 percent.

The surface layer typically is about 10 inches of reddish-brown loamy fine sand. The next layer is about 12 inches of reddish-brown fine sandy loam. The next lower layer extends to a depth of 39 inches and is underlain by indurated white caliche.

Mapped with these soils are small areas of Delmita fine sandy loam in less sloping positions. Inclusions of Nueces and Sarita soils are on long, narrow, low ridges. These inclusions make up 30 percent of the acreage but do not occur in all areas of Delmita soils.

These Delmita soils are used mostly for range. Small areas are cultivated to both dryland and irrigated crops. Soil blowing is a moderate hazard. Moisture is a limiting factor under dryland farming. Response to fertilization is good where these soils are irrigated. Watermelons and grain sorghum are the main crops.

Crop residue kept on the surface helps to control soil blowing and to maintain tilth. Cropping systems need to include crops that produce large amounts of residue. These soils are best suited to sprinkler irrigation. Capability unit IIIe-1, dryland; IIe-1, irrigated; Loamy Sand range site.



Figure 6.—Road cut showing caliche under Delmita soils.

**Delmita association (D<sub>n</sub>).**—This mapping unit is nearly level to gently sloping and gently undulating. It is mostly in broad, irregular areas 15 acres to several hundred acres in size. Slopes are less than 2 percent.

The Delmita soil in this mapping unit has the profile described as representative for the Delmita series.

Other soils in this mapping unit are the Cuevitas and Randado, which are on the higher positions in the landscape and account for about 25 percent of the acreage.

Most of this mapping unit is in range. Small areas, both irrigated and dryland, are cultivated. Soil blowing is a slight hazard. Moisture is a limiting factor under dryland farming. Response to fertilization is good where irrigation is used. Grain sorghum and watermelons are the main crops.

Crop residues kept on the surface of the soil help to control soil blowing and to maintain tilth. Cropping systems need to include crops that produce large amounts of residue. Sprinkler irrigation is best suited to the soils of this unit. Capability unit IIIc-1, dryland; IIs-1, irrigated; Red Sandy Loam range site.

### Dune Land

Dune land (D<sub>u</sub>) is a mapping unit that consists of active and stabilized sand dunes (fig. 7). These dunes

are 5 to 30 feet high and from 5 to more than 100 acres in size.

The dunes are near the Sarita and Falfurrias soils, but do not have the darkened surface layer characteristic of these soils.

Included in this mapping unit are small areas where the sandy material has been blown away.

Dune land is excessively drained and has a low available water capacity. Permeability is very rapid. Most areas of Dune land have no vegetation or only a sparse cover. Active dune areas have no agricultural value, but stabilized areas furnish limited grazing for cattle, during years of high rainfall, and a limited habitat for wildlife. The areas of Dune land should be fenced to control grazing. Capability unit VIIIe-1, dryland; Sand Dune range site.

### Falfurrias Series

The Falfurrias series consists of deep, gently sloping and gently undulating, neutral soils. These soils formed in wind-deposited sands (fig. 8).

In a representative profile, the surface layer is grayish-brown, loose, neutral fine sand in the upper 6 inches, and light brownish-gray fine sand in the lower 14 inches.

The underlying material is very pale brown, loose, neutral fine sand.



*Figure 7.—Dune land: top, active; and bottom, partly stabilized.*

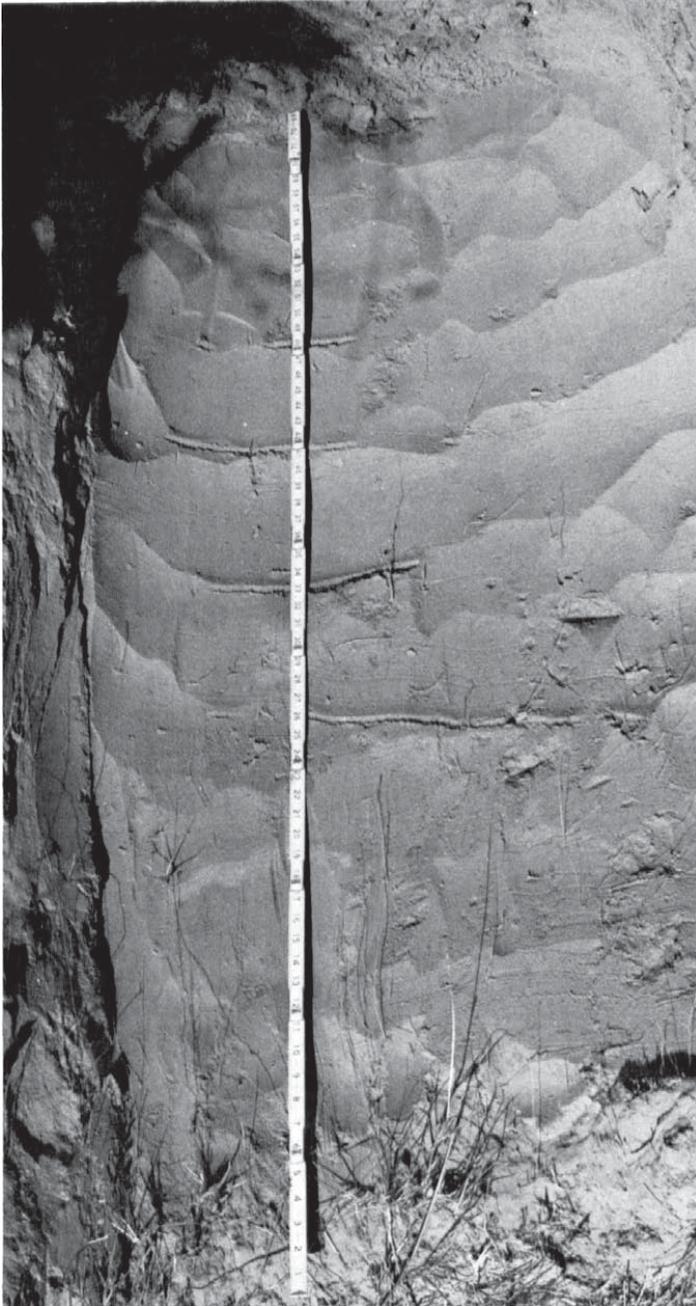


Figure 8.—Profile of Falfurrias fine sand.

These soils are somewhat excessively drained. Permeability is rapid, and the available water capacity is low.

Representative profile of Falfurrias fine sand, in an area of Falfurrias association, gently sloping, 16.6 miles south of Hebbronville on Farm Road 1017, then 200 feet west of the road in range.

A11—0 to 6 inches, grayish-brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; very friable; many fine roots; contains organic material in various stages of decomposition; neutral; clear, smooth boundary.

A12—6 to 20 inches, light brownish-gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; many fine roots; neutral; diffuse, smooth boundary.

C—20 to 90 inches, very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grain; loose; few roots in the upper part; neutral.

The A horizon ranges from 15 to 30 inches in thickness and from grayish brown to light brownish gray or light brown in color.

The C horizon ranges from 50 to more than 65 inches in thickness and from light brownish gray to very pale brown or pink in color.

**Falfurrias association, gently sloping (FfB).**—This mapping unit is made up of soils that are dominantly gently sloping and gently undulating. Slopes range from 1 to 5 percent. Mapped areas are elongated to irregular and from 25 to more than 1,000 acres in size, but are mostly from 50 to 200 acres in size.

Included in this mapping unit are areas of Nueces and Sarita soils that are nearly level and in low mounds. These soils, which make up about 15 percent of the acreage, are not in all areas of the association.

The soils in this mapping unit are used for range. They are not suitable for cultivation. They are subject to a high hazard of soil blowing, and the available water capacity is low. A good cover of growing plants is needed to help prevent soil blowing. Capability unit VIIe-1, dryland; Sandy Mound range site.

### Garceno Series

The Garceno series consists of deep, nearly level to gently sloping, calcareous soils. These soils formed in clayey and loamy material that contained some salts (fig. 9).

In a representative profile, the surface layer is brown clay loam about 16 inches thick. Below this is brown, firm clay loam about 21 inches thick. The next lower layer is brown clay about 18 inches thick. Below this is a layer of light-brown clay about 4 inches thick. The underlying material, extending to a depth of 80 inches, is pink clay loam.

These soils are well drained and moderately permeable. They have a high available water capacity. The high lime content of these soils causes chlorosis in some plants.

Representative profile of Garceno clay loam, in an area of Garceno soils, 17 miles south and west of Hebbronville on Texas Highway 16 and Farm Road 3073, then 2.1 miles south on Farm Road 649, then 0.65 mile west on a private ranch road, and 0.1 mile north along a fence.

A1—0 to 16 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate, fine and medium, subangular blocky structure; hard, firm; many roots; many fine pores; many insect casts and channels; calcareous; moderately alkaline; gradual, smooth boundary.

B2—16 to 37 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, fine and medium, blocky structure; hard, firm; many roots and root channels; many fine pores; many lime threads and films; calcareous; moderately alkaline; gradual, smooth boundary.

B3—37 to 55 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; weak, medium, blocky structure; hard, firm; common roots; common pores; few

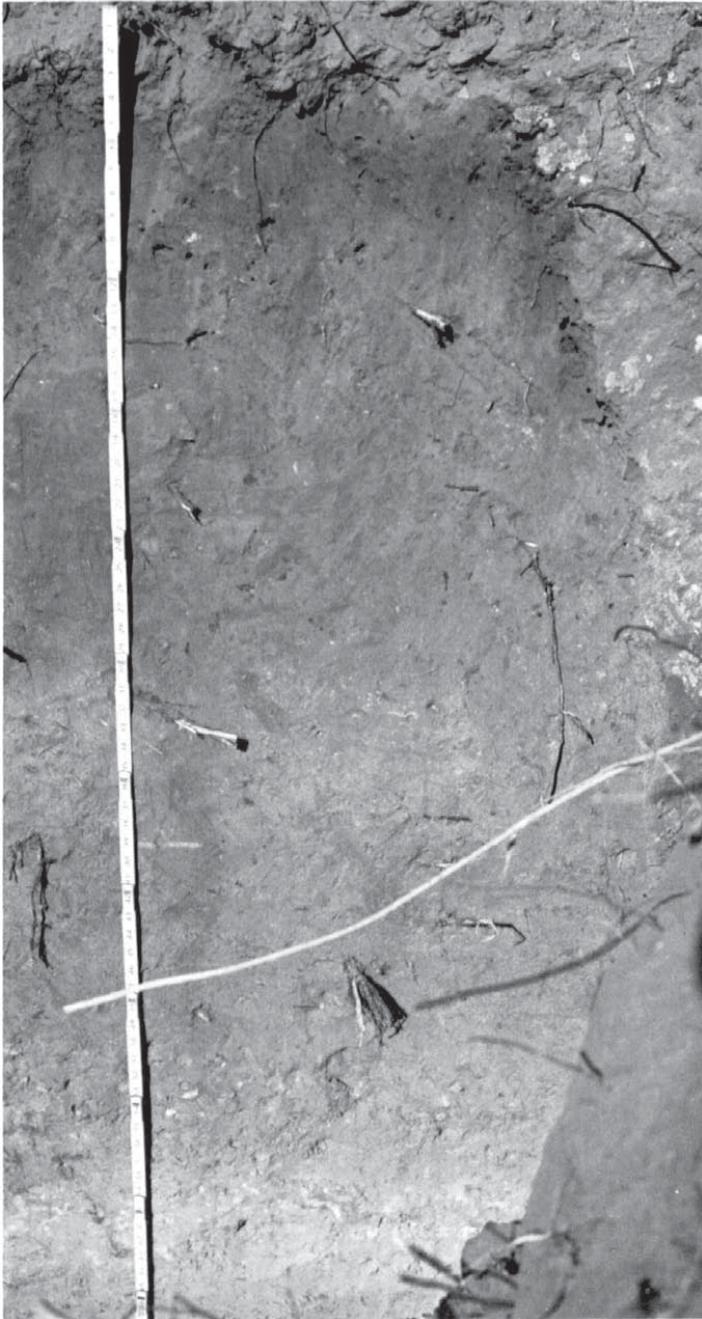


Figure 9.—Profile of Garceno clay loam.

soft lumps and films of calcium carbonate; few rounded siliceous pebbles; calcareous; moderately alkaline; clear, smooth boundary.

Clca—55 to 59 inches, light-brown (7.5YR 6/4) clay, brown (7.5YR 5/4) moist; massive; hard, firm; few fine pores; few soft lumps and few strongly cemented concretions of calcium carbonate; few rounded siliceous pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C2—59 to 80 inches, pink (7.5YR 8/4) clay loam, light brown (7.5YR 6/4) moist; massive; hard, firm; common fine pores; few soft lumps and hard concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 7 to 16 inches in thickness, from light brownish gray or grayish brown to brown in color, and from clay loam to clay in texture.

The B2 horizon ranges from 14 to 25 inches in thickness, from grayish brown to pale brown or brown in color, and from clay loam to clay in texture.

The B3 horizon is 12 to 20 inches thick and has the same range in color and texture as the B2 horizon.

The Clca horizon is 33 to 60 inches below the surface. It is light brown or pale brown to very pale brown and clay loam to clay. Visible calcium carbonate ranges from a few threads to many soft lumps or hard concretions.

The underlying C material ranges from pale brown to very pale brown or pink and from clay loam to clay.

**Garceno soils (Gc).**—These soils are nearly level to gently sloping. Slopes are mostly less than 1 percent but range to 3 percent. Soil areas are mostly irregular and range from about 15 to 75 acres in size.

Mapped with these soils are small areas of Copita and Tela soils that make up about 12 percent of the acreage. These inclusions are not in all areas of Garceno soils. Copita soils are on the higher parts of the landscape, and Tela soils are in long, narrow areas along small drainageways.

These Garceno soils are used for range. They produce many kinds of plants for grazing and wildlife. Capability unit VIc-2, dryland; Clay Loam range site.

### Hebbronville Series

The Hebbronville series is made up of deep, nearly level to gently sloping and gently undulating soils. These soils formed mainly in loamy materials.

In a representative profile, the surface layer is 15 inches thick and is pale brown in the upper 3 inches and brown in the lower 12 inches. The next lower layer is brown, very friable fine sandy loam about 23 inches thick. Below this is light yellowish-brown, calcareous fine sandy loam about 22 inches thick. The underlying material, extending to a depth of 70 inches, is very pale brown, calcareous fine sandy loam.

These soils are well drained. They are moderately rapidly permeable and have a high available water capacity.

Representative profile of Hebbronville loamy fine sand, in an area of Hebbronville soils, 4.3 miles south of Randado on Farm Road 649, and 50 feet west of the road.

A11—0 to 3 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; very weak, fine, subangular blocky structure; soft, very friable; many roots; porous; neutral; clear, smooth boundary.

A12—3 to 15 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; soft, very friable; many roots; many fine pores; neutral; gradual, wavy boundary.

B2t—15 to 38 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, subangular blocky structure; soft, very friable; few roots; many fine pores; few clay films on ped surfaces and in pores; threads and films of calcium carbonate in lower part; mildly alkaline; diffuse, wavy boundary.

B3—38 to 60 inches, light yellowish-brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable; few soft lumps of calcium carbonate; calcareous, moderately alkaline; gradual, wavy boundary.

C—60 to 70 inches, very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; slightly hard, friable; few soft lumps of calcium carbonate; calcareous, moderately alkaline.

The A horizon ranges from 12 to 19 inches in thickness, from grayish brown to pale brown or brown in color, from fine sandy loam to loamy fine sand in texture, and from neutral to mildly alkaline in reaction.

The Bt horizon ranges from 18 to 27 inches in thickness, from pale brown to brown in color, from fine sandy loam to loam in texture, and from neutral to mildly alkaline in reaction.

The B3 horizon is 14 to 30 inches thick. It is brown to light yellowish-brown, fine sandy loam to loam that is mildly alkaline to moderately alkaline.

The C horizon is from 45 to more than 60 inches below the surface. It is very pale brown to yellow fine sandy loam to loam.

**Hebbronville soils (He).**—These are nearly level to gently sloping and gently undulating soils. They are in irregular to elongated areas mostly 25 to 75 acres in size. Some areas range to as much as 500 acres or more in size. Slopes range to 3 percent but are mostly less than 2 percent.

Mapped with these soils are small areas of Brennan, Comitas, and Tela soils. These inclusions account for about 23 percent of the acreage, but are not in all areas of Hebbronville soils. Brennan soils are in the slightly lower areas of the landscape, and Comitas soils are on the higher areas. Tela soils are along drainageways.

These Hebbronville soils are used mostly for range, although some small areas are cultivated. Grain sorghum and watermelons are the principal crops. Soil blowing is a moderate hazard in cultivated areas. Moisture is a limiting factor under dryland farming. Response to fertilization is good when these soils are irrigated.

A good cropping system needs to include crops that produce large amounts of residue. Crop residues kept on the surface help control soil blowing and help maintain good tilth. These soils are best suited to sprinkler irrigation. Capability unit IIIe-1, dryland; IIe-1, irrigated; Sandy Loam range site.

## Nueces Series

The Nueces series consists of deep, nearly level to gently sloping and gently undulating soils. These soils formed in wind-deposited materials.

In a representative profile, the surface layer is brown and light yellowish-brown fine sand about 34 inches thick. The next layer is grayish-brown sandy clay loam that contains many reddish mottles and is about 11 inches thick. The next lower layer is light brownish-gray sandy clay loam, about 17 inches thick, that contains many red mottles. The underlying material, extending to a depth of 68 inches, is reddish-yellow, calcareous sandy clay loam.

These soils are moderately well drained. They are moderately slowly permeable and have a low available water capacity.

Representative profile of Nueces fine sand, in an area of Nueces-Sarita association, 9.8 miles south of Hebbronville by Farm Road 1017, then 2.9 miles east on a county road.

A11—0 to 11 inches, brown (10YR 5/3) fine sand, dark brown (10YR 3/3) moist; single grain; loose; many fine roots; neutral; diffuse, smooth boundary.

A12—11 to 23 inches, brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grain; loose; common fine roots; neutral; diffuse, smooth boundary.

A13—23 to 34 inches, light yellowish-brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; neutral; abrupt, wavy boundary.

B21t—34 to 45 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; many, fine, red mottles (2.5YR 4/6) that range slightly higher and lower in both chroma and value; strong coarse, prismatic structure; very hard, very firm; few roots; few fine and medium pores and old root channels; few insect burrows; clay films and organic matter coatings on peds; mildly alkaline; diffuse, irregular boundary.

B22t—45 to 62 inches, light brownish-gray (10YR 6/2) sandy clay loam; dark grayish brown (10YR 4/2) moist; many, prominent, medium and coarse red mottles (2.5YR 4/6); some mottles range to somewhat lower chromas; mottles cover 40 to 50 percent of a cut surface; moderate, fine and medium, prismatic structure; very hard, very firm; few roots and insect burrows; few fine pores and old root channels; clay films and organic coatings on peds; few iron-manganese concretions; mildly alkaline; diffuse, irregular boundary.

Cca—62 to 68 inches reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6) moist; massive; very hard, friable; few soft lumps of calcium carbonate; few iron manganese concretions; calcareous; moderately alkaline.

The A horizon ranges from 20 to 40 inches in thickness; from grayish brown to pale brown, brown or light yellowish brown in color; from loamy fine sand to fine sand in texture; and from slightly acid to neutral in reaction.

The Bt horizon ranges from 20 to 35 inches in thickness, from grayish brown or light gray to light brownish gray in color, and from fine sandy loam to sandy clay loam in texture. This horizon has common to many mottles in shades of red, brown yellow, and gray.

The Cca horizon is from 60 to more than 70 inches below the surface. It is very pale brown to reddish yellow or yellow in color and sandy loam to sandy clay loam in texture. The Cca horizon does not occur in all profiles.

**Nueces-Sarita association (Ns).**—This mapping unit is made up of soils that are nearly level to gently sloping and gently undulating. Slopes range to as much as 3 percent, but are dominantly less than 2 percent. Mapped areas are irregular to elongated and 50 to more than 1,000 acres in size.

The Nueces and Sarita soils in this association have the same profile as that described as representative for each of the series.

About 50 percent of this association is Nueces soils, 40 percent Sarita soils, and 10 percent inclusions of other soils. The Nueces soils are in the more level parts of the landscape; the Sarita soils are in the higher, more undulating parts.

Included in this mapping unit are areas of Comitas, Delmita, and Falfurrias soils. The Comitas and Delmita soils are below areas of Nueces and Sarita soils in the landscape. The Falfurrias soils are above the Nueces and Sarita soils.

The soils of this mapping unit are used for range. Soil blowing is a high hazard when vegetation is removed from these soils. Capability unit VIe-1, dryland; Deep Sand range site.

## Oil-Waste Land

Oil-waste land (Ow) consists of nearly level areas where oil, salt water, or oil-drilling mud have accumu-

lated (fig. 10) to such an extent that these areas are not suitable for farming or ranching. Some areas may be reclaimed in time. Most of this damage was done in the early days of oil-well drilling. Modern drilling techniques and equipment and enforced drilling regulations have greatly reduced the threat of damage. Present drilling operations cause only minor damage to surrounding soil areas.

Most areas of the mapping unit are bare of growing plants. Sparse, stunted mesquite and salt-tolerant weeds grow in some of the moderately damaged areas.

The least damaged areas of this unit are used for limited grazing by cattle and restricted wildlife habitat. Capability unit VIIIIs-1, dryland; not in a range site.

### Randado Series

The Randado series consists of very shallow to shallow, nearly level to gently sloping and gently undulating soils. These soils formed in loamy material.

In a representative profile, the surface layer is reddish brown and about 8 inches thick. The next lower layer

is yellowish-red fine sandy loam, about 8 inches thick. The underlying material is cemented caliche.

These soils are well drained and moderately permeable. They have low available water capacity.

Representative profile of Randado fine sandy loam, in an area of Randado-Delmita association, 18 miles south and west of Hebbronville by Texas Highway 16 and Farm Road 3073, then 0.2 mile south on Farm Road 649, and 200 feet east of Farm Road 649 in range.

A11—0 to 2 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; hard, very friable; porous beneath the thin surface crust; few angular caliche fragments; few rounded chert pebbles; slightly acid; clear, smooth boundary.

A12—2 to 8 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; hard, very friable; many fine pores; few angular caliche fragments; few rounded chert pebbles; slightly acid; clear, wavy boundary.

B2t—8 to 16 inches, yellowish-red (5YR 4/6) fine sandy loam, yellowish red (5YR 3/6) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky structure; hard, friable; few



Figure 10.—An area of Oil-waste land.

root channels; many fine pores; few clay bridges and clay films in pores and root channels; neutral; abrupt, wavy boundary.

C1cam—16 to 20 inches, pinkish-white (5YR 8/2) strongly cemented caliche; somewhat platy and fractured in the upper 2 to 3 inches, massive below; etched upper surface that contains a few brownish bands; gradual, wavy boundary.

C2ca—20 to 35 inches, white (10YR 8/2) weakly cemented caliche; massive but has a few fractures.

The A horizon ranges from 5 to 10 inches in thickness, from strong brown or reddish brown to yellowish red in color, from fine sandy loam to loamy fine sand in texture, and from slightly acid to mildly alkaline in reaction.

The Bt horizon ranges from 3 to 10 inches in thickness, from reddish brown to yellowish red in color, and from fine sandy loam to sandy clay loam in texture. Coarse caliche fragments make up from 0 to 25 percent of this horizon.

The solum, which is made up of the A and B horizons, is 8 to 20 inches in thickness. The underlying caliche layer is white to pinkish white and is strongly cemented or indurated in the upper few inches and weakly cemented in the next lower layer.

**Randado-Delmita association (Rd).**—This mapping unit is made up of soils that are nearly level to gently sloping and gently undulating. Slopes range to as much as 3 percent, but dominantly are less than 2 percent. Areas of this unit are irregular to oblong and mostly about 50 acres in size.

About 60 percent of this mapping unit is Randado soils, 25 percent is Delmita soils, and 15 percent is other soils.

Randado soils are more sloping and are on the higher parts of the landscape. This Randado soil has a reddish-brown fine sandy loam surface layer about 10 inches thick. The next lower layer is about 8 inches of yellowish-red fine sandy loam. The underlying material is indurated white caliche.

Delmita soils have a surface layer of reddish-brown fine sandy loam about 10 inches thick. The next lower layer is about 15 inches of yellowish-red sandy clay loam. The underlying material is white caliche.

The other soils mapped in this unit are the Cuevitas and Tela. The Cuevitas soils are above the Randado and Delmita soils, and the Tela soils are below the Randado and Delmita soils and receive drainage from these soils.

The soils of this mapping unit are used mainly for range. Low rainfall and shallow soil depth limit choice of crops and crop yields. A few small areas are used to grow watermelons and grain sorghum, and some areas have been mined for caliche for use in road building. Soil blowing is a slight hazard.

Crop residues kept on the surface help control soil blowing and help maintain good soil tilth. Crops that produce a large amount of residue are needed. These soils are best suited to sprinkler irrigation. Both soils, capability unit IVc-1, dryland; IIIs-2, irrigated; Randado part, Shallow Sandy Loam range site; Delmita part, Red Sandy Loam range site.

## Sarita Series

The Sarita series consists of deep, nearly level to gently sloping and gently undulating soils. These soils formed from wind- and water-deposited materials.

In a representative profile, the surface layer is brown and light-brown fine sand about 35 inches thick. Below

this is very pale brown fine sand about 11 inches thick. The next layer is light brownish-gray sandy clay loam, about 17 inches thick, that contains common red mottles. Below this is a layer of light-brown sandy clay loam about 12 inches thick. The underlying material, extending to a depth of 90 inches, is very pale brown fine sandy loam.

These soils are well drained. They are moderately permeable and have low available water capacity.

In Jim Hogg County, Sarita soils are mapped only in association with Nueces soils.

Representative profile of Sarita fine sand, in an area of Nueces-Sarita association, 12.35 miles south on Farm Road 1017 from its intersection with Texas Highway 285 near Hebbbronville.

A11—0 to 14 inches, brown (7.5YR 5/4) fine sand, dark brown (7.5YR 3/2) moist; single grain; loose; common roots; common pores; neutral; diffuse, wavy boundary.

A12—14 to 35 inches, light-brown (7.5YR 6/4) fine sand, dark brown (7.5YR 4/4) moist; single grain; loose; common roots and pores; neutral; diffuse, wavy boundary.

A2—35 to 46 inches, very pale brown (10YR 7/4) fine sand, yellowish brown (10YR 5/4) moist; faint, yellowish-brown (10YR 5/6) mottles in lower part; single grain; loose; neutral; abrupt, irregular boundary.

B2t—46 to 63 inches, light brownish-gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; common red (2.5YR 4/6, 4/8) mottles; moderate, very coarse, prismatic structure; very hard, very firm; few roots, mostly between peds; very dark grayish-brown (10YR 3/2) organic-matter stains on ped faces and in old root channels; prism faces coated with thin films of clay; mildly alkaline; diffuse, wavy boundary.

B3t—63 to 75 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; light brownish-gray (10YR 6/2) and yellowish-red (5YR 5/6), prominent, coarse mottles; moderate, coarse, prismatic structure; very hard, firm; some roots between peds; very dark grayish-brown (10YR 3/2) organic-matter stains on ped surfaces; noncalcareous; moderately alkaline; diffuse, wavy boundary.

C—75 to 90 inches, very pale brown (10YR 7/4) fine sandy loam; light yellowish brown (10YR 6/4) moist; massive; hard, firm; noncalcareous; moderately alkaline.

The A horizon ranges from 40 to 80 inches in thickness, from grayish brown to very pale brown in color, from loamy fine sand to fine sand in texture, and from slightly acid to neutral in reaction.

The B horizon ranges from 25 to 40 inches in thickness, from light brownish gray to light brown or pale brown in color, and from fine sandy loam to sandy clay loam in texture. This horizon has few to many mottles in shades of gray, brown, red, and yellow.

The C horizon is from 55 to more than 70 inches below the surface. It is very pale brown to yellow or reddish yellow and sandy loam to sandy clay loam.

## Tela Series

The Tela series consists of deep, nearly level soils. These soils formed in loamy sediments.

In a representative profile, the surface layer is brown sandy clay loam about 9 inches thick. Below this is a layer of brown sandy clay loam about 7 inches thick. The next lower layer is about 16 inches of pale-brown, calcareous sandy clay loam. The underlying material, extending to a depth of 63 inches, is pale-brown sandy clay loam.

These soils are well drained. Permeability is moderate, and the available water capacity is high.

Representative profile of Tela sandy clay loam, in an area of Tela soils, 15 miles south of Randado by Farm Road 649, then 1 mile west on a county road, and 175 feet north in range.

A1—0 to 9 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; hard, friable; few fine pores; mildly alkaline; clear, smooth boundary.

B21t—9 to 16 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate, fine and medium, blocky and subangular blocky structure; hard, friable; few fine pores; few thin clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

B22t—16 to 32 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; moderate, fine and medium, blocky and subangular blocky structure; hard, friable; few fine pores; few clay films; common films and threads of secondary carbonates; calcareous; moderately alkaline; clear, smooth boundary.

C—32 to 63 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, friable; few soft masses of calcium carbonate; few rounded pebbles; calcareous; moderately alkaline.

The A horizon ranges from 7 to 12 inches in thickness, from brown to dark brown or dark grayish brown in color, and from loam to sandy clay loam in texture.

The Bt horizon ranges from 14 to 38 inches in thickness, from pale brown, brown, or dark brown to dark grayish brown in color, and from sandy clay loam to clay loam in texture.

The C horizon is from 28 to 50 inches below the surface. It is pale brown to brown in color and loam to clay loam in texture.

**Tela soils (Te).**—These soils are nearly level and mainly in long, narrow areas along small drainageways. Soil areas range from about 25 to 150 acres in size but are mostly less than 75 acres in size. Slopes are less than 1 percent.

Mapped with these soils are small areas of Brennan and Copita soils and a few areas of soils that are similar to Tela but that have several inches of overwash material on the surface. These included soils make up about 25 percent of the acreage, but they are not in all mapped areas of Tela soils. Brennan and Copita soils are on the higher parts of the landscape.

These Tela soils are used mainly for range, but small areas are cultivated. Grain sorghum and introduced pasture grasses are the main crops. Low rainfall limits choice of crops and crop yields. The thick growth of brush furnishes food and cover for wildlife. These soils may be flooded as often as once in 5 years. Floods are of low velocity and of brief duration.

Crop residues kept on the surface of the soil help maintain soil tilth. Crops that produce large amounts of residue are needed in any cropping system used. Capability unit IIc-1, dryland; Ramadero range site.

## Zapata Series

The Zapata series consists of very shallow, gently sloping soils. These soils formed in loamy materials that overlie thick beds of indurated caliche.

In a representative profile, the surface layer is grayish-brown and brown fine sandy loam and sandy clay loam

about 8 inches thick. The underlying material is pinkish-white caliche that is laminar and indurated.

These soils are well drained. They are moderately permeable and have a low available water capacity.

Representative profile of Zapata fine sandy loam, in an area of Zapata soils, gently sloping, 15.95 miles west of the intersection of Farm Road 3073 and Texas Highway 16, which is just south of Hebronville.

A11—0 to 2 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; few roots; porous; surface is an estimated 20 percent angular caliche fragments, mostly less than 3 inches in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A12—2 to 8 inches, brown (10YR 4/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; hard, friable; few roots; porous; about 15 percent, by volume, caliche fragments 0.25 to 3 inches in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—8 to 12 inches, pinkish-white (7.5YR 8/2) caliche; laminar and indurated and becomes strongly cemented with depth; surface is smooth but etched; material is marked with thin brown bands.

The solum, made up of the A11 and A12 horizons, ranges from 2 to 10 inches in thickness, from light brownish gray to grayish brown or brown in color, and from fine sandy loam to clay loam in texture. The Ccam horizon is indurated to strongly cemented in the upper 4 to 6 inches and becomes weakly cemented with increase in depth.

**Zapata soils, gently sloping (ZcB).**—These soils are in irregular to elongated areas that are dominantly less than 100 acres in size but range from 10 to about 300 acres in size. Slopes range from 1 to 5 percent.

Mapped with these soils are caliche outcrops along slope breaks and areas of nearly level Cuevitas and Randado soils. These included soils make up about 25 percent of the acreage, but they are not in all mapped areas of these Zapata soils.

These Zapata soils are used for range. Capability unit VIIc-1, dryland; Shallow Ridge range site.

## Use of Soils for Tilled Crops

This section discusses management of the soils in Jim Hogg County for tilled crops, both dryland and irrigated, and expected yields of selected crops.

## Capability Grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on a farm or ranch. 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 limitations of soils when used for field crops, the risk of damage when they are farmed, and the way the soils respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major

reclamation projects; and does not apply to rice, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range or for engineering.

In the capability system, all kinds of soils are grouped at three levels: the class, subclass, and unit. The soils of Jim Hogg County have been placed in dryland and irrigated capability units, subclasses, and classes as shown in the following list.

#### CLASSIFICATION OF DRYLAND CAPABILITY UNITS

Class I. Soils have few limitations that restrict their use. (No class I dryland soils in Jim Hogg County.)

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

Subclass IIc. Soils that have slight limitations because of climate.

Unit IIc-1. Nearly level, loamy, noncalcareous soils that have moderate permeability.

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

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Unit IIIe-1. Nearly level to gently sloping and gently undulating, sandy, noncalcareous soils that have moderately rapid to moderately slow permeability.

Subclass IIIc. Soils that have severe limitations because of climate.

Unit IIIc-1. Nearly level to gently sloping and gently undulating, loamy, noncalcareous soils that have moderate permeability.

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

Subclass IVc. Soils that have very severe limitations because of climate.

Unit IVc-1. Nearly level to gently sloping and gently undulating, loamy, acid to noncalcareous soils that have moderate permeability.

Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (No class V soils in Jim Hogg County.)

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

Subclass VIe. Soils severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIe-1. Nearly level to gently sloping and gently undulating, sandy, noncalcareous soils that have moderate to moderately slow permeability.

Subclass VIi. Soils that have severe limitations because of shallow root zone.

Unit VIi-1. Nearly level to gently sloping and gently undulating, loamy, acid to noncalcareous soils that have moderate permeability.

Subclass VIc. Soils that have severe limitations because of climate.

Unit VIc-1. Nearly level to gently sloping, loamy, calcareous soils that have moderate permeability.

Unit VIc-2. Nearly level, loamy, calcareous soils that have moderate permeability.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to range, woodland, or wildlife food and cover.

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIIe-1. Gently sloping and gently undulating, sandy, noncalcareous soils that have rapid permeability.

Subclass VIIi. Soils severely limited by very shallow root zone.

Unit VIIi-1. Gently sloping, loamy, calcareous soils that have moderate permeability.

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

Subclass VIIIe. Soils very restricted in use by erosion.

Unit VIIIe-1. Gently sloping and gently undulating, duned, sandy areas that have very rapid permeability.

Subclass VIIIi. Soils very severely limited by waste materials that restrict or prevent growth of most plants.

Unit VIIIi-1. Nearly level areas that have been damaged by oil, salt water, or drilling mud.

#### CLASSIFICATION OF IRRIGATED CAPABILITY UNITS

Class I. Soils have few limitations that restrict their use. (No subclass in class I.)

Unit I-1. Nearly level to gently sloping, loamy, noncalcareous soils that have moderate permeability.

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

Subclass IIe. Soils subject to moderate erosion unless protected.

Unit IIe-1. Nearly level to gently sloping and gently undulating, sandy, noncalcareous soils that have moderate to moderately rapid permeability.

Subclass IIi. Soils moderately limited because of low available water capacity.

Unit IIi-1. Nearly level to gently sloping and gently undulating, loamy, noncalcareous soils that have moderate permeability.

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

Subclass IIIs. Soils that have severe limitations because of lack of available moisture capacity or poor tilth.

Unit IIIs-1. Nearly level to gently sloping and gently undulating, sandy, noncalcareous soils that have moderately rapid permeability.

Unit IIIs-2. Nearly level to gently sloping and gently undulating, loamy, acid to noncalcareous soils that have moderate permeability.

Classes IV through VIII. No irrigated soils in these classes in Jim Hogg County.

**Predicted yields**

Table 2 lists predicted yields of the principal crops grown in Jim Hogg County on both dryland and irrigated soils. These predictions are based on information obtained from farmers and others familiar with the soils. Predicted yields are average yields that can be expected over a period of years under an improved level of management.

The estimated yields given in table 2 can be expected if the following management practices are used:

**Nonirrigated cropland—**

1. Rainfall is conserved.
2. Soil-improving crops and crops that produce a large amount of residue are grown in the cropping system and are used to conserve moisture and improve tilth.
3. Proper grazing and harvesting are practiced.
4. Timely control of insects, diseases, and weeds is consistently applied.
5. Improved crop varieties are planted.

**Irrigated cropland—**

1. Rainfall is conserved.
2. A suitable quality irrigation water is used.
3. Irrigations are timed to meet the need of the soil and crop.
4. The irrigation system is properly designed and efficiently used.
5. Crop residues are managed to maintain soil tilth.
6. Minimum but timely tillage is used.

7. Insects, diseases, and weeds are consistently controlled.
8. Fertilizer is applied according to soil tests and crop needs.
9. Improved crop varieties are used at recommended seeding rates.

**Use of the Soils as Range <sup>2</sup>**

Jim Hogg County lies within the Rio Grande Plains and is made up of nearly level to gently sloping and gently undulating soils. Through most of the 1800's the county was an open grassland supporting a lush stand of mid and short grasses.

Around 1860 settlers from Europe established a cattle grazing industry in this area. By the 1870's, the county was being fenced and permanent water supplies provided for more intensive grazing. Overgrazing and drought had caused a decline of the better forage grasses and encroachment of mesquite, pricklypear cactus, and other shrubby plants by the early 1900's.

Range is land on which the climax vegetation, or natural potential plant community, is composed mainly of grasses, forbs, and shrubs valuable for grazing and present in sufficient quantity to justify grazing use. Most of Jim Hogg County continues to be used as range. Cattle ranches in the county range from small acreages to units more than 50,000 acres in size. Most of these ranches are cow-calf operations, but a few are of the stocker type. A few sheep and goats also are raised for meat.

In recent years the raising of wild game birds and animals has become increasingly important. It is now a significant secondary land use. The leasing of hunting rights for deer, javelina, quail, and dove provides a supplementary source of income for ranchers.

**Range Sites and Condition Classes**

Different soils are grouped into range sites according to their ability to produce different kinds or proportions of plants, or total annual yields of native vegetation. Each range site has the ability to support distinctive kinds of plants differing from those on any other site. These sites also differ in their needs for management and in the kinds and number of grazing animals they can safely support. A knowledge of the kinds and amounts of plants that can be grown on a particular site is necessary in order to plan wisely the management of that site. Such factors as soil, topography, and climate are responsible for differences in plants and the amount of such plants produced.

Before the introduction of domestic livestock in Jim Hogg County, the vegetation that grew on each site was the potential, or climax, plant community. Each climax plant community consisted of a mixture of several kinds of plants best able to efficiently use the soil and available moisture. Some of these plants grew mainly in the warm part of the year; others grew during the cool season. Some grew tall; others were short. Some

TABLE 2.—Predicted average acre yields of principal crops

[Only arable soils are listed in this table. Absence of data indicates that crop is not generally grown on the soil named]

Soil	Dryland soils		Irrigated soils	
	Water-melons	Grain sorghum	Water-melons	Grain sorghum
Brennan soils.....	Lb. 7,500	Lb. 2,200	Lb. 17,500	Lb. 6,500
Comitas soils.....	7,500	1,700	14,250	-----
Delfina association.....	7,500	1,700	-----	-----
Delmita soils.....	7,500	1,700	15,100	5,900
Delmita association.....	7,000	2,000	17,500	6,000
Hebbroville soils.....	7,500	1,700	16,125	5,900
Randado-Delmita association.....	6,500	1,500	15,000	5,000
Tela soils.....	-----	2,000	-----	-----

<sup>2</sup> By DONALD T. PENDLETON and CLIFFORD W. CARTER, range conservationists, Soil Conservation Service.

were deeply rooted plants; others were shallow. Some were palatable to grazing animals; others were not.

Livestock and game animals graze selectively, and repeatedly graze or browse those plants they like best.

Continuous heavy grazing of the potential plant community for extended periods reduces its vigor and competitive ability. Eventually this vegetation is eliminated. Those plants first eliminated from the climax plant community are called *decreasers*. These decreasers are usually the most palatable and productive native plants that the site and climate are capable of growing.

When the decreaser plants, because of continued heavy use, begin to die out of the plant community, other secondary plants replace them. These secondary plants were always present in the climax plant community, but because of their lower palatability, they were not grazed so heavily as the decreasers. Under heavy grazing, they had the advantage in competing with the decreasers for space, sunlight, plant nutrients and water. These secondary plants are known as *increasers*.

Since the terms decreaser and increaser indicate the initial response of plants to continuous heavy use, it is important to specify the kind of animal that is exerting the grazing pressure. For example, a grass plant that decreases from cattle grazing may increase under grazing by goats or deer.

When the decreasers are eliminated from a climax plant community, grazing animals must turn to the increasers for forage. Increasers are ordinarily less productive than decreasers. So unless the grazing pattern which eliminated the decreasers is altered, the increasers are overused, decline in vigor, and begin to disappear from the plant community.

When the increasers and decreasers are both depleted, they are replaced with plants that are not native to the site or that were not on the site in appreciable amounts. These plants are known as *invaders*. Usually invaders have special adaptations, such as spines, burs, toxins, low palatability, or extremely low growth, that prevents overuse by grazing animals. Invaders are usually less productive than climax plants, and their yields are less reliable.

By this process the range site changes from the best plants to the poorest. These successive changes are referred to by ranchers as *range condition*. Range condition indicates the degree to which the composition of the existing plant community differs from the potential vegetation. If 76 to 100 percent of the composition is the original, or climax vegetation, the range condition is *excellent*; if 51 to 75 percent is climax, the condition is *good*; if 26 to 50 percent is climax, the condition is *fair*; and if 25 percent or less is climax, the condition is *poor*.

Range condition gives an indication of the deterioration in the plant community and provides a basis for planning the management needed to improve the range. All range sites respond to good management; some respond faster than others. Proper stocking rate, deferment of grazing, and grazing systems are some of the common management practices used in the management of these sites. Some sites lend themselves to mechanical treatment, such as mechanical brush control and range seeding, and others do not. Chemical brush and weed

control is another management tool for improving production on some sites.

Range deterioration has occurred in parts of Jim Hogg County. Good management is required to return this land to a productive state. The objective of sound grazing management and treatment of range is to maintain good to excellent range condition and to improve fair or poor range condition.

## Descriptions of Range Sites

This subsection describes range sites in Jim Hogg County and the climax vegetation of these sites. Range condition is discussed for each site, and the predicted annual yield of herbage, including that produced by woody plants is given for each site in excellent condition. Twelve distinct range sites have been described in Jim Hogg County. To find the range sites in which a given soil has been placed, turn to the "Guide to Mapping Units" at the back of this survey.

### CLAY LOAM RANGE SITE

The Garceno soils are the only soils in this range site. These nearly level to gently sloping soils are deep, calcareous, and loamy. They are well drained, are moderately permeable, and have high available water capacity.

Originally this site was open grassland broken by scattered mesquite and chaparral. Among the grasses that make up about 65 percent of the potential plant community on this site are four-flower trichloris, Arizona cottontop, and lovegrass tridens. Other grasses that account for about 35 percent are pink pappusgrass, plains lovegrass, curly mesquite, and slim tridens. As deterioration of the range site occurs, woody vegetation increases. The principal invading plants are red grama, three-awn, annual forbs and grasses, mesquite, white brush, condalia, spiny hackberry, and pricklypear.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,000 pounds in wet years to 1,500 pounds in dry years.

### DEEP SAND RANGE SITE

The Nueces-Sarita association is the only mapping unit in this range site. The deep, sandy, noncalcareous soils in this site are nearly level to gently sloping and gently undulating. They are well drained, are moderately to moderately slowly permeable, and have low available water capacity (fig. 11). This site is well adapted to deeply rooted grasses because of moisture from normal rains penetrates deeply.

The climax plant community is grass. Grasses that make up about 70 percent of the potential vegetation are seacoast bluestem, crinkleawn, and tanglehead. Brownseed paspalum and switchgrass, in lesser amounts, are also present. Other grasses that make up about 30 percent of the climax vegetation are fringleaf paspalum, knotroot panicum, hooded windmillgrass, sand dropseed, sand witchgrass, western indigo, and Pan American balsamscale. Such perennial forbs as snoutbean, partridge pea, and indigo make up as much as 5 percent of the vegetation in some places.

As the site deteriorates, it is invaded by red lovegrass, fringed signalgrass, sandbur, white snakecotton,



*Figure 11.*—An area of the Deep Sand range site. Soils are of the Nueces and Sarita series.

croton, wildbuckwheat, perennial horsemint, mesquite in scattered patterns, and catclaw.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 4,000 pounds in wet years to 2,000 pounds in dry years.

#### GRAY SANDY LOAM RANGE SITE

The Copita soils are the only soils in this range site. These soils are deep, calcareous, and loamy. They are nearly level to gently sloping, well drained, and moderately permeable. The available water capacity is high.

The climax plant community consists of grasses such as Arizona cottontop, plains bristlegrass, and feathery bluestem. These and grasses such as trichloris, lovegrass tridens, and tanglehead, make up a little more than 50 percent of the vegetation.

Other grasses that make up nearly half of the climax vegetation are hooded windmillgrass, Texas bristlegrass, pink and whiplash pappusgrass, knotroot panic, slim tridens, fall witchgrass, and hairy grama.

The site grows some palatable woody shrubs, such as kidneywood, ratany, guajillo, ephedra, and bumelia. These are preferred forage plants for deer, and this site commonly supports a number of deer. Ebony is a climax tree on the site (fig. 12).

Any deterioration results in a loss of climax plants and an invasion of red grama, whorled dropseed, Halls panicum, red lovegrass, red three-awn and many annual grasses and weeds. Many kinds of woody plants also invade the site. Among these are mesquite, blackbrush,

pricklypear, wolfberry, spiny hackberry, condalia, amargosa, and others.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 1,000 pounds in dry years.

#### LOAMY SAND RANGE SITE

The gently sloping and gently undulating soils of this range site are moderately deep to deep, noncalcareous, and sandy. They are well drained and moderately to moderately rapidly permeable. The available water capacity is low.

The site was originally open grassland dotted by widely spaced ebony and bumelia trees and mottes. Grasses that make up about two-thirds of the climax vegetation are four-flower trichloris, Arizona cottontop, plains bristlegrass, lovegrass tridens, and tanglehead.

Other grasses, which make up about one-third of the plant community, are hooded windmillgrass, knotroot panicum, Texas bristlegrass, fringleaf paspalum, and sand dropseed.

Among the invading grasses are red grama, red and tumble lovegrass, fringed signalgrass, sandbur, and other annual grasses and weeds. As the site deteriorates, it is invaded and eventually dominated by single-stemmed mesquite trees and many kinds of chaparral brush. Some of these are amargosa, condalia, spiny hackberry, and allthorn.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 1,000 pounds in dry years.



Figure 12.—An area of the Gray Sandy Loam range site that has been root-plowed and seeded to buffelgrass. Soils are of the Copita series.

#### RAMADERO RANGE SITE

The Tela soils are the only soils in this range site. These nearly level soils are along small, intermittent drainageways and are well drained and moderately permeable. They are deep, noncalcarous, and loamy. In some places the site has a mantle of sandy loam or silty clay loam overwash from surrounding soils. The site receives runoff from adjacent higher lying soils, and the available water capacity is high.

The Ramadero site is a preferred grazing site. The potential plant community on this site is an open grassland dominated by four-flower trichloris. Decreaser plants that compose about 70 percent of the climax vegetation are, in addition to trichloris, plains bristlegrass, Arizona cottontop, and lovegrass tridens. Big cenchrus

and Wright's sacaton grow on the banks of some of the larger drainageways. Other grasses that make up about 30 percent of the climax plant community are Nash windmillgrass, pappusgrass, buffalograss, and Texas bristlegrass.

Where this site is in deteriorated condition, invaders such as tumble windmillgrass, whorled dropseed, red grama, Halls panicum, three-awn, ragweed, and prairie-coneflower are common on the site. In the lower condition classes, the site commonly grows a dense stand of large mesquite trees and rank underbrush such as spiny hackberry, whitebrush, retama, huisache, and condalia.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 5,000 pounds in wet years to 2,500 pounds in dry years.

## RED SANDY LOAM RANGE SITE

The soils of this site are nearly level to gently sloping and gently undulating. These soils are moderately deep, noncalcareous, and loamy. They are well drained and moderately permeable. The available water capacity is low.

The climax plant community on this site is an open grassland. Grasses such as Arizona cottontop, tanglehead, lovegrass tridens, and plains bristlegrass make up about 60 percent of the vegetation. Other grasses that make up about 40 percent of the plant community are hooded windmillgrass, Texas bristlegrass, slim tridens, and slender and hairy grama.

Common invaders on the site are fringed signalgrass, red lovegrass, tumblegrass, burgrass, red three-awn, sandbur, and several kinds of woody plants. In years of abundant winter moisture, annual weeds such as bladderpod and tallowweed grow on the site, in lower condition classes, and provide palatable and nutritious grazing for 6 weeks to 2 months in spring. Where this occurs, these annuals use the soil moisture and retard the spring growth of dependable perennial forage plants.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,000 pounds in wet years to 1,000 pounds in dry years.

## SAND DUNE RANGE

Dune land, a land type, is the only mapping unit in this site. These are deep sands in mounds 10 to 30 feet high. They are excessively drained and very rapidly permeable. The available water capacity is low.

Some of these areas are active dunes, and some are partially stabilized (fig. 13).

The potential plant community on this site consists of grasses such as gulfdune paspalum, seacoast bluestem, and crinkleawn. Other grasses common to the site are fringleaf paspalum, giant sand dropseed, and hooded windmillgrass. The site also grows some perennial legumes such as snoutbean, partridgepea, indigo, and prairie-clover. Plants that invade are red lovegrass, tumble lovegrass, sandbur, fringed signalgrass, snake-cotton, wildbuckwheat, croton, gerardia, and horsemint.

The Sand Dune site requires special treatment. It presents a problem, since sand blowing from this site is a hazard to surrounding sites. This site should be fenced. It should not be grazed in poor condition, as all of the growth produced on the site should be allowed to return to the surface to help keep the soil stabilized. Grazing on the site in any condition must be carefully managed. Re-establishment of vegetation is extremely difficult because the surface dries rapidly and the blowing sand has an abrasive effect on plants.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 300 pounds in dry years.

## SANDY LOAM RANGE SITE

The soils of this site are nearly level to gently sloping and gently undulating. These soils are well-drained, deep, noncalcareous, and loamy to sandy. They are moderately to moderately rapidly permeable, and their available water capacity is high.

The climax plant community consists of open grassland dotted by ebony trees. Grasses that make up about

65 percent of the climax vegetation are Arizona cottontop, fourflower trichloris, plains bristlegrass, lovegrass tridens, and tanglehead.

Other grasses that account for about 35 percent of the plant community are hooded windmillgrass, Texas bristlegrass, knotroot panicum, slim tridens, fall witchgrass, sand dropseed, pink and whiplash pappusgrass, and slender grama.

This Sandy Loam range site also grows some palatable forbs and woody plants such as bushsunflower, orange zexmenia, daleas, prairie-clover, ephedra, and skeleton-leaf goldeneye. Most of these plants are preferred forage plants for deer. Ebony trees and mottes dot the landscape and add to the attractiveness of the site.

Common invaders on this site are red grama, red lovegrass, whorled dropseed, Halls panicum, and three-awn. As the site deteriorates from its potential, single-stemmed mesquite trees and many kinds of chaparral brush move in and dominate. Among these invaders are spiny hackberry, whitebrush, wolfberry, condalias, amargosa, allthorn, pricklypear and tasajillo, desert yaupon, and others.

Where the site is in fair and poor condition, during years of adequate winter moisture, the site produces a lush crop of annual weeds such as talloweed and bladderpod. These annuals produce palatable and nutritious grazing for short periods in the spring. Growth of more dependable perennial forage plants, however, is retarded following competitive productive periods by annuals.

This site provides a good habitat for deer, javelina, and quail if sufficient cover is available.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 2,000 pounds in dry years.

## SANDY MOUND RANGE SITE

This site is made up of one mapping unit, Falfurrias association, gently sloping. The sites in this mapping unit are excessively drained, deep, noncalcareous sands. Permeability is rapid, and the available water capacity is low.

The climax plant community is open grassland. Grasses that make up about 70 percent of the potential vegetation are seacoast bluestem, crinkleawn, tanglehead, Florida paspalum, Texasgrass, and switchgrass.

Other grasses are brownseed paspalum, fringleaf paspalum, knotroot panicum, hooded windmillgrass, sand dropseed, and Pan American balsamscale. Perennial forbs such as snoutbean, indigo, and milkpea make up as much as 5 percent of the vegetation in some places. Scattered large mesquite trees also grow on this site.

As the site deteriorates, it is invaded by red lovegrass, fringed signalgrass, sandbur, three-awn, and annual forbs.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 4,000 pounds in wet years to 2,000 pounds in dry years.

## SHALLOW RIDGE RANGE SITE

Zapata soils, gently sloping, are the only soils in this range site. These soils are very shallow, calcareous, and loamy. They are well drained and moderately permeable. The available water capacity is low.



*Figure 13.*—An area of the Sand Dune range site showing both active and stabilized Dune land.

The climax plant community consists of short and mid grasses and several woody shrubs. About 50 percent of the potential plant community is grasses such as Arizona cottontop, tanglehead, pink and whiplash pappusgrass, and lovegrass tridens. Other grasses that account for almost half of the production are hooded windmillgrass, Texas bristlegrass, slim tridens, perennial three-awn, sand dropseed, and fall witchgrass. Perennial shrubs and forbs that are native to the site are kidneywood, guajillo, ephedra, cenizo, feather dalea, ratany, bushsunflower, zexmenia, and skeletonleaf goldeneye.

As the condition of the site declines, native woody plants increase noticeably, and such woody invaders as blackbrush, mesquite, pricklypear, paloverde, condalia, and scented lippia begin to spread. Low-growing, fast-maturing grasses and weeds also invade. Among the more common invaders are red grama, hairy tridens, red lovegrass, gummy lovegrass, sandbur, and other annuals.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 1,500 pounds in wet years to 800 pounds in dry years.

#### SHALLOW SANDY LOAM RANGE SITE

The soils of this site are nearly level to gently sloping and gently undulating. These soils are very shallow to shallow, acid to noncalcareous, and loamy to sandy. They are well drained and moderately permeable. The available water capacity is low.

The climax plant community on this site contains Arizona cottontop, tanglehead, lovegrass tridens, and plains bristlegrass. These grasses make up about 55 percent of the total annual yield. Other grasses, such as hooded windmillgrass, Texas bristlegrass, slim tridens, pappusgrass, fall witchgrass, sand dropseed, and perennial three-awn, account for almost half of the production. Perennial shrubs and forbs native to the site are bumelia, kidneywood, guajillo, ephedra, skeletonleaf

goldeneye, bushsunflower, and zexmenia. Among native legumes are snoutbean, indigo and milkvetch.

As range condition declines, red grama, red lovegrass, fringed signalgrass, sandbur, and other annual grasses and weeds invade. Woody plants such as blackbrush, spiny hackberry, condalia, and pricklypear are also common invaders. Like the other sandy loam range sites, this site in fair or poor condition grows annual weeds such as tallweed and bladderpod in years following abundant winter moisture.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 2,500 pounds in wet years to 1,000 pounds in dry years.

#### TIGHT SANDY LOAM RANGE SITE

The Delfina association is the only mapping unit in this range site. The soils in the unit are nearly level to gently sloping and gently undulating. These soils are deep, noncalcareous, and loamy to sandy. They are moderately well drained and moderately slowly permeable. The available water capacity is high.

The potential plant community on this site is open grassland dotted by a few woody trees and shrubs. Grasses that make up approximately 65 percent of the vegetation are fourflower trichloris, Arizona cottontop, and feathery bluestem. Other grasses are plains bristlegrass, pink pappusgrass, and slim tridens. Grassbur, three-awn, red lovegrass, annual forbs, and woody plants are invaders on this site. Mesquite, condalia, spiny hackberry, and wolfberry are some of the prominent woody plants.

Where this site is in excellent condition, the potential acre yield of air-dry herbage ranges from 5,000 pounds in wet years to 1,800 pounds in dry years.

### *Use of Soils for Wildlife*<sup>3</sup>

Wildlife is an important source of recreation and income in Jim Hogg County. Most of the land in the county is leased for recreational hunting. Interpretations for wildlife management are discussed in this section. The soils of the county are rated for wildlife habitat and kinds of wildlife in table 3, and these ratings are explained in the following subsections.

#### Soil Interpretations for Wildlife Habitat

Successful management of wildlife requires that food, cover, and water be available in a suitable combination. Absence or inadequate distribution of any one factor can limit or eliminate a particular kind of wildlife from a site.

Most wildlife habitats are managed by planting suitable vegetation or by manipulating existing vegetation to increase desired plants. In addition, water areas can be created or natural ones improved as wildlife habitats.

Soil interpretations for wildlife habitat aid in selecting the more suitable sites for various kinds of management and in planning for use of the sites as parks and nature areas. They also serve as indicators of the level of management intensity needed to achieve desired results.

Soil properties that affect the growth of wildlife habitat are: (1) thickness of soil useful to plants, (2) surface texture, (3) available water capacity, (4) wetness, (5) surface stoniness or rockiness, (6) flood hazard, and (7) slope.

The soil areas shown on the soil survey maps are rated without regard to size, shape, or positional relationships with adjoining areas. Certain influences on habitats, for example elevation and aspect, must be appraised on the site.

In table 3 the soils of Jim Hogg County are rated for the creation, improvement, or maintenance of six wildlife habitat elements. These ratings are based on limitations imposed by the characteristics or behavior of the soil. Four levels of suitability are recognized: *Well suited, suited, poorly suited, and unsuited.*

*Suitability Ratings of Soils for Wildlife:* The following definitions are given for habitat suitability ratings used in table 3:

*Well suited* indicates that habitats generally are easily created, improved, or maintained; that the soil has few or no limitations that affect management; and that satisfactory results can be expected.

*Suited* indicates that habitats can be created, improved, or maintained in most places; that the soil has moderate limitations that affect management; and that moderate intensity of management and fairly frequent attention may be required for satisfactory results.

*Poorly suited* indicates that habitats can be created, improved, or maintained in most places; that the soil has rather severe limitations; that habitat management is difficult and expensive and requires intensive effort; and that results are not always satisfactory.

*Unsuited* indicates that the soil limitation is so extreme that it is impractical, if not impossible, to manage the designated habitat element. Unsatisfactory results are probable. (For short-term usage, soils rated as "poorly suited" may provide easy establishment and temporary values.)

*Habitat Elements for Wildlife:* The six habitat elements rated in table 3 are defined and exemplified as follows:

Grain and seed crops are agricultural grains or seed-producing annuals that are planted to produce food for wildlife. Examples are corn, sorghums, millet, and oats.

Grasses and legumes are domestic perennial grasses that can be established by planting and that furnish food and cover for wildlife. Examples are ryegrass and panic-grasses.

Wild herbaceous upland plants are perennial grasses, forbs, and weeds that provide food and cover for wildlife. Examples of these are croton, ragweed, and blue-stems.

Hardwood trees and shrubs are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, or foliage (browse) used extensively as food by wildlife. These plants commonly become established through natural processes, but may be planted. Examples are oak, mesquite, whitebrush, granjeno, catclaw, blackbrush, cenizo, kidneywood, guajillo, Texas wild olive, desert-yaupon, guayacan, Texas wild persimmon, and Texas-ebony.

<sup>3</sup>By JAMES HENSON, biologist, Soil Conservation Service.

TABLE 3.—Use of

Soil series and map symbols	Wildlife habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants
Brennan: Br.....	Well suited.....	Well suited.....	Well suited.....
Comitas: Cm.....	Suited.....	Well suited.....	Well suited.....
Copita: Ct.....	Suited.....	Well suited.....	Well suited.....
Cuevitas: Cu.....	Unsuited.....	Poorly suited.....	Suited.....
For Randado part of Cu, see Randado series.			
Delfina: Df.....	Well suited.....	Well suited.....	Well suited.....
Delmita: Dl, Dn.....	Suited.....	Well suited.....	Well suited.....
Dune land: Du.....	Unsuited.....	Unsuited.....	Poorly suited.....
Falfurrias: FfB.....	Unsuited.....	Suited.....	Poorly suited.....
Garcano: Gc.....	Suited.....	Well suited.....	Well suited.....
Hebronville: He.....	Suited.....	Well suited.....	Well suited.....
Nueces: Ns.....	Poorly suited.....	Suited.....	Poorly suited.....
For Sarita part of Ns, see Sarita series.			
Oil-waste land: Ow.....	Poorly suited.....	Poorly suited.....	Poorly suited.....
Randado: Rd.....	Poorly suited.....	Poorly suited.....	Suited.....
For Delmita part of Rd, see Delmita series.			
Sarita:.....	Poorly suited.....	Suited.....	Poorly suited.....
Mapped only in an association with the Nueces soils.			
Tela: Te.....	Well suited.....	Well suited.....	Well suited.....
Zapata: ZaB.....	Unsuited.....	Poorly suited.....	Suited.....

Wetland food and cover plants are annual and perennial wild herbaceous plants in moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover that is extensively used by wetland wildlife. Examples are wild millet, rushes, sedges, wild rice cutgrasses, and cattails.

Shallow water developments are low dikes and water control structures established to create habitat principally for waterfowl. They can be designed to be drained, planted, and flooded or as permanent impoundments to grow submerged aquatics. Both fresh and brackish water are included.

*Kinds of Wildlife:* The three general kinds of wildlife (rated in table 3) are defined as follows:

Openland wildlife is the birds, reptiles, and mammals that normally frequent cropland, pastures, and areas that are overgrown with grasses, herbs, and shrubby growth. Examples of this kind of wildlife are bobwhite quail, scaled quail, white-winged and mourning doves, cottontail rabbits, jackrabbits, and sparrows.

Brushland wildlife is birds and mammals that normally frequent wooded areas of hardwood trees and shrubs. Examples of brushland wildlife are deer and turkey.

Wetland wildlife is birds and mammals that normally frequent such areas as farm ponds. Examples of this kind of wildlife are various kinds of ducks. Most ponds also are stocked with fish.

### Engineering Uses of the Soils<sup>4</sup>

Soils are used in engineering mainly to support structures and as a material in structures. Soil materials are

<sup>4</sup>This section by BILLY J. GARNER, area engineer, Soil Conservation Service, Harlingen, Texas.

used in the construction of roads and airports; to support buildings, pipelines, or drainage systems; in structures for water storage, erosion control, sewage disposal, or irrigation; and for many other uses.

The soil properties most important to the engineer are permeability to water, compressibility, shear strength, compaction characteristics, soil drainage, shrink-swell potential, grain size, plasticity, and soil reaction (pH). Also important are depth to the water table, depth to bedrock, and topography.

The information in this survey can be used to:

1. Make studies of soil and land use that will aid in selecting and developing sites for industrial, business, residential, and recreational uses.
2. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and landscape conditions that will aid in the selection of locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected sites.
4. Locate probable sources of gravel and other materials used in construction.
5. Correlate performance of engineering structures with soil mapping units.
6. Determine the suitability of soils for the cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports for planners and engineers.

soils for wildlife

Wildlife habitat elements—Continued			Kinds of wildlife		
Hardwood trees and shrubs	Wetland food and cover plants	Shallow water developments	Openland wildlife	Brushland wildlife	Wetland wildlife
Suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Well suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Well suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Poorly suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Unsuited	Poorly suited	Poorly suited	Poorly suited	Unsuited	Poorly suited.
Suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Poorly suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.
Suited	Unsuited	Unsuited	Well suited	Well suited	Unsuited.
Suited	Unsuited	Unsuited	Poorly suited	Suited	Unsuited.

The engineering interpretations in this subsection can be useful for many purposes, but it should be emphasized that they will not eliminate the need for testing at the site of a specific engineering work involving heavy loads and where excavations are deeper than the depths of layers here reported. Small areas of soils other than the dominant soils described in the mapping units may have different engineering properties than those listed. Even in these situations, however, the soil map is useful for planning more detailed field investigations and for indicating the kinds of problems that may be expected. The estimated values for traffic-supporting capacity are described in words and should not be assigned specific values.

Some terms used by the soil scientists may be unfamiliar to engineers, and some terms may have a special meaning in soil science. These and other terms are defined in the Glossary at the back of this survey.

Although most of the information in this subsection is in tables 4, 5, and 6, additional information useful to engineers can be found in other sections of this survey, particularly "Descriptions of the Soils" and "Formation and Classification of Soils."

### Engineering Classification Systems

Most highway engineers classify soil materials according to the AASHO System.<sup>5</sup> In this system, the soils are placed in seven basic groups, designated A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing capacity, or the best soils for road subgrade (foundation). In group A-7 are the poorest soils, clays that have low strength when wet. Groups A-1,

A-2, and A-7 can be further divided to indicate more precisely the nature of the soil material. If soil material is near a classification boundary, it is given a symbol showing both classes; for example "A-2 or A-4."

In the Unified Soil Classification System,<sup>6</sup> soil materials are classed according to particle size distribution, plasticity index, liquid limit, and organic matter. Soils are grouped in 15 classes. The eight classes of coarse grained soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils are identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils is identified as Pt. Soils on the border line between two classes are designated by symbols for both classes; for example "CH or MH." The AASHO classification and the Unified classification of the soils in Jim Hogg County are shown in table 6. The data shown in this table were derived from tests performed by the Texas Highway Department on samples collected by soil scientists in the county.

### Estimated Engineering Properties of Soils

Table 4 provides estimated properties of soils and is based on field classifications and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and from detailed experience in working with the individual kind of soil in the survey area.

Hydrologic soil groups shown in the second column of table 4 give the potential runoff resulting from rainfall. The soils are classified on the basis of intake of water and water transmission within the soil after wetting and without the protective effects of vegetation.

<sup>5</sup> American Association of State Highway Officials. Standard Specifications for Highway Materials and Methods of Sampling and Testing. Ed. 8, 2 v., illus. 1961.

<sup>6</sup> United States Department of Defense. Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations. MIL-STD-619B, 30 pp., illus. 1963.

TABLE 4.—*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. The soils for referring to other series that appear in the first column of this table. Symbol > means more than; symbol < means

Soil series and map symbols	Hydro-logic group	Depth to bedrock	Depth from surface	Classification		
				USDA texture	Unified	AASHO
Brennan: Br.....	B	Inches >60	Inches 0-12 12-65 65-80	Fine sandy loam..... Sandy clay loam..... Fine sandy loam.....	SM SC SC	A-2-4 A-6, A-2 A-2-4
Comitas: Cm.....	A	>60	0-31 31-87 87-112	Loamy fine sand..... Fine sandy loam..... Sandy clay loam.....	SM SM-SC, SM SC or CL	A-2-4 A-2-4 or A-4 A-6
Copita: Ct.....	B	>60	0-16 16-33 33-43 43-68	Fine sandy loam..... Sandy clay loam..... Fine sandy loam..... Weakly consolidated fine sandy loam.	SM-SC SC SM SM	A-2-4 A-6 or A-2-6 A-2-4 A-2-4
*Cuevitas: Cu..... For Randado part of Cu, see Randado series.	D	7-14	0-9 9-16	Fine sandy loam..... Indurated caliche.	SM	A-2-4
Delfina: Df.....	B	>60	0-7 7-19 19-90	Loamy fine sand..... Fine sandy loam..... Sandy clay loam.....	SM SM, SC SC	A-2-4 A-2-6, A-2-4 A-6 or A-2-6
Delmita: Dl, Dn.....	C	20-40	0-23 23-31 31-33	Fine sandy loam..... Sandy clay loam..... Indurated caliche.	SM SC	A-2-4 A-2-6, A-6
Dune land: Du. Properties too variable to rate.						
Falfurrias: FfB.....	A	>60	0-90	Fine sand.....	SP-SM	A-2-4
Garceno: Gc.....	C	>60	0-37 37-59 59-80	Clay loam..... Clay..... Clay loam.....	CL CH, CL CL	A-7 A-7 A-7
Hebbronville: He.....	B	>60	0-15 15-60 60-70	Loamy fine sand..... Fine sandy loam..... Fine sandy loam.....	SM, SP-SM SM SM-SC or SC	A-2-4 A-2-4 A-2-4
*Nueces: Ns..... For Sarita part of Ns, see Sarita series.	C	>60	0-34 34-68	Fine sand..... Sandy clay loam.....	SP-SM SC	A-2-4 A-2-6
Oil-waste land: Ow. Properties too variable to rate.						
*Randado: Rd..... For Delmita part of Rd, see Delmita series.	C	8-20	0-8 8-16 16-35	Fine sandy loam..... Fine sandy loam..... Cemented caliche.	SM or SM-SC SC	A-2-4 A-2-4 or A-6
Sarita: Mapped only in an association with the Nueces soils.	A	>60	0-46 46-75 75-90	Fine sand..... Sandy clay loam..... Fine sandy loam.....	SP-SM SC SM	A-2-4 A-2-6 or A-6 A-2-4
Tela: Te.....	B	>60	0-9 9-32 32-63	Sandy clay loam..... Sandy clay loam..... Sandy clay loam.....	SC SC or CL SC or CL	A-6 A-6 A-6
Zapata: ZaB.....	C	2-10	0-8 8-12	Fine sandy loam and sandy clay loam. Indurated caliche.	SC or CL	A-6

*significant in engineering*

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions less than. Absence of entry in a column indicates that characteristics are too variable for the material to be estimated]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.75 mm.)	No. 10 (2.0 mm.)	No. 40 (0.425 mm.)	No. 200 (0.075 mm.)				
100	100	100	20-35	<i>Inches per hour</i> 2.0-6.3	<i>Inches per inch of soil</i> 0.10-0.14	<i>pH</i> 6.6-7.3	Low.
95-100	95-100	90-100	30-50	0.63-2.0	0.13-0.16	6.6-8.4	Low.
95-100	95-100	90-100	25-35	2.0-6.3	0.10-0.13	7.9-8.4	Low.
100	100	90-100	15-25	2.0-6.3	0.07-0.10	6.1-7.3	Low.
100	100	85-100	24-50	2.0-6.3	0.11-0.15	6.1-8.4	Low.
100	98-100	85-90	40-55	0.63-2.0	0.13-0.16	7.9-8.4	Low.
100	100	100	25-35	2.0-6.3	0.10-0.13	7.9-8.4	Low.
100	100	95-100	30-50	0.63-2.0	0.13-0.16	7.9-8.4	Low.
80-95	80-95	80-95	25-35	2.0-6.3	0.09-0.13	7.9-8.4	Low.
70-100	70-100	65-95	25-30	2.0-6.3	0.09-0.13	7.9-8.4	Low.
100	100	100	20-35	0.63-2.0	0.10-0.14	6.6-7.8	Low.
100	100	100	15-25	2.0-6.3	0.07-0.10	6.6-7.3	Low.
100	100	100	20-35	2.0-6.3	0.10-0.14	7.4-7.8	Low.
90-100	90-100	90-100	25-50	0.2-0.63	0.16-0.20	7.4-8.4	Low.
100	100	100	20-35	2.0-6.3	0.10-0.14	6.6-7.3	Low.
100	95-100	95-100	30-35	0.63-2.0	0.12-0.15	6.6-7.3	Low.
100	100	95-100	5-10	6.3-20.0	0.05-0.8	6.6-7.3	Low.
100	95-100	90-100	70-85	0.63-2.0	0.15-0.18	7.9-8.4	Moderate.
100	95-100	90-100	80-90	0.63-2.0	0.15-0.18	7.9-8.4	High.
100	95-100	90-100	80-90	0.63-2.0	0.15-0.18	7.9-8.4	Moderate.
100	100	75-90	12-24	2.0-6.3	0.07-0.12	6.6-7.8	Low.
100	100	75-90	20-35	2.0-6.3	0.14-0.17	6.6-8.4	Low.
100	100	95-100	20-30	2.0-6.3	0.14-0.17	7.9-8.4	Low.
100	100	100	9-12	6.3-20.0	0.05-0.08	6.1-7.3	Low.
100	100	100	20-30	0.2-0.63	0.12-0.16	7.4-8.4	Low.
95-100	80-100	80-90	25-35	0.63-2.0	0.10-0.14	6.1-7.8	Low.
95-100	80-100	80-90	30-45	0.63-2.0	0.12-0.15	6.6-7.3	Low.
100	100	60-85	5-12	6.3-20.0	0.03-0.06	6.1-7.3	Low.
100	100	80-90	30-40	0.63-2.0	0.12-0.16	7.4-8.4	Moderate.
100	100	100	20-35	2.0-6.3	0.10-0.14	7.9-8.4	Low.
100	100	80-90	40-50	0.63-2.0	0.10-0.15	7.4-7.8	Low.
100	100	95-100	45-65	0.63-2.0	0.15-0.20	7.4-8.4	Low.
100	95-100	95-100	40-65	0.63-2.0	0.15-0.20	7.9-8.4	Low.
85-95	75-95	75-90	40-65	0.63-2.0	0.10-0.15	7.9-8.4	Low.

TABLE 5.—*Engineering interpretations*

[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. The soils in such mapping units may have different an entry in a column indicates that characteristics

Soil series and map symbols	Suitability as source of—				Degree of limitations and soil features affecting—		
	Topsoil	Sand	Caliche	Road fill	Septic tank filter fields	Sewage lagoons	Foundations for low buildings
Brennan: Br.....	Fair: 8 to 16 inches of fine sandy loam.	Poor: excessive fines.	Unsuitable.....	Fair: fair traffic-supporting capacity.	Slight.....	Moderate: moderate permeability.	Slight.....
Comitas: Cm.....	Poor: loamy fine sand texture.	Fair: excessive fines.	Unsuitable.....	Fair: fair traffic-supporting capacity.	Slight.....	Severe: moderately rapid permeability.	Slight.....
Copita: Ct.....	Fair: 10 to 16 inches of fine sandy loam.	Poor: excessive fines.	Unsuitable.....	Fair: fair traffic-supporting capacity.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight.....
*Cuevitas: Cu..... For Randado part of Cu; see Randado series.	Fair: 7 to 14 inches of fine sandy loam.	Poor: excessive fines; only 7 to 14 inches of material.	Good.....	Good <sup>1</sup> .....	Severe: depth to indurated caliche is 7 to 14 inches.	Severe: depth to indurated caliche is 7 to 14 inches.	Moderate: depth to indurated caliche is 7 to 14 inches. <sup>1</sup>
Delfina: Df.....	Poor: loamy fine sand texture.	Poor: excessive fines.	Unsuitable.....	Fair: fair traffic-supporting capacity.	Severe: moderately slow permeability.	Slight.....	Slight.....
Delmita: Dl.....	Poor: loamy fine sand	Poor: excessive fines.	Good.....	Poor where 20 to 36 inches of material; fair where 36 to 40 inches of material; fair traffic-supporting capacity.	Severe: depth to indurated caliche is 20 to 40 inches.	Severe: depth to indurated caliche is 20 to 40 inches.	Slight.....
Dn.....	Good.....	Poor: excessive fines.	Good.....	Poor where 20 to 24 inches of material; fair where 24 to 40 inches of material; fair traffic-supporting capacity.	Severe: depth to indurated caliche is 20 to 40 inches.	Severe: depth to indurated caliche is 20 to 40 inches.	Slight.....

See footnote at end of table.

*of soil properties*

properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table. Absence of are too variable for the material to be classified]

Degree of limitations and soil features affecting—Continued							Soil features affecting irrigation	Corrosivity class for uncoated steel and contributing soil features
Farms ponds		Highway location	Camp areas	Paths and trails	Picnic areas	Playgrounds		
Embankments	Reservoir areas							
Moderate: poor resistance to piping and erosion.	Moderate: moderate permeability.	Moderate: fair traffic-supporting capacity.	Slight.....	Slight.....	Slight.....	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Features generally favorable.	Moderate: conductivity.
Moderate: fair slope stability.	Severe: moderately rapid permeability.	Moderate: fair traffic-supporting capacity.	Moderate: loamy fine sand surface layer.	High intake rate; low available water capacity; subject to soil blowing.	Low.			
Moderate: poor resistance to piping and erosion.	Moderate: moderate permeability.	Moderate: fair traffic-supporting capacity.	Slight.....	Slight.....	Slight.....	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 3 percent.	Features generally favorable.	High: resistivity.
Severe: depth to indurated caliche is 7 to 14 inches.	Severe: depth to indurated caliche is 7 to 14 inches.	Moderate: depth to indurated caliche is 7 to 14 inches. <sup>1</sup>	Slight.....	Slight.....	Slight.....	Moderate: depth to indurated caliche is 7 to 14 inches. <sup>1</sup>	Depth to indurated caliche is 7 to 14 inches.	Moderate: conductivity.
Moderate: poor resistance to piping and erosion.	Moderate: moderately slowly permeable.	Moderate: fair traffic-supporting capacity.	Moderate: loamy fine sand surface layer.	Low intake rate; subject to soil blowing.	High: conductivity.			
Moderate: depth to indurated caliche is 20 to 40 inches.	Moderate: depth to indurated caliche is 20 to 40 inches.	Severe where depth to indurated caliche is 20 to 36 inches; moderate where depth to indurated caliche is 36 to 40 inches; fair traffic-supporting capacity.	Moderate: loamy fine sand surface layer.	High intake rate; subject to soil blowing.	Moderate: conductivity.			
Moderate: depth to indurated caliche is 20 to 40 inches.	Moderate: depth to indurated caliche is 20 to 40 inches.	Severe where depth to indurated caliche is 20 to 36 inches; moderate where depth to indurated caliche is 36 to 40 inches; fair traffic-supporting capacity.	Slight.....	Slight.....	Slight.....	Slight.....	Features generally favorable.	Moderate: conductivity.

TABLE 5.—*Engineering interpretations*

Soil series and map symbols	Suitability as source of—				Degree of limitations and soil features affecting—		
	Topsoil	Sand	Caliche	Road fill	Septic tank filter fields	Sewage lagoons	Foundations for low buildings
Dune land: Du. Properties too variable to rate.							
Falfurrias: FfB.....	Poor: fine sand texture.	Fair: excessive fines; poorly graded.	Unsuitable.....	Good.....	Slight.....	Severe: rapid permeability.	Slight.....
Garceno: Gc.....	Fair: clay loam texture.	Poor: excessive fines.	Unsuitable.....	Poor: poor traffic-supporting capacity; high shrink-swell potential.	Moderate: moderate permeability.	Moderate: moderate permeability.	Severe: high shrink-swell potential.
Hebbronville: He.....	Poor: loamy fine sand texture.	Fair: excessive fines.	Unsuitable.....	Good.....	Slight.....	Severe: moderately rapid permeability.	Slight.....
*Nueces: Ns..... For Sarita part of Ns, see Sarita series.	Poor: fine sand texture.	Fair: excessive fines; poorly graded.	Unsuitable.....	Fair: fair traffic-supporting capacity.	Severe: moderately slow permeability.	Slight where 0 to 2 percent slopes; moderate where 2 to 3 percent slopes.	Moderate: moderately well drained.
Oil-waste land: Ow. Properties too variable to rate.							
*Randado: Rd..... For Delmita part of Rd, see Delmita series.	Fair: 8 to 20 inches of fine sandy loam.	Poor: excessive fines; only 8 to 20 inches of material.	Good.....	Fair: fair traffic-supporting capacity. <sup>1</sup>	Severe: depth to cemented caliche is 8 to 20 inches.	Severe: depth to cemented caliche is 8 to 20 inches.	Moderate: depth to cemented caliche is 8 to 20 inches. <sup>1</sup>
Sarita..... Mapped only in an association with the Nueces soils.	Poor: fine sand texture.	Fair: excessive fines; poorly graded.	Unsuitable.....	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Slight.....	Severe: seepage through surface.	Moderate: moderate shrink-swell potential.
Tela: Te.....	Fair: sandy clay loam texture.	Poor: excessive fines.	Unsuitable.....	Fair: fair traffic-supporting capacity.	Moderate: flood hazard.	Moderate: moderate permeability.	Severe: flood hazard.
Zapata: ZaB.....	Poor: 15 to 20 percent fragments.	Poor: excessive fines; only 2 to 10 inches of material.	Good.....	Fair: fair traffic-supporting capacity. <sup>1</sup>	Severe: depth to indurated caliche is 2 to 10 inches.	Severe: depth to indurated caliche is 2 to 10 inches.	Moderate: depth to indurated caliche is 2 to 10 inches. <sup>1</sup>

<sup>1</sup> Indurated caliche considered as bedrock. Caliche is rippable and is considered as good material below indurated layer.

of soil properties—Continued

Degree of limitations and soil features affecting—Continued							Soil features affecting irrigation	Corrosivity class for uncoated steel and contributing soil features
Farm ponds		Highway location	Camp areas	Paths and trails	Picnic areas	Playgrounds		
Embankments	Reservoir areas							
Severe: fair stability; erosion hazard; compacted permeability is rapid.	Severe: rapid permeability.	Slight.....	Severe: loose fine sand surface layer.	High intake rate; low available water capacity; subject to soil blowing.	Low.			
Moderate: fair stability; high compressibility	Moderate: moderate permeability.	Severe: poor traffic-supporting capacity; high shrink-swell potential.	Moderate: clay loam surface layer.	Low intake rate...	High: conductivity			
Moderate: fair stability; poor resistance to piping and erosion.	Severe: moderately rapid permeability.	Slight.....	Moderate: loamy fine sand surface layer.	High intake rate; subject to soil blowing.	Low.			
Severe: poor slope stability; poor resistance to piping and erosion.	Moderate: moderately slow permeability.	Moderate: fair traffic-supporting capacity.	Severe: loose fine sand surface layer.	High intake rate; low available water capacity; subject to soil blowing.	Moderate: moderately well drained; sandy clay loam texture.			
Severe: 8 to 20 inches of material.	Severe: depth to cemented caliche is 8 to 20 inches.	Moderate: fair traffic-supporting capacity. <sup>1</sup>	Slight.....	Slight.....	Slight.....	Moderate: depth to cemented caliche is 8 to 20 inches. <sup>1</sup>	Depth to cemented caliche is 8 to 20 inches.	Moderate: conductivity
Severe: poor slope stability; poor resistance to piping and erosion.	Moderate to severe: moderate permeability; seepage through the surface.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Severe: loose fine sand surface layer.	High intake rate; low available water capacity; subject to soil blowing.	Low.			
Moderate: fair compressibility.	Moderate: moderate permeability.	Moderate: fair traffic-supporting capacity; flood hazard.	Moderate: sandy clay loam surface layer.	Features generally favorable.	High: conductivity.			
Severe: only 2 to 10 inches of material.	Severe: depth to indurated caliche is 2 to 10 inches.	Moderate: fair traffic-supporting capacity. <sup>1</sup>	Slight.....	Slight.....	Slight.....	Moderate: 15 to 20 percent fragments; 2 to 5 percent slopes.	Depth to indurated caliche is 2 to 10 inches.	High: conductivity.

TABLE 6.—*Engineering*

[Tests performed by the Texas Highway Department in accordance with standard

Soil name and location	Parent material	Texas report No.	Depth from surface	Shrinkage		
				Limit	Lineal	Ratio
Comitas loamy fine sand: 3.15 miles east of Hebbronville on Texas Highway 285: (modal)	Old terrace.	24-R	5-31	16	2.2	1.77
		25-R	31-59	17	2.4	1.78
Copita fine sandy loam: 39 miles southwest of Hebbronville on Farm Road 649: (modal)	Loamy calcareous sediments.	26-R	0-16	17	2.6	1.80
		27-R	16-33	17	4.8	1.81
		28-R	43-62	17	2.3	1.75
Delfina loamy fine sand: 14 miles west of Hebbronville on Martinez Ranch. (modal)	Sandy clays.	37-R	7-19	15	1.2	1.82
		38-R	24-41	17	9.3	1.80
		39-R	49-72	17	5.7	1.79
Delmita loamy fine sand: 16.1 miles west of Hebbronville on Farm Road 3073: (modal)	Loamy material.	44-R	7-13	16	1.3	1.81
		45-R	23-31	16	4.3	1.82
Falfurrias fine sand: 15 miles south of Hebbronville on Farm Road 1017: (modal)	Wind-deposited sand.	22-R	0-24	19	0	1.72
		23-R	24-41	18	.4	1.72
Sarita fine sand: 16 miles south of Hebbronville on Farm Road 1017: (modal)	Wind-deposited sand.	68-20-R	0-19	15	2.3	1.70
		21-R	45-54	19	8.0	1.72

<sup>1</sup> Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

Soils in hydrologic group A have high infiltration rates even when thoroughly wetted. Soils in this group are chiefly deep, well-drained to excessively drained sand, gravel, or both. They have a high rate of water transmission and a low runoff potential.

Soils in hydrologic group B have moderate infiltration rates when thoroughly wetted. They are chiefly moderately deep to deep, moderately well drained to well drained soils of moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission and moderate runoff potential.

Soils in hydrologic group C have slow infiltration rates when thoroughly wetted. These are chiefly soils with a layer that impedes the downward movement of water or soils with moderately fine to fine texture and slow infiltration rate. These soils have a slow rate of water transmission and a high runoff potential.

Soils in hydrologic group D have very slow infiltration rates when thoroughly wetted. They are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils that overlie nearly impervious material. These soils have a very slow rate of water transmission and a very high runoff potential.

Depth to bedrock is an indication of the type and depth at which consolidated materials may be expected.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the glossary at the back of this survey.

The columns headed "Percentage passing sieve" list estimates for soil materials passing sieves of four sizes. The information is useful in helping to determine suitability of the soil as material for construction purposes.

Permeability, as rated in table 4, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other characteristics resulting from use of the soils are not considered.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value is explained in the Glossary.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes

test data

procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis <sup>1</sup>							Liquid limit	Plasticity index	Classification <sup>2</sup>	
Percentage passing sieve—				Percentage smaller than—					AASHO <sup>3</sup>	Unified <sup>4</sup>
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.				
		100	23	15	9	6	19	2	A-2-4	SM
		100	24	19	11	10	20	4	A-2-4	SM
		100	33	26	13	10	22	6	A-2-4	SM-SC
	100	99	41	35	19	15	26	12	A-6	SC
	98	93	28	22	6	3	22	3	A-2-4	SM
		100	21	16	11	10	17	2	A-2-4	SM
	99	98	46	40	34	33	36	22	A-6	SC
	99	96	29	27	16	13	28	14	A-2-6	SC
		100	22	16	9	8	18	2	A-2-4	SM
	99	99	32	25	19	18	24	11	A-2-6	SC
		100	8	4	1	1	23	4	A-2-4	SP-SM
		100	9	4	0	0	23	3	A-2-4	SP-SM
		100	9	6	1	0	24	4	A-2-4	SP-SM
		100	34	32	27	27	35	20	A-2-6	SC

<sup>2</sup> Unified and AASHO classification made by SCS personnel.

<sup>3</sup> Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate.

<sup>4</sup> Based on the Unified classification system. See footnote 6, page 27.

in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures.

The depth to a seasonal water table is many feet below the soil surface of all the soils in Jim Hogg County. A column for seasonal high water table therefore was not included on the table.

### Engineering Interpretations of Soil Properties

Table 5 contains selected information useful to engineers and others who plan to use soil material in construction of highways, farm facilities, buildings, sewage disposal systems, and other structures. Detrimental or undesirable features are emphasized. The ratings and other interpretations in this table are based on estimated engineering properties of the soils in table 4; on available test data, including those in table 6; and on field experience. In general, the information applies to soil depths, as indicated in table 4.

Topsoil, as used in table 5, designates a fertile soil or soil material, ordinarily rich in organic matter, that is used as a topdressing for lawns, gardens, roadbanks, and earthen dams. The ratings indicate the suitability of each soil for such use. Soils are rated poor or fair as a source of topsoil when the soils are heavy, sticky,

difficult to handle or work, eroded, or low in organic matter.

Sand is individual rock or mineral fragments in soils that have diameters ranging from 0.05 to 2 millimeters. It is the textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay. Ratings are based on the probability that mapped areas of the soils contain deposits of sand, but do not indicate quality or size of deposits.

Caliche is a more or less cemented deposit of calcium carbonate that is used extensively in road building. Ratings are based on the probability that mapped areas of the soils contain deposits of caliche, but do not indicate quality or size of deposits.

Road fill is soil material on which a subbase is laid and the pavement is built. Suitability ratings are based on the performance of the soil material as fill when excavated and compacted, or compacted and used in place. In general, sandy material that contains adequate binder is the most suitable for this purpose.

Septic tank filter fields are rated mainly for seepage loss, location of water table, and susceptibility to flooding. The degree of limitations and principal reasons for assigning moderate or severe limitations are given.

Sewage lagoons are rated chiefly for susceptibility to seepage, location of water table, and slope. The de-

gree of limitation and principal reasons for assigning moderate or severe limitations are given.

Foundations for low buildings are rated chiefly on the ability of the undisturbed soil to support low buildings that have normal foundation loads. Specific values for bearing capacity are not assigned.

Farm pond embankments serve as dams. The features of the soil and the underlying material are rated for susceptibility to seepage, permeability, and resistance to piping and erosion.

Farm pond reservoir areas are rated mainly on susceptibility to seepage and depth of fractured or permeable bedrock or other permeable material.

Highway location is influenced by those features and qualities of the soil that affect the performance of the soil for the location of highways. The entire soil profile is evaluated on basis of undisturbed soil without artificial drainage. It is assumed that the surface soil, because of its higher organic matter content, will be removed in construction and used for topsoil.

Camp areas are used for overnight or week-long camping and are affected mostly by texture of the surface soil and soil depth. Flooding, dust, slope, and rockiness are other criteria used in rating soils for camp areas. Grass-covered, tree-shaded grounds are most desirable for camp sites.

Paths and trails are used for footpaths, hiking trails, and bridle paths and are affected mostly by texture of the surface soil. The best soils are firm when wet, not dusty when dry, not rocky, and not frequently flooded.

Picnic areas are affected by texture of the surface soil, flooding, slope, and rockiness.

Playground areas are affected by texture of the surface soil, slope, rockiness, and soil depth.

Irrigation is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in the fragipan or other layers that restrict movement of water; amount of water available to plants; need for drainage; and depth to water table or bedrock.

Corrosivity of soils is rated at a depth of 4 feet. Properties affecting corrosion of uncoated steel pipe are drainage, texture, acidity, resistivity, and conductivity. Corrosivity of concrete is not a problem in Jim Hogg County, and thus a column for this was not included.

Columns for dikes and levees, agricultural drainage terraces and diversions, grassed waterways, and winter grading were not included, because these are not used and are not a problem in Jim Hogg County.

## Engineering Test Data

Table 6 contains the results of engineering tests performed by the Texas Highway Department on selected soils in Jim Hogg County. The table shows the specific location where samples were taken, parent material, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering. The terms that

appear in column headings in table 6 are explained in the following paragraphs.

Parent material is the disintegrated and partly weathered rock from which soil has formed.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops. As moisture leaves a soil, the soil shrinks and decreases in volume in direct proportion to the loss in moisture until a condition of equilibrium is reached. At this point, shrinkage stops although additional moisture may be removed. This point of moisture content where shrinkage stops is called the shrinkage limit of the soil and is reported as the moisture content, by oven-dry weight of soil, where this condition prevails.

Lineal shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the liquid limit to the shrinkage limit.

The shrinkage ratio is the volume change, expressed as a percentage of the volume of the dry soil, divided by the moisture loss above the shrinkage limit, which is expressed as a percentage of the weight of the dry soil.

Mechanical analysis shows the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve. Silt is that material larger than 0.002 millimeter in diameter that passes through the No. 200 sieve. Clay is that fraction passing through the No. 200 sieve that is smaller than 0.002 millimeter in diameter. The clay fraction was determined by the hydrometer method, rather than the pipette method most soil scientists use in determining the clay content in soil samples.

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 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 passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the plastic limit and the liquid limit. It indicates the range of moisture content within which a soil material is plastic.

AASHO and Unified Classifications systems have been explained previously.

## Formation and Classification of Soils

This section discusses the major factors of soil formation and tells how they have affected the formation of soils in Jim Hogg County.

### Formation of Soils

The five major factors of soil formation are climate, living organisms, parent material, relief, and time. The kind of soil that forms in one area differs from the kind of soil in another area if there has been a difference between the two areas in one or more of these major factors.

### Climate

The present climate of Jim Hogg County is a subtropical steppe type characterized by low summer humidity. The wet climate of past geologic ages influenced the deposition of parent materials. Because rainfall is low and there are long, dry periods, soil development has been slow. Soils are seldom wet below the root zone and, as a result, most of the soils have a horizon of calcium carbonate accumulation. Leaching has not removed free lime from the upper layers of Copita, Garceno, or Zapata soils. The sandy Falfurrias, Nueces, and Sarita soils are examples of soils that have been leached.

Wind played some role in development of soils in the eastern part of the county. It has affected development of the Falfurrias, Nueces, and Sarita soils.

### 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. Vegetation in this county is mostly grass and brush. The grasses are tall or short, depending on the kind of parent material. Comitas and Falfurrias soils, which have sandy parent material, support tall grasses; Garceno clay loam, which has a clayey parent material, supports short grasses and thick brush.

Vegetation, dominantly grasses, has affected soil formation in Jim Hogg County more than other living organisms. Prairie vegetation has contributed large amounts of organic matter that has helped keep the soil porous and granular. Micro-organisms decomposed the roots and distributed organic matter throughout the soil.

Man also has influenced soil formation by fencing the range for grazing and allowing it to be overgrazed, by changing the vegetation, and by clearing and cultivating the soils.

### Parent material

Parent material, particularly its texture and lime content, greatly influences soil development. Soils that developed from fine-textured material generally formed more rapidly and to a greater degree, than soils formed in coarse-textured material.

The nearly level Brennan and Copita soils developed in calcareous, loamy sediments. Falfurrias soils developed in sandy materials.

### Relief

Relief influences soil development through its effects on drainage and runoff. If other factors of soil development are equal, the degree of profile development depends on the amount of water that enters a soil. Prevailing southeasterly winds have deposited sands to form undulating topography in a southeast to northwest pattern in parts of the county.

### Time

The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have been active. Most of the soils in Jim Hogg County are young soils that have a weakly developed profile, such as Copita and Garceno soils. Brennan and Hebronville soils have been developing long enough to have

calcium carbonate move downward from the upper horizons. Clay particles have also moved downward from the surface layer.

### Classification of Soils

Soils are classified to make their significant characteristics and interrelationships more easily remembered. Classification is useful in assembling knowledge about the soils, in seeing relationships of one soil to another and to the whole environment, and in developing principles that are helpful in understanding behavior of soils and their response to manipulation. First through classification, and then through use of soil maps, a knowledge of soils can be applied to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow organization and application of knowledge about soils in managing farms, fields, and woodlands; 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 adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments in the current system should search the latest literature available.<sup>7</sup>

The current system of classification has six categories. Beginning with the most inclusive, 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 that are observable and measureable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 7, the soil series of Jim Hogg County are placed in the order, subgroup, and family categories of the current system. The 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. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

**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. The names of suborders have two syllables. The last syllable indicates the order.

**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 have accumulated; those that have pans that

<sup>7</sup> Soil Classification, A Comprehensive System, 7th approximation. 265 pp. illus., 1960. (Supplement issued in March, 1967.)

interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder.

**SUBGROUP.**—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties, intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

**FAMILY.**—Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and the other properties mentioned.

### Additional Facts About the County

This section of the soil survey presents specific statistical and historical information intended to give a clearer image of significant influences and trends at work in Jim Hogg County. The principal agricultural enterprises in the county are mentioned, the chief transportation arteries are described, and climatic ranges are given.

Jim Hogg County was established in 1913. Hebbroville, the only town in the county, is the county seat and has a population of 4,079. Population of the county leveled off in the 1940's and has remained about the same since then. The 1970 census recorded 4,654 persons in the county. Jim Hogg County was named for James Stephen Hogg, the first native-born governor of Texas.

The county was created from Brooks and Duval Counties. Hebbroville, a center for oil and ranching activities, was named for James R. Hebbro.

The economy of the county is based on livestock; field crops, mainly watermelons; and oil and gas.

**Ranching and farming.**—About 98 percent of Jim Hogg County is used for range. Raising beef cattle is the chief agricultural enterprise, but a few cultivated crops also are produced.

Almost every ranch has cowherds and sells feeder or replacement calves at weaning time. Cattle feed mainly on native range, but on some ranch units supplemental feed grains, forage crops, and pasture grasses are grown. A few dairy cattle, sheep, and goats are raised.

Irrigation farming, still limited in this county, started in the 1950's. Water for the irrigation is supplied by wells 150 to 300 feet deep and applied by a sprinkler system. Watermelons, the major cash crop, is the only crop that is irrigated. Other crops grown in the county are grain sorghum and forage sorghum that are fed to cattle, and buffleggrass and improved bermudagrass that are used for pasture.

**Transportation, markets, and farm conveniences.**—Most rural areas have electricity, and some have telephones. Ranch and farm work is abundant, and some people migrate to the major farming sections of the county each year.

Texas Highways 359 and 285 and Farm Market Road 2687 run in a generally east to west direction. Texas Highway 16 runs north to south, as do Farm Market roads 649 and 1017. The Texas Mexican Railway passes through Hebbroville. Unpaved roads can be used most of the time and cover all the county. Travel over unpaved roads during dry periods in the sandy section of the county requires a 4-wheel drive vehicle.

### Climate<sup>8</sup>

This subsection describes the climate of Jim Hogg County. The temperature and precipitation data for the county are summarized in table 8.

This county has a subtropical steppe climate characterized by low summer humidity. The essentially con-

<sup>8</sup> By ROBERT B. ORTON, Texas State climatologist.

TABLE 7.—Classification of soil series in the current system

Series	Family	Subgroup	Order
Brennan	Fine-loamy, mixed, hyperthermic	Ardic Haplustalfs	Alfisols.
Comitas	Loamy, mixed, hyperthermic	Arenic Aridic Haplustalfs	Alfisols.
Copita	Fine-loamy, mixed, hyperthermic	Ustollic Calciorthids	Ardisols.
Cuevitas	Loamy, mixed, hyperthermic, shallow	Ustollic Paleorhids	Aridisols.
Delfina	Fine-loamy, mixed, hyperthermic	Aquic Haplustalfs	Alfisols.
Delmita	Fine-loamy, mixed, hyperthermic	Petrocalcic Paleustalfs	Alfisols.
Falfurrias	Mixed, hyperthermic	Typic Ustipsamments	Entisols.
Garceno	Fine, mixed, hyperthermic	Ustollic Camborhids	Aridisols.
Hebbroville	Coarse-loamy, mixed, hyperthermic	Aridic Haplustalfs	Alfisols.
Nueces	Loamy, mixed, hyperthermic	Aquic Arenic Paleustalfs	Alfisols.
Randado	Loamy, mixed, hyperthermic, shallow	Petrocalcic, Ustollic Paleargids	Aridisols.
Sarita	Loamy, mixed, hyperthermic	Grossarenic Paleustalfs	Alfisols.
Tela	Fine-loamy, mixed, hyperthermic	Typic Argiustolls	Mollisols.
Zapata	Loamy, carbonatic, hyperthermic, shallow	Ustollic Paleorhids	Aridisols.

tinental climate has a considerable range in extremes of temperature, but the air masses of continental origin play a minor role in determining weather in the area.

Southeasterly winds, born of warm air masses from the Gulf of Mexico, prevail throughout the year and cause mild winter temperatures. Summers are hot. The mean daily maximum temperatures exceed 95° F., in each of the summer months.

Rainfall, most often in the form of thunderstorms, averages 18.53 inches annually. Thunderstorms occur on about 28 days a year. A primary rainfall maximum occurs early in fall, and a secondary maximum early in summer.

Drought is fairly common. Periods of a month or longer with little or no rainfall have occurred during all seasons. In most years, March is the driest month, but July and December also are dry. In an average year, evaporation of water from a lake or similar exposed surface exceeds precipitation by 44 inches.

The percentage humidity is less than that of coastal counties. The mean relative humidity at noon is estimated at 62 percent in January, 55 percent in April, 48 percent in July, and 56 percent in October.

Jim Hogg County receives only about half of the possible sunshine in winter as a result of morning cloudiness. It receives 60 percent in spring, 76 percent in summer, and 65 percent in fall.

The county has an exceptionally long warm season (freeze-free period). The average is 303 days. There is a 20 percent chance of a temperature of 32° F. or below after March or before November. The average date of the last temperature of 32° or below in the spring is February 15, and the first in the fall is December 15.

### Glossary

- Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms are called peds. Clods are aggregates produced by tillage or similar disturbance.
- Alkaline soil.** Generally, a soil that is alkaline throughout most or all of the part occupied by plant roots. Precisely, any soil having a pH value greater than 7.0. Practically, a soil having a pH above 7.3.
- Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
- Association, soil.** A group of soils geographically associated in a characteristic repeating pattern.
- Available water capacity.** The amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil depth.
- Base saturation.** The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.
- Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- Caliche.** A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard thick beds just beneath the solum, or it may be exposed at the surface by erosion.
- Chaparral.** A dense community of shrub plants, normally permanent, that is dominated by evergreen shrubs or dwarf trees.
- Chlorosis.** A yellowing between veins on upper foliage that results from chlorophyll deficiency. Many factors, including heredity, cause chlorosis.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay film.** A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

TABLE 8.—Temperature and precipitation data

[Temperature data from Laredo, Webb County; precipitation data from Hebbronville, Jim Hogg County, elevation 559 feet. The period covered is 1953-69. The symbol < means less than]

Month	Temperature	Precipitation								
	Average monthly <sup>1</sup>	Monthly average <sup>1</sup>	Probability, in percent, of receiving selected amounts during month							
			0 or a trace	0.50 inch or more	1.00 inch or more	2.00 inches or more	3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more
	° F.	Inches								
January	57.7	1.11	1	60	40	20	10	5	2	1
February	61.7	1.42	5	60	40	15	4	1	<1	<1
March	68.1	.52	2	55	33	10	3	2	<1	<1
April	75.2	1.61	1	70	53	30	18	10	6	3
May	80.8	1.46	1	90	80	50	30	20	11	5
June	85.7	2.02	1	84	65	40	25	15	10	5
July	87.5	.59	11	65	48	28	15	9	4	1
August	87.5	1.59	5	75	59	38	20	12	10	5
September	82.7	4.04	1	90	80	60	40	30	20	18
October	75.5	2.21	5	75	75	35	20	12	9	5
November	64.8	1.28	5	55	35	15	5	2	1	<1
December	59.2	.68	3	62	44	20	8	5	2	1
Year	73.9	18.53								

<sup>1</sup> Average length of record, 15 years.

- Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Climax vegetation.** The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.
- Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.
- Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
- Loose.*—Noncoherent; does not hold together in a mass.
- Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
- Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
- Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
- Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.
- Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
- Soft.*—When dry, breaks into powder or individual grains under very slight pressure.
- Cemented.*—Hard and brittle; little affected by moistening.
- Decreaser.** Any of the climax range plants most heavily grazed. Because they are the most palatable, they are first to be destroyed by overgrazing.
- Deferred grazing.** The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.
- Eolian soil material.** Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.
- Erosion.** The wearing away of the land surface by wind (sandblast), running water, and other geological agents.
- Fertility, soil.** The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.
- Genesis, soil.** The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.
- Gully.** A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.
- Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:
- A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
- B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.
- C horizon.*—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.
- R layer.*—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.
- Humus.** The well-decomposed, more or less stable part of the organic matter in mineral soils.
- Increasesers.** Species in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing; increasesers commonly are shorter than decreaseers, and some are less palatable to livestock.
- Invaders.** On range, plants that come in and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface. (Most weeds are "invaders").
- 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 relatively level plots 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, to confine the flow of water to one direction.
- Furrow.*—Water is applied in small ditches made by cultivation implements used for tree and row crops.
- Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
- Wild flooding.*—Irrigation water, released at high points, flows onto the field without controlled distribution.
- Miscellaneous land type.** A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.
- Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.
- Mott.** A small grove of trees on a prairie.
- Mottling, soil.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common, and many*; size—*fine, medium, and coarse*; and contrast—*faint, distinct, and prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.
- Munsell notation.** A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, a value of 6, and a chroma of 4.
- Natural soil drainage.** Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.
- Excessively drained* soils are commonly very porous and rapidly permeable and have a low water-holding capacity.
- Somewhat excessively drained* soils are also very permeable and are free from mottling throughout their profile.
- Well-drained* soils are nearly free from mottling and are commonly of intermediate texture.
- Moderately well drained* soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

*Imperfectly or somewhat poorly drained* soils are wet for significant periods but not all the time. Commonly they have mottlings below depths of 6 to 16 inches.

*Poorly drained* soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

*Very poorly drained* soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

**Ped.** An individual, natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

**Permeability.** The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

**Phase, soil.** A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

**pH value.** A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value alkalinity; and a lower value, acidity.

**Plowpan.** A compacted layer formed in the soil immediately below the plowed layer.

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

**Range condition.** The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair, and poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

**Range site.** An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

pH		pH	
Extremely acid---	Below 4.5	Neutral -----	6.6 to 7.3
Very strongly acid--	4.5 to 5.0	Mildly alkaline-----	7.4 to 7.8
Strongly acid-----	5.1 to 5.5	Moderately alkaline--	7.9 to 8.4
Medium acid-----	5.6 to 6.0	Strongly alkaline----	8.5 to 9.0
Slightly acid-----	6.1 to 6.5	Very strongly alkaline-----	9.1 and higher

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Sand.** Individual rock or mineral fragments in soils that have diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consists of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

**Series, soil.** A group of soils that developed from a particular type of parent material and have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

**Silica.** Silica is a combination of silicon and oxygen. The mineral form is called quartz.

**Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

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

**Soil separates.** Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

**Solum.** The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Substratum.** Technically the part of the soil below the solum.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness; the plowed layer.

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

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

**Topsoil.** A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to top-dress roadbanks, lawns, and gardens.

**Well-graded soil.** A soil or soil material consisting of particles that are 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 over-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

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 range site, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, p. 6.  
 Predicted yields, table 2, p. 19.  
 Interpretations for wildlife, table 3,  
 p. 26.

Engineering uses of the soils, tables 4, 5,  
 and 6, pp. 28 through 35.  
 Classification of soil series, table 7,  
 p. 38.

Map symbol	Mapping unit	De-scribed on page	Capability unit		Range site	Page
			Dryland	Irrigated		
			Symbol	Symbol	Name	
Br	Brennan soils-----	6	IIIc-1	I-1	Sandy Loam	23
Cm	Comitas soils-----	7	IIIe-1	IIIs-1	Loamy Sand	21
Ct	Copita soils-----	8	VIc-1	-----	Gray Sandy Loam	21
Cu	Cuevitas-Randado association-----	8	VI s-1	-----	Shallow Sandy Loam	24
Df	Delfina association-----	9	IIIe-1	-----	Tight Sandy Loam	25
Dl	Delmita soils-----	9	IIIe-1	IIE-1	Loamy Sand	21
Dn	Delmita association-----	10	IIIc-1	IIs-1	Red Sandy Loam	23
Du	Dune land-----	10	VIIIe-1	-----	Sand Dune	23
FFB	Falfurrias association, gently sloping-----	12	VIIe-1	-----	Sandy Mound	23
Gc	Garceno soils-----	13	VIc-2	-----	Clay Loam	20
He	Hebbronville soils-----	14	IIIe-1	IIE-1	Sandy Loam	23
Ns	Nueces-Sarita association-----	14	VIe-1	-----	Deep Sand	20
Ow	Oil-waste land-----	14	VIII s-1	-----	-----	-----
Rd	Randado-Delmita association-----	16	IVc-1	III s-2	-----	-----
	Randado part-----	-----	-----	-----	Shallow Sandy Loam	24
	Delmita part-----	-----	-----	-----	Red Sandy Loam	23
Te	Tela soils-----	17	IIC-1	-----	Ramadero	22
ZaB	Zapata soils, gently sloping-----	17	VII s-1	-----	Shallow Ridge	23

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