Soil Survey of Guadalupe Mountains National Park, Texas

United States Department of Agriculture

Natural Resources Conservation Service

National Park Service

In cooperation with the United States Department of Interior National Park Service, and Texas AgriLife Research

How To Use This Soil Survey

General Soil Map

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

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

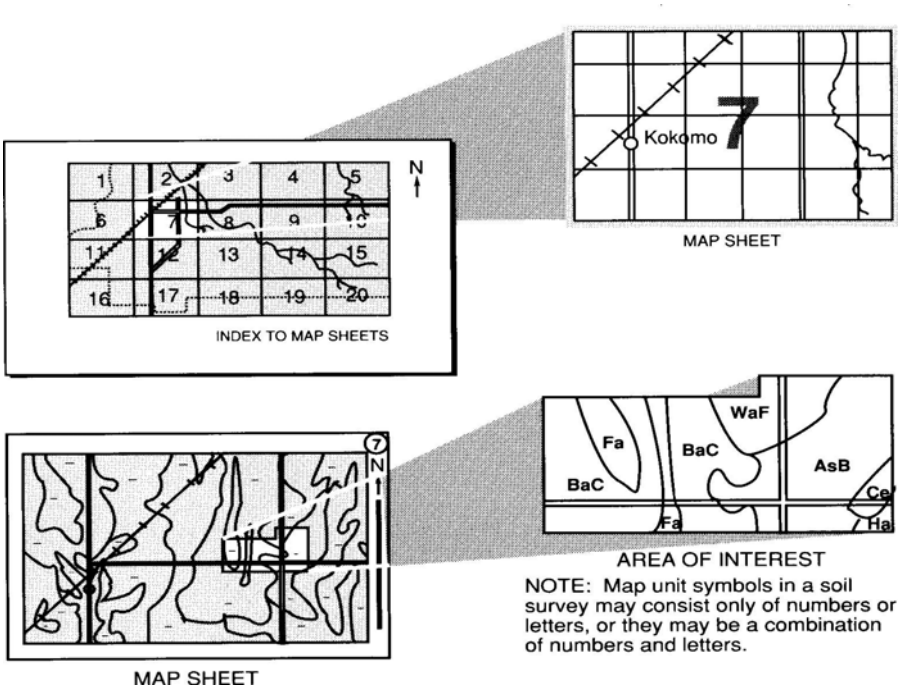
Detailed Soil Maps

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

To find information about your area of interest, locate that area on the **Index to Map Sheets**.

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

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



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including Texas AgriLife Research, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2010. Soil names and descriptions were approved in 2010. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2010. This survey was made cooperatively by the Natural Resources Conservation Service and Texas AgriLife Research. The survey is part of the technical assistance furnished to the National Park Service, Guadalupe Mountains National Park Unit.

The proper citation for this soil survey report is as follows:

United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service. 2010. Soil Survey of Guadalupe Mountains National Park, Texas.

Cover: The cover depicts a typical area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky, on the alluvial fan remnants of the front range in Guadalupe Mountains National Park. Lostpeak-Rock outcrop complex, 40 to 95 percent slopes is on the very steep slopes above the fans. El Capitan Peak is in the background and Manzanita Spring is in the foreground.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov

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Issued 2010

Foreword

This soil survey was developed in conjunction with the National Park Service Inventory and Monitoring Program and is intended to serve as the official source document for soils occurring within Guadalupe Mountains National Park.

This soil survey contains information that affects current and future land use planning in the park. It contains predictions of soil behavior for selected land uses. The surveys highlight soil limitations, actions needed to overcome the limitations, and the impact of selected land uses on the environment. This soil survey is designed to meet the needs of the National Park Service and their partners to better understand the various soil properties present in the park and their affect on various natural ecological properties to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the users identify and reduce the effects of soil limitations on various land uses. The user is responsible for identifying and complying with existing laws and regulations. Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

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

Donald W. Gohmert
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Soil Survey of Guadalupe Mountains National Park, Texas

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In cooperation with
the U.S. Department of the Interior, National Park Service

The survey area is in the Trans-Pecos region of west Texas in the northwestern corner of Culberson County and the northeastern corner of Hudspeth County. The survey covers an area of 88,276 acres. The survey area is bordered by Forest Service, Bureau of Land Management, and private land in New Mexico to the north and private land on the east, south, and west sides in Texas.

The survey area includes portions of Major Land Resource Areas (MLRA) Southern Desertic Basins, Plains, and Mountains—MLRA 42, Southern Desert Foothills—MLRA 70D, and Central New Mexico Highlands—MLRA 70C.

There are no perennial streams located in the park although there are numerous intermittent streams fed by springs and flash floods. The most consistent source of water in a stream can be found in McKittrick Canyon. This spring-fed stream disappears under a thick bed of alluvial gravels only to reappear further downstream in numerous places. The springs located in the park are the only source of water for wildlife in the area.

Elevations range from a low of 1,103 m in the Salt Basin on the west side of the park to 2,666 m at Guadalupe Peak, the highest point in Texas.

Soil scientists have determined that there are about twenty-three different kinds of soils in the park in fifteen map units. Of these twenty-four soils, eight are new series proposed within the park boundary. The soils vary widely in their texture, color, natural drainage, slope, and other characteristics. The climate in which these soils occur also varies widely. All of the new soils occur in MLRA 70C and MLRA 70D. These soils in the higher elevations are generally on slopes of 40 percent or more, and high in rock fragments. These soils occur in climates with enough soil moisture to foster the growth of woodland and montane forest plant communities, including montane grasslands.

General Nature of the Survey Area

This section provides general information about Guadalupe Mountains National Park. It describes the history, agriculture, and climate of the survey area.

History

The following section is from the Texas Online Handbook
http://www.tshaonline.org/handbook/online/articles/GG/gkg2.html

Guadalupe Mountains National Park, in Hudspeth and Culberson Counties on the New Mexico border, preserves some of the exposed remnants of the Capitan Reef, one of the world's finest examples of ancient barrier reefs. The Guadalupe Range slopes upward from New Mexico to its highest peak within the national park. The park comprises 76,293 acres and includes the four highest peaks in Texas. Beginning some 250 million years ago, seawater and decaying marine organisms deposited lime along the shallow shelf of the Delaware Basin of the Permian Sea, forming a reef many hundreds of feet thick. Sediments buried the reef as the ocean drained away. Compression within the earth pushed up the area within the past ten to twelve million years. Erosion began to wear away the softer sedimentary rock, exposing parts of the hard limestone of the Capitan Reef. In a process that continues today, runoff from the old reef began to deposit salt on the flats now west of the park boundaries.

Plants and animals combine in the park in a mixture of species native to Mexico, the Rocky Mountains, and the eastern United States. The park includes a small segment of the Chihuahuan Desert and protects such desert species as prickly pear cacti, walking-stick chollas, kangaroo rats, and coyotes. The cliffs of McKittrick Canyon harbor an oasis of spring-fed streams, porcupines, mule deer, and lush stands of grey oak, velvet ash, bigtooth maple, and alligator juniper. Wild turkeys, elk, mountain lions, and black bears roam forests of conifers and aspens at higher elevations. Many species of birds, ranging from hummingbirds to golden eagles, may be found in the park. Aoudad sheep that were introduced into the Guadalupes from North Africa by hunting-lease operators have taken over the ecological niche once occupied by desert bighorn sheep, which had been killed off in the Guadalupes by 1910. Federal law now protects all animals, plants, fossils, and natural or historical objects in the park.

Hunter-gatherer groups left pictographs and cooking pits in the Guadalupes as early as 12,000 years ago; some Indian rock art sites are now accessible by park trails. Mescalero Apaches claimed the Guadalupes as one of their last strongholds after Comanche horsemen and subsequently the United States Army pushed them from the plains below. As early as 1680 the Apaches raided the small community of El Paso del Norte (Ciudad Juárez), 100 miles to the west, and for nearly two centuries harassed Comanche Indians and settlers alike from the Guadalupe highlands. A troop of United States Cavalry, led by Lt. Howard B. Cushing, devastated a Mescalero encampment at Manzanillo Springs on December 30, 1869. A company of Texas Rangers ambushed the remaining fugitive Guadalupe Apaches on January 29, 1881, at Hueco Tanks. The first Butterfield Overland Mail stagecoaches to leave either end of the St. Louis-San Francisco mail route met just west of Guadalupe Pass in 1858. The Pinery stagecoach station near Pine Springs was once a regular stop and its stone foundations remain near the park entrance.

Most of the land within the park was once the Guadalupe Mountain Ranch, sold to the federal government by J. C. Hunter, Jr., whose father had purchased the ranch in 1924 and produced mohair from Angora goats. The 500-odd elk, or wapiti, (*Cervus canadensis*), now inhabiting the park and the prairies below are descendants of forty-seven animals that the Wind Cave Refuge of South Dakota shipped to Hunter in 1928 to replace the native Merriam's elk that had been hunted out of the Guadalupes by the 1880s. Hunter offered in 1933 to donate 300 acres of land in McKittrick Canyon to the state, to be made into a state park in exchange for a highway to the

canyon entrance. Despite the canyon's scenery and recreational potential, however, the state park board concluded in a 1938 study of the area that developers would likely mar the surrounding private lands unless the state could acquire the adjacent property.

Wallace E. Pratt, a petroleum geologist, donated 4,988 acres of his ranch in North McKittrick Canyon to the National Park Service on October 14, 1959. Pratt later donated another 684 acres after discussing with J. C. Hunter, Jr., and Hunter's representative, Edward Glenn Biggs, their plans to sell the 71,790 acres of the Guadalupe Mountain Ranch to the federal government and to have the area set aside as a national park. Biggs organized a lobbying effort at the Department of the Interior in Washington and a publicity campaign in the area to promote the park. He invited members of local chambers of commerce, writers in local and national publications, senators, governors, and congressmen to spend weekends at the ranch. The National Park Service conducted an initial survey of the area in 1962 and reported that it appeared to meet the criteria for national parks. Texas senators and congressmen introduced bills in Congress in 1963 and 1965 to establish Guadalupe Mountains National Park, but opposition surfaced to the purchase of more Texas land while approval was pending for Padre Island National Seashore and Big Thicket National Preserve. There was also opposition, which continues, from area ranchers who had leased approximately 12,000 acres adjoining the park, now used as a buffer zone to protect the fragile flora and fauna of the Guadalupe ecosystem.

On October 15, 1966, President Lyndon B. Johnson signed the act establishing the park. The legislation stipulated that all mineral, oil, and gas rights be donated to the federal government before funds would be allocated to purchase the ranch. The Texas legislature rescinded the state's mineral rights to the land, and in 1967 Texaco and Standard Oil did likewise after drilling a further, unsuccessful research hole at the mouth of McKittrick Canyon. The park was established on September 30, 1972.

An eighty-mile network of trails offers the best means to see the park, either on foot or horseback. High-country trails, some the remnants of trails that ranch hands once followed to reach their herds, ascend as much as 3,000 feet over steep terrain. Trails in the canyons and lowlands are shorter and less difficult. The maple and hardwood trees of McKittrick Canyon turn to brilliant colors in late October and early November, making fall one of the most popular times to visit the park. High winds usually blow in the spring, and severe storms may produce flash floods in the summer months. The National Park Service maintains the Frijole Visitor Center at the park entrance on U.S. Highways 62 and 180, a visitor center at the entrance to McKittrick Canyon, and a ranger station in Dog Canyon accessible by New Mexico Highway 137.

BIBLIOGRAPHY: John Barnett, Guadalupe Mountains National Park: Its Story and Its Scenery (Carlsbad, New Mexico: Carlsbad Caverns Natural History Association, n.d.). Joanne Burley, "Glenn Biggs and the Establishment of Guadalupe Mountains National Park," West Texas Historical Association Year Book 61 (1985). Alan Tennant, The Guadalupe Mountains of Texas (Austin: University of Texas Press, 1980). Vertical Files, Dolph Briscoe Center for American History, University of Texas at Austin.

Agriculture

By the late 1800s, the Mescalero Apaches had for the most part been driven out of the Guadalupe’s. Settlers began to arrive and attempted to make a living farming and ranching in these mountains. Although there were a few who prospered, most failed. Among the few ranchers who persevered and prospered in the Guadalupe Mountains were the Smith family, Henry and Rena Belcher, and Adolphus Williams. The Smith family operated an orchard at Frijole Ranch for nearly 40 years. Henry and Rena Belcher had a ranch at the foot of the rugged Western Escarpment, 5,000 feet below Guadalupe Peak. The Belcher's ranch was later sold to James Adolphus Williams, and became known as Williams Ranch. In the early 1940's, both Frijole and

Williams Ranches were bought by Judge J.C. Hunter. Hunter eventually owned much of what is now Guadalupe Mountains National Park.
http://www.nps.gov/gumo/historyculture/ranching.htm

On the north side of the park early settlers ran sheep and goats on the rugged hills using the meadows as homesteads where they could grow gardens and build corrals to protect their stock.

Climate

Prepared by the Natural Resources Conservation Service National Water and Climate Center, Portland, Oregon.

Climate tables are created from climate station Dell City 5 SSW Texas.

Thunderstorm days, relative humidity, percent sunshine, and wind information are estimated from various climate atlases.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Dell City 5 SSW in the period 1979 to 2000. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 44 degrees F and the average daily minimum temperature is 28 degrees. The lowest temperature on record, which occurred at Dell City 5 SSW on December 15, 1987, is -5 degrees. Guadalupe Mountains National Park's temperatures are about 20 degrees colder on average than Dell City, TX that lies to the west of the park at lower elevations.

In summer, Dell City's average temperature is 79 degrees and the average daily maximum temperature is 95 degrees. The highest temperature, which occurred at Dell City 5 SSW on June 28, 1994, is 115 degrees. Guadalupe Mountains National Park's temperatures are about 25 degrees cooler on average than Dell City, TX that lies to the west of the park at lower elevations.

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

The average annual total precipitation is about 10 inches. Of this, about 8 inches, or 78 percent, usually falls in April through October. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 2.44 inches at Dell City 5 SSW on May 23, 1987. Thunderstorms occur on about 38 days each year, and most occur in June.

The average seasonal snowfall is 0.7 of an inch. The greatest snow depth at any one time during the period of record was 3.2 inches recorded in January 1983. On an average, there are no days per year that have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 3.2 inches recorded on January 1, 1983. Snowfall in Guadalupe Mountains National Park increases to about a foot at the highest elevations with some snow cover persisting for several days a year in protected areas.

The average relative humidity in mid-afternoon is about 24 percent. Humidity is higher at night, and the average at dawn is about 60 percent. The sun shines 78 percent of the time in summer and 72 percent in winter. The prevailing wind is from the west. Average wind speed is highest, 13 miles per hour, in April.

Figure 1, Figure 2, and Figure 3 are spatial analysis of the climate variables in Guadalupe Mountains National Park.

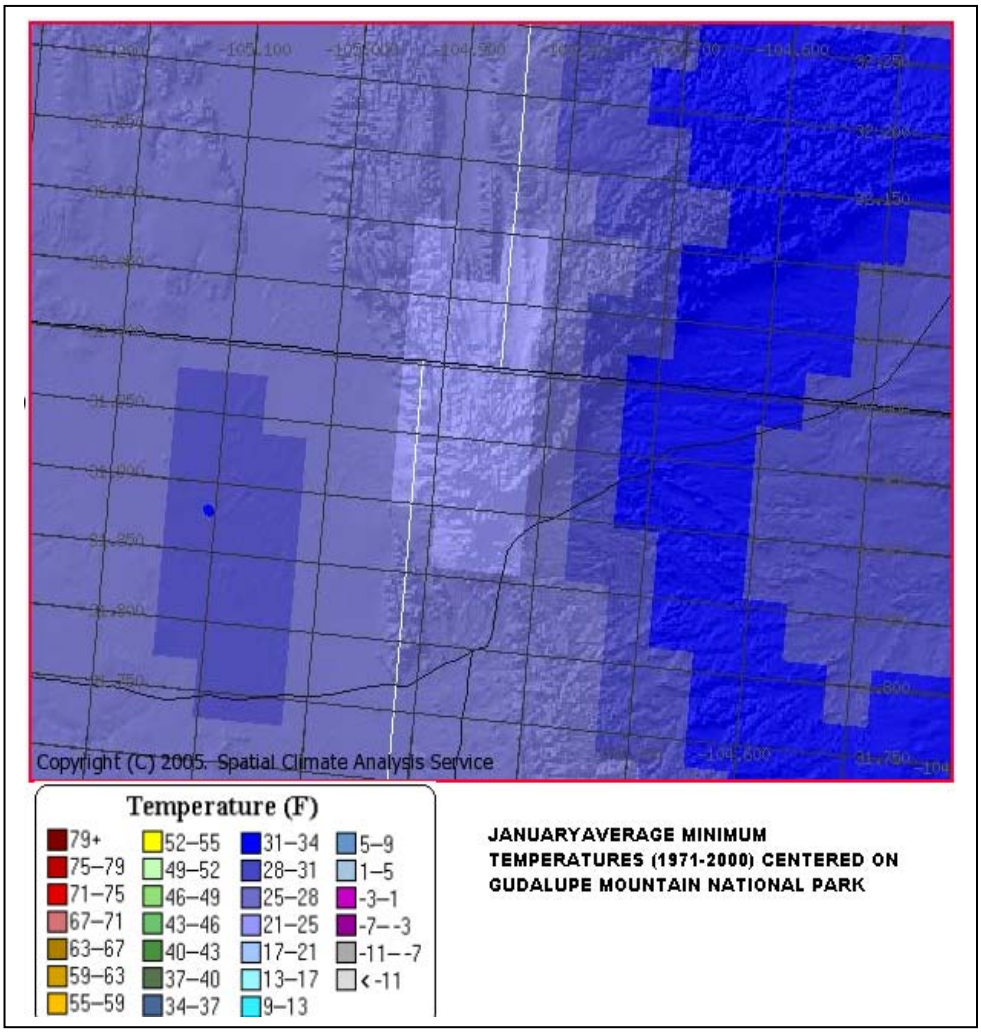


Figure 1.—PRISM spatial climate map centered on Guadalupe Mountains National Park showing the average January minimum temperatures for the period 1971-2000. It reveals that the park's temperatures average between 21 to 25 degrees F. The monthly and annual averages are shown on the table in fig. 3.

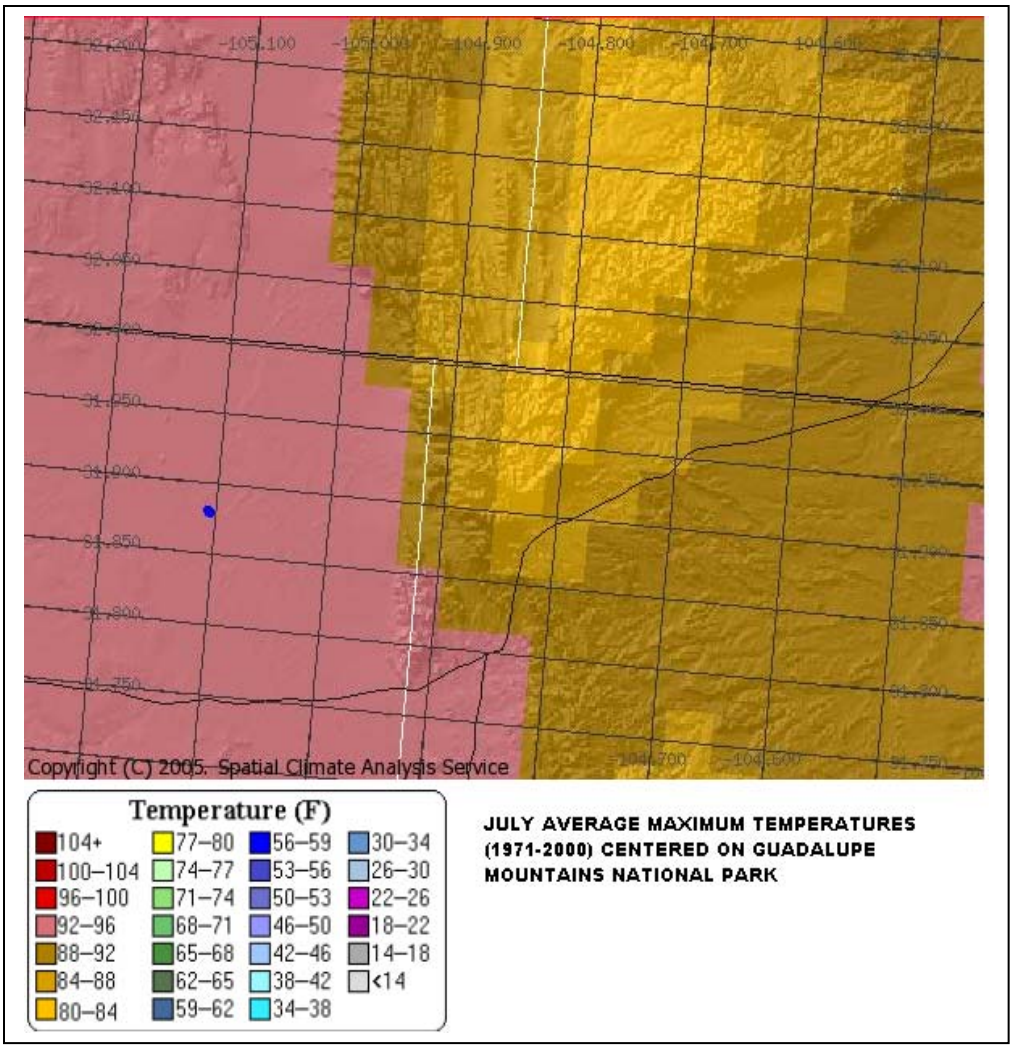
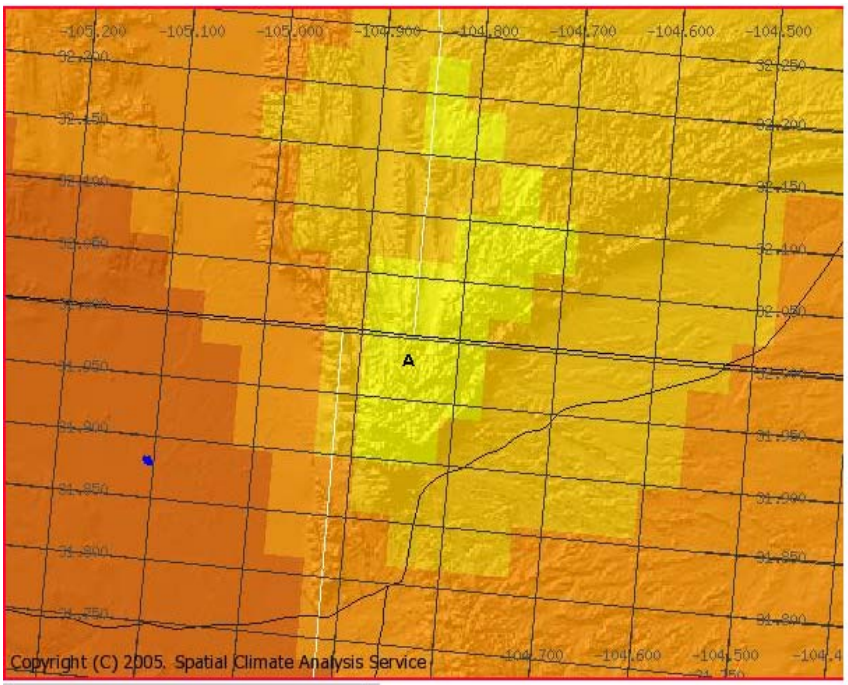


Figure 2.—PRISM spatial climate map centered on Guadalupe Mountains National Park showing the average July maximum temperatures for the period 1971-2000. It reveals that the park's temperatures average between 77 to 84 degrees F. The monthly and annual averages are shown on the table in fig. 3.



Precipitation (in.)

0	16–20	36–40	80–100
<4	20–24	40–50	100–120
4–8	24–28	50–60	120–140
8–12	28–32	60–70	140–160
12–16	32–36	70–80	160+

Longitude:	-104.853	Area "A"
Latitude:	31.978	1971-2000 Normals

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
tmax	45.88	48.94	55.53	61.16	69.10	76.80	76.93	74.41	69.82	63.75	53.15	47.08	**61.9**
tmin	28.17	30.72	34.88	40.12	48.88	54.88	56.91	57.65	52.27	45.77	36.09	28.69	**42.9**
ppt	0.94	0.85	0.56	0.45	1.35	3.15	4.31	4.55	4.86	2.11	1.40	1.08	**25.61**

temperature in deg F **precipitation in inches**

Figure 3.—PRISM spatial climate map centered on Guadalupe Mountains National Park (labeled "A") showing the average annual total precipitation for the period 1971-2000. It reveals that the park's total annual precipitation is 25.61 inches. The monthly and annual average temperatures and total precipitation are shown at the bottom of this figure.

How This Survey Was Made

This survey was made in conjunction with the National Park Service's Soil Inventory and Monitoring Program to provide information about the soils and miscellaneous areas within Guadalupe Mountains National Park. A scoping meeting was held in November, 2007 with park staff to identify their soil resource information needs and to relate those needs to the development of the park soil survey. Of particular interest to park staff was information regarding the gypsiferous soils in the Salt Basin and Gypsum Sand Dunes areas of the park, as well as having the final products provide information regarding soil resources in the park that would facilitate current and future management of their natural and cultural resources.

The field work for the Guadalupe Mountains National Park soil survey was initiated in August 2009, and was completed in April, 2010. The Final Field Review was held June 2010. The Final Correlation of Guadalupe Mountains National Park was completed in July 2010.

During the soil survey, ecological site and soil component relationships were observed, and soil-site correlation concepts were established to help in designing the map units. Soil and plant specialists tested the concepts during mapping and collected field documentation at numerous points across the landscape.

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

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, they system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they delineated the boundaries of these bodies on digital imagery and identified each as a specific map unit.

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

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

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

Figure 4 shows the patterns of soils and underlying materials in the Guadalupe Mountains National Park soil survey area.

Soils of the Desert Grassland Vegetative Zone

This map unit makes up about 32 percent of the survey area. The major soils are the Bissett, Chilicotal, Chispa, and Tenneco soils. Also in this group are areas of Rock outcrop. The Chilicotal, Chispa, and Tenneco soils are deep or very deep with loamy or gravelly surfaces. The Bissett soils are very shallow and shallow to limestone with loamy surfaces.

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. The reference plant community is desert grassland with scattered shrubs and forbs. Common plants include black grama, sideoats grama, bush muhly, slim tridens, range ratany, lechuguilla, tasajillo, sand dropseed, mariola, rough ephedra, Gregg's coldenia, and pricklypear. Woody species such as creosote bush, ocotillo, mesquite, skeletonleaf goldeneye, and tarbush have encroached on most areas.

1. Chilicotal-Bissett-Chispa-Tenneco

Very shallow, shallow, deep, or very deep, well drained, moderately permeable, loamy, gravelly, or very gravelly soils

This map unit makes up about 32 percent of the survey area. It is 25 percent Chilicotal soils, 21 percent Bissett soils, 21 percent Chispa soils, 8 percent Tenneco soils, 20 percent Rock outcrop and 5 percent other soils. Areas of this map unit are underlain by gypsum layers below 100 cm (fig. 4).

Bissett soils are on limestone hills and escarpments on 15 to 60 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over very slowly permeable limestone bedrock. Typically, the surface layer is brown loam about 4 cm thick. The subsoil from 4 to 34 cm is brown very gravelly loam. The underlying material from 34 to 59 cm is limestone bedrock.

Chilicotal soils are on alluvial fans and fan remnants on 3 to 13 percent slopes. They are deep or very deep, well drained, and moderately permeable soils. Typically the surface layer is light yellowish brown gravelly loam about 21 cm thick. The upper part of the subsoil from 21 to 55 cm is pale brown very cobbly loam; and the lower part of the subsoil from 55 to 157 cm is very pale brown very gravelly sandy loam with carbonate accumulations.

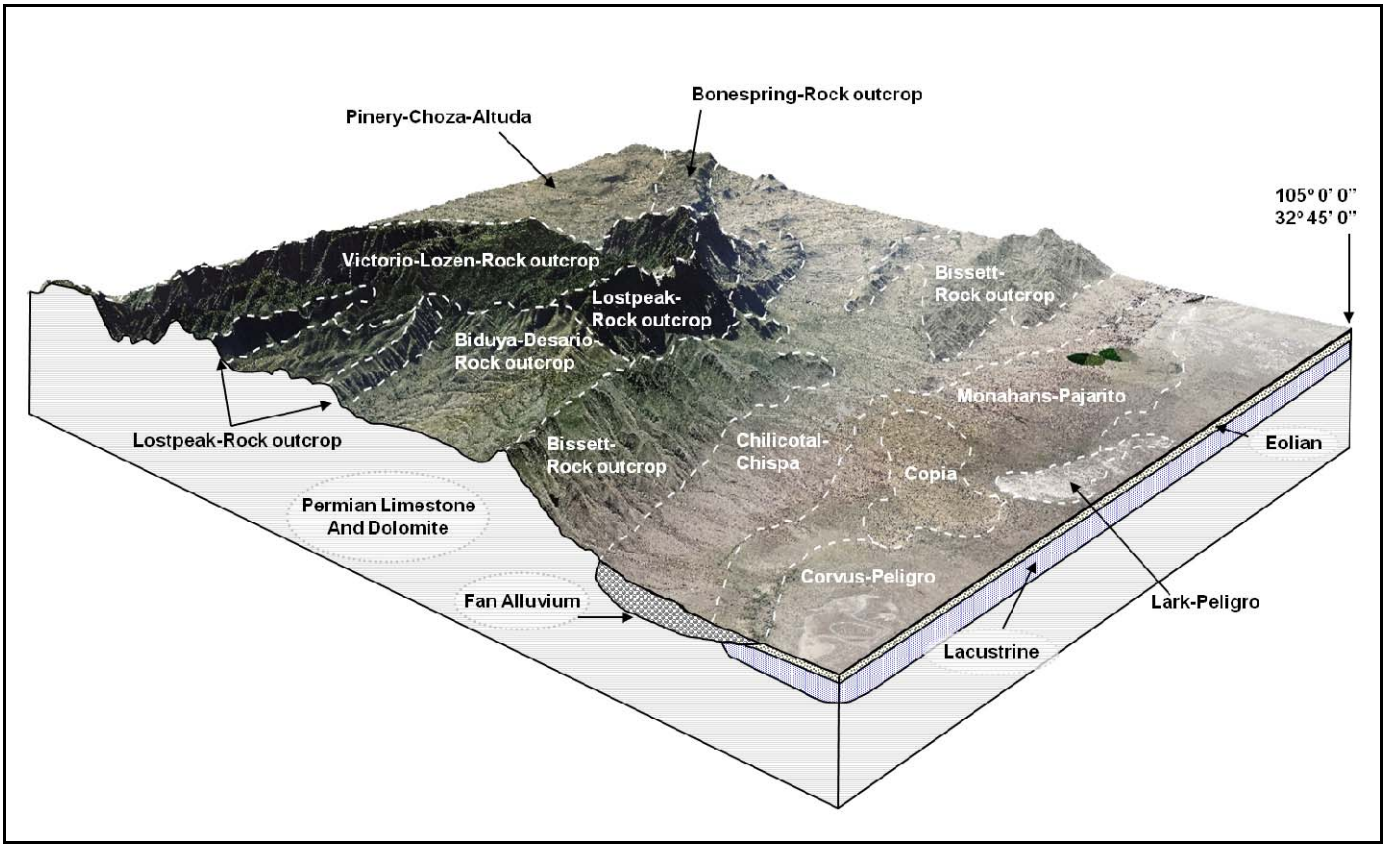


Figure 4.—Patterns of soils and underlying material from the high country down the western escarpment into the salt basin. General Soil Map Units 1, 2, 3, 4. 5, and 6 appear on this diagram. The "High Country" includes General Soil Map Units 3—Victorio-Lozen-Rock outcrop; 5—Biduya-Desario-Lazarus; and 6—Lostpeak-Rock outcrop. The Salt Basin includes General Soil Map Unit 2—Monahans-Corvus-Peligro. At the upper end of the basin, General Soil Map Unit 1—Chilicotal-Bissett-Chispa-Tenneco occurs, and is on the fan remnants of the escarpment.

Chispa soils are on alluvial fans and fan remnants on 3 to 13 percent slopes. They are deep or very deep, well drained, and moderately permeable soils. Typically, the surface layer is light yellowish brown gravelly loam about 8 cm thick. The upper part of the subsoil from 8 to 19 cm is very pale brown fine sandy loam. The lower part of the subsoil from 19 to 157 cm is very pale brown loam that has carbonate accumulations.

Tenneco soils are on alluvial fans on 2 to 5 percent slopes. They are deep or very deep, well drained, and moderately permeable soils. Typically, the surface layer is pale brown very fine sandy loam about 13 cm thick. The upper part of the subsoil from 13 to 72 cm is brown very fine sandy loam, the middle part of the subsoil from 72 to 110 cm is light brown loam, and the lower part of the subsoil from 110 to 203 cm is light brown loam that has carbonate masses.

Rock outcrop occurs on areas of exposed limestone bedrock on escarpments and ledges or exposed areas on the summits, shoulders, and backslopes of hills and mountains. Slopes range from 10 to 60 percent.

Soils of the Desert Shrub Vegetative Zone

This group of map units makes up about 19 percent of the survey area. The major soils are Copia, Monahans, and Peligro. Also included in this group are the Corvus, Lark, and Pajarito soils. Most of the soils in this group have a very fine sandy loam,

fine sandy loam, or sandy surface. Monahans and Pajarito soils are very deep and have sandy loam surfaces. Peligro is a deep gypsiferous soil with a fine sandy loam surface. Copia soils are very deep sandy soils. Lark soils are very deep gypsiferous sandy soils. Corvus soils have a gypsiferous fine sandy loam surface layer and is shallow to a petrogypsic layer.

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. Associated plants include mesa dropseed, bush muhly, plains bristlegrass, threeawns, creosote bush, soaptree yucca, fourwing saltbush, spike dropseed, sand dropseed, giant dropseed, black grama, broom dalea, western honey mesquite, and croton.

2. Monahans-Corvus-Peligro

Very deep, well drained to excessively drained, very rapidly permeable, loamy and sandy soils

This map unit makes up about 19 percent of the survey area. It is 29 percent Monahans soils, 22 percent Corvus soils, 20 percent Peligro soils, 12 percent Copia soils, 9 percent Pajarito soils and 8 percent Lark soils (fig. 4).

Monahans soils are on alluvial fans on 0 to 5 percent slopes. They are very deep, well drained, and rapidly permeable soils. Typically, the surface layer is pale brown very fine sandy loam about 10 cm thick. The upper part of the subsoil from 10 to 33 cm is pale brown fine sandy loam. The lower part of the subsoil from 33 to 203 cm is very pale brown and light gray fine sandy loam, with accumulations of gypsum.

Corvus soils are on relict stabilized gypsum dunes on basin floors on 1 to 5 percent slopes. They are shallow, well drained, and moderately rapid permeable soils over slowly permeable petrogypsic layers. Typically, the surface layer is light yellowish brown gypsiferous very fine sandy loam about 6 cm thick. The upper part of the subsoil from 6 to 41 cm is light yellowish brown gypsiferous fine sandy loam. The middle part of the subsoil from 41 to 49 cm is light gray gypsiferous fine sandy loam. The lower part of the subsoil from 49 to 74 cm is white extremely hard gypsiferous material.

Peligro soils are on relict playa dunes and interdunes on basin floors on 1 to 5 percent slopes. They are moderately deep to very deep, well drained, and moderately rapid permeable soils. Typically, the surface layer is brown very fine sandy loam about 5 cm thick. The upper part of the subsoil from 5 to 89 cm is white fine sandy loam with gypsum crystals and clusters. The lower part of the subsoil from 89 to 112 cm is pale yellow fine sandy loam with reddish yellow redox concentrations and gypsum masses and clusters. The underlying material from 112 to 203 cm is pale yellow gypsiferous very fine sandy loam with gypsum masses and crystals.

Copia soils are on dunes and shrub-coppice dunes on 2 to 7 percent slopes. They are very deep, excessively drained, and very rapidly permeable soils. Typically the surface layer is very pale brown loamy fine sand about 4 cm thick. The underlying material from 4 to 203 cm is very pale brown fine sand.

Pajarito soils are on alluvial fans on 0 to 5 percent slopes. They are very deep, well drained, and rapidly permeable soils. Typically the surface layer is pale brown very fine sandy loam about 28 cm thick. The upper part of the subsoil from 28 to 98 cm is very pale brown very fine sandy loam. The lower part of the subsoil from 98 to 203 cm is very pale brown very fine sandy loam with carbonate accumulations.

Lark soils are on vegetated dunes on dune fields on 5 to 8 percent slopes. They are very deep, excessively drained, and very rapidly permeable soils. Typically the surface layer is light gray gypsiferous fine sand about 27 cm thick. The underlying material from 27 to 203 cm is white gypsiferous fine sand.

Soils of the Mixed Conifer Forest Vegetative Zone

This group of map units makes up about 17 percent of the survey area. The major soils are the Victorio and Lozen soils. Also in this group are areas of Rock outcrop. Most of the soils in this group have clay loam, loam, and very gravelly or very cobbly surfaces. Victorio soils are very shallow or shallow clayey soils over limestone bedrock. Lozen soils are very shallow or shallow loamy soils over limestone bedrock (fig. 5).

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. The native plant community is a mixed conifer forest. The three conifers characterizing this site are Douglas fir, southwestern white pine, and ponderosa pine. Shrubs or small trees in the understory include Gambel oak, Knowlton hophornbeam, and Utah serviceberry. Grasses that occur in the site include New Mexico muhly, Arizona fescue, pinion ricegrass, and nodding brome.

3. Victorio-Lozen-Rock outcrop

Very shallow or shallow, well drained, moderately permeable, loamy or clayey, very gravelly or very cobbly soils or exposed limestone bedrock

This map unit makes up about 17 percent of the survey area. It is 53 percent Victorio soils, 30 percent Lozen soils, 16 percent Rock outcrop and 1 percent other soils (fig. 4).

Victorio soils are on hills or mountains on 10 to 95 percent slopes. They are very shallow or shallow, well drained, moderately permeable soils over very slowly permeable bedrock. Typically, the surface layer is very dark brown gravelly slightly decomposed plant material about 7 cm thick. The subsurface layer from 7 to 17 cm is very dark gray gravelly loam. The upper part of the subsoil from 17 to 30 cm is brown very cobbly clay loam. The lower part of the subsoil from 30 to 47 cm is light brown very cobbly clay. The underlying material from 47 to 72 cm is limestone bedrock. Lozen soils are on hills or mountains on 10 to 95 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over very slowly permeable bedrock. Typically, the surface layer is very dark brown extremely cobbly loam about 22 cm thick. The subsurface layer from 22 to 43 cm is very dark brown extremely cobbly loam. The underlying material from 43 to 68 cm is indurated limestone bedrock.

Also included are areas of Rock outcrop, which is exposed bedrock on the summit, shoulder, and backslopes of hills and mountains, or as escarpments and ledges. Slopes range from 10 to 95 percent.

Soils of the Mixed Prairie Vegetative Zone

This group of map units makes up about 11 percent of the survey area. The major soils are the Altuda, Bonespring, Choza, and Pinery soils. Also in this group are areas of Rock outcrop. Most of the soils in this group have loamy and gravelly surfaces. Altuda and Bonespring soils are very shallow and shallow to bedrock. Choza soils are very shallow and shallow to indurated caliche. Pinery soils are very deep and very gravelly (fig. 6).

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. The native vegetation consists of short and mid grasses with an abundance of shrubs. Common plants include sideoats grama, black grama, blue grama, hairy grama, cane bluestem, curlyleaf muhly, little bluestem, fragrant sumac, skunkbush sumac, sotol, pricklypear, oaks, Warnock's grama, New Mexico feather grass, mountain mahogany, skeletonleaf goldeneye, yucca, winterfat, mariola, redberry juniper, and pinyon pine.

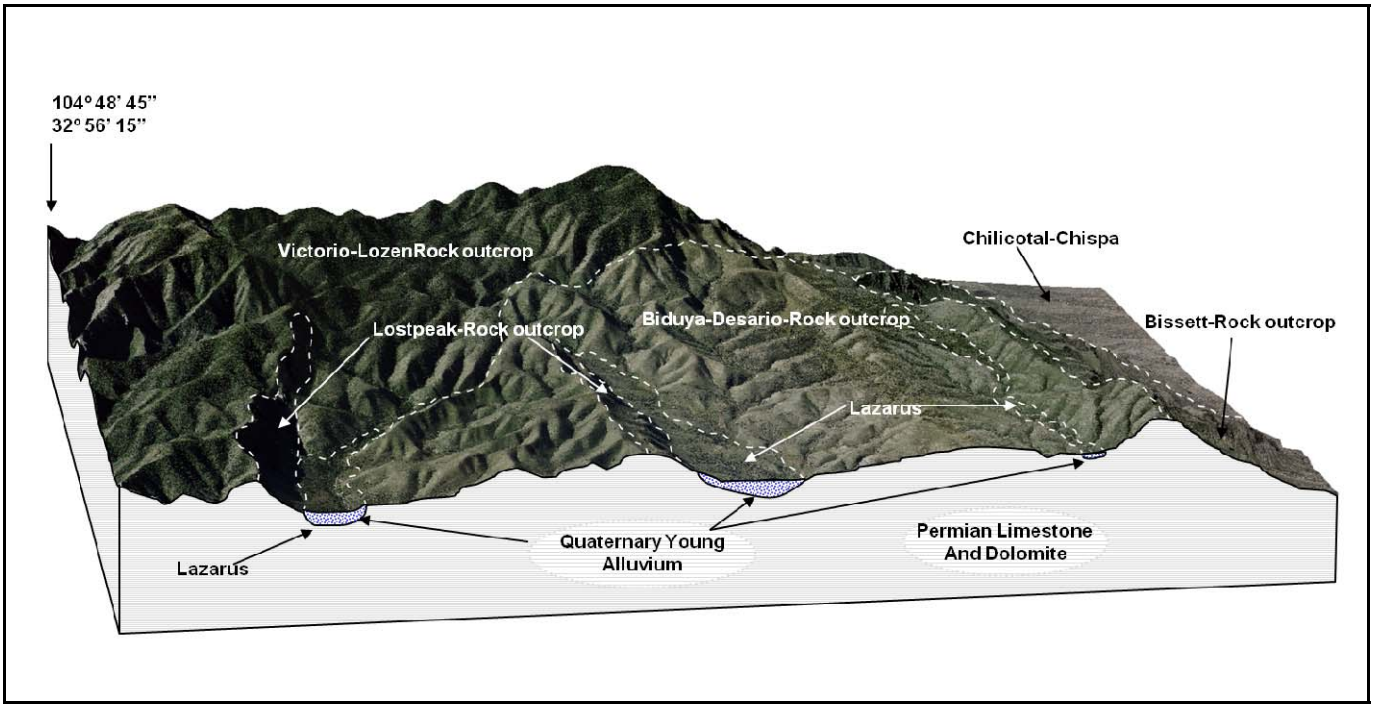


Figure 5. Patterns of soils and underlying material from the high country. View is from the north looking south into the park.

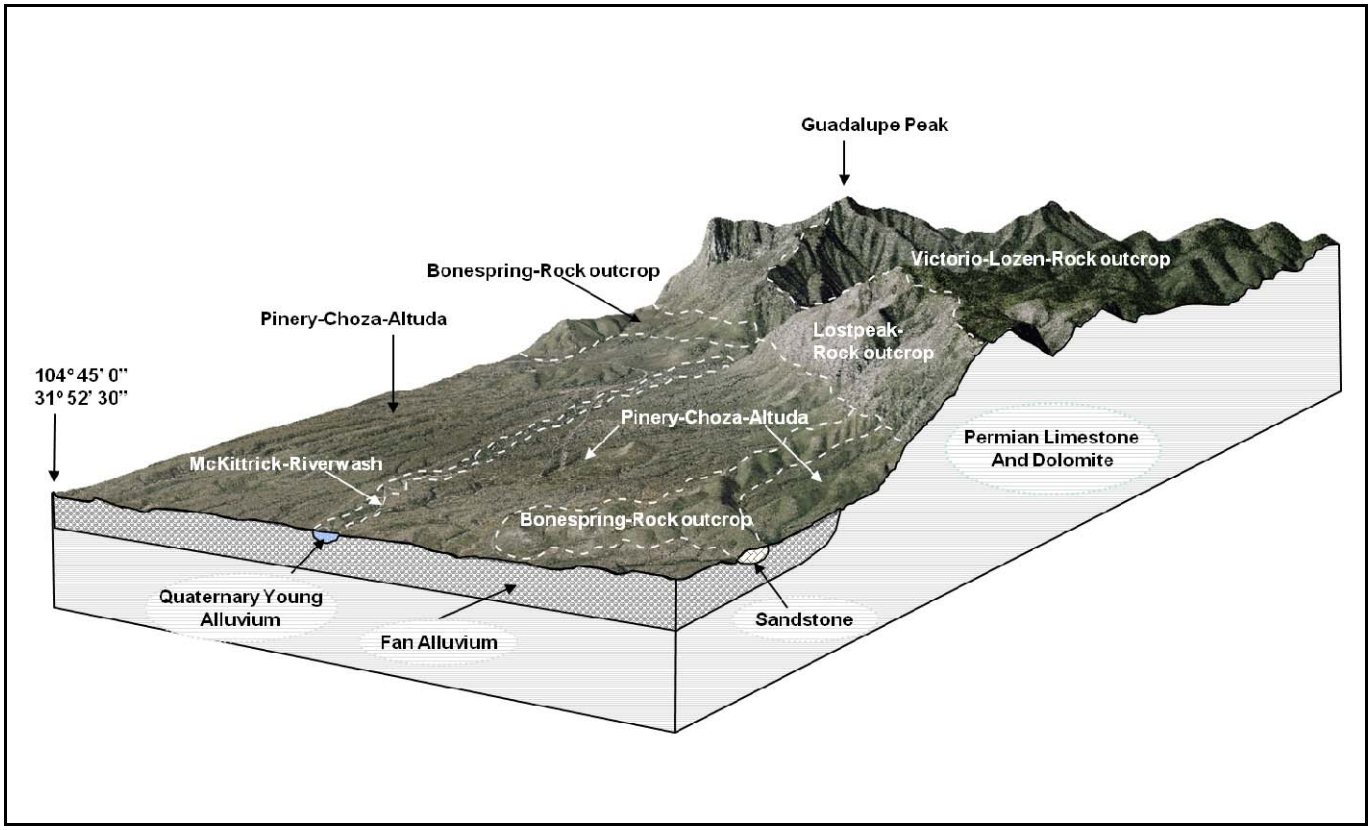


Figure 6.—Patterns of soils and underlying material from the high country down the east escarpment onto the fan alluvium of the front range.

4. Bonespring-Pinery-Choza-Altuda

Very shallow or shallow, well drained, moderately permeable, loamy, very gravelly, soils

This map unit makes up about 11 percent of the survey area. It is 24 percent Bonespring soils, 22 percent Pinery soils, 17 percent Choza soils, 15 percent Altuda soils, 13 percent Rock outcrop, and 9 percent other soils (fig. 4).

Bonespring soils are on sandstone hills and mountains on 10 to 60 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over very slowly permeable fractured sandstone bedrock. Typically, the surface layer is light brown very channery sandy loam about 9 cm thick. The subsurface layer from 9 to 28 cm is light brown extremely gravelly sandy loam. The underlying material from 28 to 53 cm is fractured sandstone bedrock.

Pinery soils are on alluvial fans on 5 to 20 percent slopes. They are deep or very deep, well drained, and moderately permeable soils. Typically the surface layer is very dark grayish brown gravelly loam about 26 cm thick. The subsurface layer from 26 to 48 cm is brown very gravelly loam. The subsoil from 48 to 157 cm is light yellowish brown extremely cobbly loam with accumulations of secondary calcium.

Choza soils are on fan remnants on 5 to 20 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over indurated caliche. Typically the surface layer is dark grayish brown very gravelly loam about 15 cm thick. The subsurface layer from 15 to 26 cm is brown very gravelly loam. The subsoil from 26 to 51 cm is very pale brown cemented material.

Altuda soils are on limestone hills and mountains on 10 to 60 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over very slowly permeable limestone bedrock. Typically, the surface layer is very dark grayish brown very gravelly loam about 12 cm thick. The subsoil layer from 12 to 28 cm is pale brown very gravelly loam. The underlying material from 28 to 53 cm is limestone bedrock.

Also included are areas of Rock outcrop, which is exposed bedrock on the summit, shoulder, and backslopes of hills and mountains, or as escarpments and ledges. Slopes range from 10 to 60 percent.

Soils of the Mountain Savannas Vegetative Zone

This group of map units makes up about 8 percent of the survey area. The major soils are Biduya, Desario, and Lazarus soils. Also in this group are areas of Rock outcrop. The soils in this group have loamy and very gravelly surfaces. Biduya and Desario soils are very shallow or shallow to limestone bedrock. Lazarus soils are very deep clay loam soils (fig. 5).

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. Common plants include New Mexico feathergrass, pine muhly, curlyleaf muhly, New Mexico muhly, sideoats grama, sacahuista, mountain mahogany, sotol, pinyon pine, and oneseed juniper.

5. Biduya-Desario-Lazarus

Very shallow or shallow, well drained, moderately permeable, loamy or very gravelly soils

This map unit makes up about 8 percent of the survey area. It is 37 percent Biduya soils, 26 percent Desario soils, 15 percent Lazarus soils, 14 percent Rock outcrop, and 8 percent other soils (fig. 4).

Biduya soils are on limestone hills and mountains on 10 to 25 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over

very slowly permeable limestone bedrock. Typically, the surface layer is very dark grayish brown very cobbly loam about 13 cm thick. The underlying material from 12 to 38 cm is indurated limestone bedrock.

Desario soils are on limestone hills and mountains on 20 to 50 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over very slowly permeable limestone bedrock. Typically, the surface layer is dark grayish brown gravelly loam about 12 cm thick. The subsoil layer from 12 to 31 cm is brown very gravelly loam with accumulations of secondary calcium. The underlying material from 31 to 56 cm is indurated limestone bedrock.

Lazarus soils are on canyons, terraces, and drainageways on 2 to 9 percent slopes. They are very deep, well drained, and moderately permeable soils. Typically, the surface layer is dark brown clay loam about 0 to 19 cm thick. The subsoil layer from 19 to 203 cm is brown clay loam and brown loam.

Rock outcrop consists of areas of exposed limestone bedrock on escarpments and ledges or exposed areas on the summits, shoulders, and backslopes of hills and mountains. Slopes range from 10 to 50 percent.

Soils of the Mountain Shrub Vegetative Zone

This group of map units makes up about 12 percent of the survey area. The major soil is Lostpeak. Also in this group are areas of Rock outcrop. The soils in this group have a loamy and very gravelly surface. Lostpeak soils are very shallow or shallow to limestone bedrock (fig. 6).

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. The reference plant community is a mountain shrubland with few scattered trees. Variability in shrub dominance is likely attributed to differences in soil texture, aspect, elevation, and/or rock outcrop. Common plants include wavyleaf oak, mountain mahogany, desert ceanothus, sotol, sacahuista, saddlebush, mariola, fragrant sumac, New Mexico muhly, bull muhly, plains lovegrass, cane bluestem, curlyleaf muhly, New Mexico feathergrass, pinyon pine, and ponderosa pine.

6. Lostpeak-Rock outcrop

Very shallow or shallow, well drained, moderately permeable, loamy, very gravelly, soils or exposed limestone bedrock

This map unit makes up about 12 percent of the survey area. It is 70 percent Lostpeak soils, 25 percent Rock outcrop, and 5 percent other soils.

Lostpeak soils are on limestone hills and mountains on 40 to 95 percent slopes. They are very shallow or shallow, well drained, and moderately permeable soils over very slowly permeable bedrock. Typically the surface layer is dark grayish brown very gravelly clay loam about 19 cm thick. The underlying material from 19 to 44 cm is indurated limestone bedrock.

Rock outcrop are areas of exposed limestone bedrock on the summits, shoulders, and backslopes of hills and mountains, and include almost vertical escarpments and ledges. Slopes range from 40 to 95 percent.

Soils of the Riparian Woodland Vegetative Zone

This group of map units makes up about 1 percent of the survey area. The major soil is McKittrick. Also in this group are areas of Riverwash. The soils in this group have sandy loam and very gravelly surfaces. McKittrick soils are very deep (fig. 6).

The semiarid soils in this group are used as rangeland, recreation, or wildlife habitat. Common plants include little bluestem, yellow Indiangrass, bull muhly, pinyon

ricegrass, pine muhly, sedges, sotol, Apache plume, bigtooth maple, chinquapin oak, velvet ash, madrone, hoptree, alligator juniper, ponderosa pine, and pinyon pine.

7. McKittrick-Riverwash

Very deep, well drained, moderately rapid, gravelly loamy soils

This map unit makes up about 1 percent of the survey area. It is 51 percent McKittrick soils, 22 percent Riverwash, and 27 percent other soils.

McKittrick soils are on occasionally flooded to frequently flooded valley floors and flood plain steps on 0 to 3 percent slopes. They are very deep, well drained, and moderately rapidly permeable soils. Typically, the surface layer is dark grayish brown gravelly sandy loam about 12 cm thick. The upper part of the subsoil layer from 12 to 41 cm is dark grayish brown very gravelly sandy loam. The lower part of the subsoil from 41 to 157 cm is dark yellowish brown extremely cobbly coarse sandy loam.

Riverwash consists of areas of cobbles and gravels in the main stream channel. These areas typically have little to no vegetation and undergo repeated high intensity flash flooding. Slopes range from 0 to 1 percent.

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic class other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Copia loamy fine sand, 2 to 7 percent slopes is a phase of the Copia series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Bissett-Rock outcrop complex, 15 to 60 percent slopes is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock-outcrop is an example.

Table 4 lists the map units in this survey area. Other tables show properties of the soils and the limitations, capabilities, and potentials for many uses. The “Glossary” defines many of the terms used in describing the soils.

BDG—Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes

Map unit setting: Mountains (fig. 7)
Major Land Resource Area: MLRA 70C—Central New Mexico Highlands
Elevation: 1,832 to 2,441 m
Mean annual precipitation: 330 to 381 cm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Map Unit Composition

Biduya: 42 percent
Desario: 28 percent
Rock outcrop: 18 percent
Minor components:
Lazarus soils—4 percent; on valley sides on canyons, valley floors on canyons; not hydric (fig. 8)
Unnamed soils—8 percent; not hydric

Biduya

Setting

Landscape: Mountains
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: Northwest
Aspect range: All aspects
Slope: 10 to 25 percent
Parent material: Residuum weathered from limestone and sandstone gravelly colluvium derived from limestone and sandstone

Properties and Qualities

Depth to restrictive feature: 10 to 43 cm to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)

Figure 7.—An area of Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes, in the Brokeoff Mountains on the north side of the park. Soils are shallow over limestone and support cool-season grasses. Vegetation includes New Mexico feathergrass, pine muhly, curlyleaf muhly, New Mexico muhly, sideoats grama, sacahuista, mountain mahogany, sotol, pinyon pine, alligator juniper, and oneseed juniper.

Figure 8.—An area of Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes, in the Brokeoff Mountains on the north side of the park. Soils are shallow over limestone and support cool-season grasses. Vegetation includes New Mexico feathergrass, pine muhly, curlyleaf muhly, New Mexico muhly, sideoats grama, sacahuista, mountain mahogany, sotol, pinyon pine, alligator juniper, and oneseed juniper. An area of Lazarus soil is the lower open meadow in the center and is an inclusion in this map unit. Runoff from the surrounding hills increases moisture allowing it to support a more productive plant community.

Salinity maximum: Non-saline (about 0.6 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 2

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 1.2 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Ecological site: Shallow Limestone (R070CY102NM)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, mesic Aridic Lithic Haplustolls

Typical Profile

A—0 to 13 cm; very cobbly loam
R—13 to 38 cm; limestone bedrock

Desario

Setting

Landscape: Mountains
Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: Northwest
Aspect range: All aspects
Slope: 20 to 50 percent
Parent material: Residuum weathered from limestone and sandstone gravelly colluvium derived from limestone and sandstone
Vegetation: New Mexico muhly, Metcalfe's muhly, New Mexico feathergrass, curlyleaf muhly

Properties and Qualities

Depth to restrictive feature: 29 to 52 cm to lithic bedrock
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Non-saline (about 0.3 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 20

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 2.0 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7e
Ecological site: Shallow Limestone (R070CY102NM)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, mesic Lithic Calciustolls

Typical Profile

A—0 to 12 cm; gravelly loam
Bk—12 to 31 cm; very gravelly loam
R—31 to 56 cm; limestone bedrock

Rock outcrop

Setting

Landscape: Mountains
Slope: 10 to 50 percent
Parent material: Limestone

Properties and Qualities

Depth to restrictive feature: Lithic bedrock at surface
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Flooding frequency: None
Ponding frequency: None

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

BRG—Bissett-Rock outcrop complex, 15 to 60 percent slopes

Map unit setting: Hills
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,192 to 2,111 m
Mean annual precipitation: 254 to 381 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 187 to 239 days

Map Unit Composition

Bissett: 45 percent
Rock outcrop: 43 percent
Minor components:
Chispa soils—8 percent; on fans; not hydric
Unnamed soils—4 percent; not hydric

Bissett

Setting

Landscape: Hills
Landform: Hillslopes (fig. 9)

Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: Southwest
Aspect range: All aspects
Slope: 15 to 60 percent
Parent material: Gravelly residuum weathered from limestone
Vegetation: Black grama, sideoats grama, other forbs

Properties and Qualities

Depth to restrictive feature: 18 to 49 cm to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 0.7 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 35

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Low (about 4.0 cm)

Figure 9.—An area of Bissett-Rock outcrop complex, 15 to 60 percent slopes, in the Patterson Hills on the south side of the park. Vegetation includes black grama, sideoats grama, sand dropseed, mariola, creosote bush, ocotillo, lechuguilla, rough ephedra, Gregg's coldenia, and pricklypear.

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Limestone Hill and Mountain (Desert Grassland) (R042XC249TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, thermic Lithic Ustic Haplocalcids

Typical Profile

A—0 to 4 cm; loam
Bk—4 to 34 cm; very gravelly loam
R—34 to 59 cm; limestone bedrock

Rock outcrop

Setting

Landscape: Hills
Slope: 15 to 60 percent
Parent material: Limestone

Properties and Qualities

Depth to restrictive feature: Lithic bedrock at surface
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Flooding frequency: None
Ponding frequency: None

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

BSG—Bonespring-Rock outcrop complex, 10 to 60 percent slopes

Map unit setting: Hills
Major Land Resource Area: MLRA 70D—Southern Desert Foothills
Elevation: 1,346 to 2,461 m
Mean annual precipitation: 287 to 523 cm
Mean annual air temperature: 14 to 19 degrees C
Frost-free period: 203 to 255 days

Map Unit Composition

Bonespring: 63 percent
Rock outcrop: 20 percent
Minor components:
- Altuda soils—9 percent; on hillslopes; not hydric
- Murray soils—2 percent; on alluvial fans; not hydric
- Pinery soils—6 percent; on alluvial fans; not hydric

Bonespring

Setting

Landscape: Hills (fig. 10)
Landform: Ridges

Landform position (two-dimensional): Summit, shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: Southeast
Aspect range: Southwest to east (clockwise)
Slope: 10 to 60 percent
Parent material: Slope alluvium and/or residuum weathered from limestone and sandstone
Vegetation: Black grama, sideoats grama, blue grama

Properties and Qualities

Depth to restrictive feature: 8 to 47 cm to lithic bedrock
Shrink-swell potential: Low (about 2.0 LEP)
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 5

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 1.6 cm)

Figure 10.—An area of Bonespring-Rock outcrop complex, 10 to 60 percent slopes, along the Salt Basin Trail. Vegetation includes sideoats grama, Warnock's grama, black grama, New Mexico feathergrass, mountain mahogany, skeletonleaf goldeneye, yucca, winterfat, mariola, and redberry juniper.

Interpretive Groups

Land capability subclass (nonirrigated): 6c
Ecological site: Sandstone Hill (R070DY749TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, calcareous, thermic Aridic Lithic Ustorthents

Typical Profile

A—0 to 9 cm; very channery sandy loam
Bk—9 to 28 cm; extremely gravelly sandy loam
R—28 to 53 cm; sandstone bedrock

Rock outcrop

Setting

Landscape: Hills
Slope: 10 to 60 percent
Parent material: Sandstone

Properties and Qualities

Depth to restrictive feature: Lithic bedrock at surface
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Flooding frequency: None
Ponding frequency: None

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

CAD—Chispa-Tenneco complex, 2 to 9 percent slopes

Map unit setting: Hills
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,121 to 1,377 m
Mean annual precipitation: 254 to 381 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 187 to 239 days

Map Unit Composition

Chispa: 50 percent
Tenneco: 33 percent
Minor components:
Unnamed soils—17 percent; not hydric

Chispa

Setting

Landscape: Hills
Landform: Fans

Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: Northwest
Aspect range: All aspects
Slope: 2 to 9 percent
Parent material: Loamy alluvium derived from limestone and dolomite
Vegetation: Black grama, bush muhly, sideoats grama, creosote bush, Arizona cottontop, other forbs

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 3.0 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 25

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 24.8 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Ecological site: Gravelly (Desert Grassland) (R042XC244TX)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Fine-loamy, mixed, superactive, thermic Ustic Haplocalcids

Typical Profile

A—0 to 15 cm; loam
Bk—15 to 203 cm; loam

Tenneco

Setting

Landscape: Hills
Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Down-slope shape: Linear
Across-slope shape: Concave
Aspect, representative: Northwest
Aspect range: All aspects
Slope: 2 to 5 percent
Parent material: Loamy alluvium derived from limestone and dolomite
Vegetation: Tobosa, blue grama, black grama, burrograss

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Slightly saline (about 5.0 dS/m)

Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 19

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 36.4 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6c
Ecological site: Loamy (R042XC007NM)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Fine-loamy, mixed, superactive, thermic Ustic Haplocambids

Typical Profile

A—0 to 13 cm; very fine sandy loam
Bw1—13 to 72 cm; very fine sandy loam
Bw2—72 to 110 cm; loam
Bk—110 to 203 cm; loam

CCD—Chilicotal-Chispa complex, 3 to 13 percent slopes

Map unit setting: Fan Piedmonts (fig. 11)
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,142 to 1,724 m
Mean annual precipitation: 254 to 381 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 187 to 239 days

Map Unit Composition

Chilicotal: 51 percent
Chispa: 28 percent
Minor components:
Tenneco soils—12 percent; on alluvial fans; not hydric
Unnamed soils—9 percent; not hydric

Chilicotal

Setting

Landscape: Fan piedmonts
Landform: Fan remnants
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: Southwest
Aspect range: South to north (clockwise)
Slope: 3 to 13 percent
Parent material: Gravelly alluvium derived from limestone and dolomite

Figure 11.—An area of Chilicotal-Chispa complex, 3 to 13 percent slopes, along the Williams Ranch Road. The hills in the background are the Patterson Hills. Vegetation includes tobosa, burrograss, plains bristlegrass, creosote bush, tarbush, and western honey mesquite.

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 1.0 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 35

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 13.7 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Gravelly (Desert Grassland) (R042XC244TX)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids

Typical Profile

A—0 to 21 cm; gravelly loam
Bk1—21 to 55 cm; very cobbly loam
Bk2—55 to 157 cm; very gravelly sandy loam

Chispa

Setting

Landscape: Fan piedmonts
Landform: Fan remnants
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: Southwest
Aspect range: South to north (clockwise)
Slope: 3 to 13 percent
Parent material: Gravelly alluvium derived from limestone and dolomite

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 1.2 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 17

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 18.6 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Ecological site: Gravelly (Desert Grassland) (R042XC244TX)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Fine-loamy, mixed, superactive, thermic Ustic Haplocalcids

Typical Profile

A—0 to 8 cm; fine sandy loam
Bk1—8 to 19 cm; fine sandy loam
Bk2—19 to 157 cm; loam

COC—Copia loamy fine sand, 2 to 7 percent slopes

Map unit setting: Basin floors
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,108 to 1,181 m
Mean annual precipitation: 150 to 319 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 180 to 214 days

Map Unit Composition

Copia: 90 percent
Minor components:
Unnamed soils—10 percent; not hydric

Copia

Setting

Landscape: Basin floors
Landform: Dunes (fig. 12)
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: West
Aspect range: All aspects
Slope: 2 to 7 percent
Parent material: Eolian sands
Vegetation: Giant dropseed, mesa dropseed, perennial forbs

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 0.3 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Figure 12.—An area of Copia loamy fine sand, 2 to 7 percent slopes, in the quartz dunes area on the west side of the park. Vegetation includes spike dropseed, sand dropseed, mesa dropseed, giant dropseed, black grama, bush muhly, broom dalea, western honey mesquite, soaptree yucca, and croton.

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Excessively drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 12.2 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Ecological site: Deep Sand (R042XB011NM)
Hydric soil status: No
Hydrologic soil group: A
Soil classification: Mixed, thermic Typic Torripsamments

Typical Profile

A—0 to 4 cm; loamy fine sand
C—4 to 203 cm; fine sand

CPB—Corvus-Peligro complex, 1 to 5 percent slopes

Map unit setting: Basins (fig. 13)
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,104 to 1,123 m
Mean annual precipitation: 150 to 319 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 180 to 214 days

Map Unit Composition

Corvus: 43 percent
Peligro: 27 percent
Minor components:
Lark soils—7 percent; on dune fields; not hydric
Monahans soils—3 percent; on alluvial fans; not hydric
Nasa soils—20 percent; on relict stabilized gypsum dunes on basin floors; not hydric

Corvus

Setting

Landscape: Basins
Landform: Relict stabilized gypsum dunes on basin floors
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: West
Aspect range: All aspects
Slope: 1 to 5 percent
Parent material: Gypsiferous loamy eolian deposits
Vegetation: Gyp grama, gyp coldenia, gyp dropseed

Properties and Qualities

Depth to restrictive feature: 31 to 52 cm to petrogypsic
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 3.0 dS/m)

Figure 13.—An area of Corvus-Peligro complex, 1 to 5 percent slopes, in the salt basin area on the west side of the park. The less vegetated area with a cryptogrammic crust is the Corvus soil. Vegetation on the Corvus soil includes gyp grama, gyp dropseed, gyp coldenia, and gyp monopod. The area with increased plant cover is the Peligro soil. This increase in vegetation is because of the slightly thicker A horizon. Vegetation on the Peligro soil includes alkali sacaton, spike dropseed, gyp grama, fourwing saltbush, gyp coldenia, and tasajillo.

Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate equivalent (percent): 4

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Very low
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Moderate (about 6.5 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Ecological site: Gyp Outcrop (R042XB007NM)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy, hypergypsic, thermic, shallow Typic Petrogypsids

Typical Profile

A—0 to 6 cm; gypsiferous very fine sandy loam
By—6 to 49 cm; gypsiferous fine sandy loam; gypsiferous loamy fine sand
Bym—49 to 74 cm; cemented gypsiferous material

Peligro

Setting

Landscape: Basins
Landform: Relict playa dunes on basin floors
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: West
Aspect range: All aspects
Slope: 1 to 5 percent
Parent material: Gypsiferous eolian deposits

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 2.0 LEP)
Salinity maximum: Slightly saline (about 4.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate equivalent (percent): 4

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 29.3 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Ecological site: Gyp Upland (R042XB006NM)
Hydric soil status: No
Hydrologic soil group: A
Soil classification: Coarse-gypseous, hypergypsic, thermic Leptic Haplogypsids

Typical Profile

A—0 to 5 cm; very fine sandy loam
By—5 to 112 cm; gypsiferous fine sandy loam
Cy—112 to 203 cm; gypsiferous very fine sandy loam

LAD—Lazarus loam, 2 to 9 percent slopes

Map unit setting: Mountains
Major Land Resource Area: MLRA 70C—Central New Mexico Highlands
Elevation: 1,834 to 2,104 m
Mean annual precipitation: 508 to 660 cm
Mean annual air temperature: 8 to 16 degrees C
Frost-free period: 135 to 250 days

Map Unit Composition

Lazarus: 80 percent
Minor components:
Desario soils—8 percent; on hills; not hydric

McKittrick soils—8 percent; on flood plain steps on valley floors; not hydric
Penasco soils—4 percent; on valley sides on canyons, valley floors on canyons; not hydric

Lazarus

Setting

Landscape: Mountains
Landform: Valley sides on canyons, valley floors on canyons (fig. 14)
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Aspect, representative: Northwest
Aspect range: All aspects
Slope: 2 to 9 percent
Parent material: Alluvium derived from limestone and dolomite
Vegetation: Western wheatgrass, blue grama, sideoats grama, Texas needlegrass, little bluestem

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Non-saline (about 0.4 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Figure 14.—An area of Lazarus loam, 2 to 9 percent slopes, in West Dog Canyon. An area of Biduya-Desario-Rock outcrop, 10 to 50 percent slopes, is on the hills in the background. Vegetation includes finestem needlegrass, New Mexico feathergrass, western wheatgrass, wolftail, blue grama, cholla, oneseed juniper, and pinyon pine.

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 40.6 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7e
Ecological site: Loamy (R070CY109NM)
Hydric soil status: No
Hydrologic soil group: C
Soil classification: Fine-silty, mixed, superactive, mesic Pachic Argiustolls

Typical Profile

A—0 to 19 cm; loam
Bt1—19 to 109 cm; clay loam
Bt2—109 to 203 cm; loam

LPC—Lark-Peligro complex, 1 to 8 percent slopes

Map unit setting: Basins (fig. 15)
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,106 to 1,130 m
Mean annual precipitation: 150 to 319 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 180 to 214 days

Map Unit Composition

Lark: 50 percent
Peligro: 40 percent
Minor components:
Nasa soils—10 percent; on relict stabilized gypsum dunes on basin floors; not hydric

Lark

Setting

Landscape: Basins
Landform: Dune fields
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: West
Aspect range: All aspects
Slope: 5 to 8 percent
Parent material: Gypseous eolian sands

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 0.0 LEP)
Salinity maximum: Very slightly saline (about 2.1 dS/m)

Figure 15.—An area of Lark-Peligro complex, 1 to 8 percent slopes, in the salt basin area on the west side of the park. Lark soils are on the high dune areas. Vegetation on the Lark soil includes gyp grama, Indian ricegrass, frosted mint, soaptree yucca, and gyp coldenia. The lower interdune area is the Peligro soil. Vegetation on the Peligro soil includes alkali sacaton, spike dropseed, gyp grama, fourwing saltbush, gyp coldenia, and tasajillo.

Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Excessively drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 12.2 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Ecological site: Vegetated Gypsum Dunes (R042XB003NM)
Hydric soil status: No
Hydrologic soil group: A
Soil classification: Gypsic, thermic Typic Torripsamments

Typical Profile

Ay—0 to 27 cm; gypsiferous fine sand
Cy—27 to 203 cm; gypsiferous fine sand

Peligro

Setting

Landscape: Basins
Landform: Interdunes
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Aspect, representative: West
Aspect range: All aspects
Slope: 1 to 8 percent
Parent material: Gypsiferous eolian deposits
Vegetation: Gyp dropseed, fourwing saltbush

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 2.0 LEP)
Salinity maximum: Very slightly saline (about 3.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate equivalent (percent): 1

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 27.2 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7c
Ecological site: Gyp Upland (R042XB006NM)
Hydric soil status: No
Hydrologic soil group: A
Soil classification: Coarse-gypseous, hypergypsic, thermic Leptic Haplogypsids

Typical Profile

A—0 to 18 cm; loamy fine sand
By—18 to 43 cm; gypsiferous sandy loam
Cy—43 to 203 cm; gypsiferous fine sandy loam

LRH—Lostpeak-Rock outcrop complex, 40 to 95 percent slopes

Map unit setting: Mountains (fig. 16)
Major Land Resource Area: MLRA 70C—Central New Mexico Highlands
Elevation: 1,426 to 2,647 m
Mean annual precipitation: 330 to 381 cm
Mean annual air temperature: 8 to 16 degrees C
Frost-free period: 135 to 250 days

Figure 16.—An area of Lostpeak-Rock outcrop complex, 40 to 95 percent slopes, on the east escarpment. Vegetation includes wavyleaf oak, mountain mahogany, desert ceanothus, sotol, sacahuista, saddlebush, mariola, fragrant sumac, New Mexico muhly, bull muhly, plains lovegrass, cane bluestem, curlyleaf muhly, New Mexico feathergrass, pinyon pine, and ponderosa pine.

Map Unit Composition

Lostpeak: 70 percent
Rock outcrop: 25 percent
Minor components:
Unnamed soils—5 percent; not hydric

Lostpeak

Setting

Landscape: Mountains
Landform: Escarpments
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Aspect, representative: Southeast
Aspect range: Northeast to northwest (clockwise)
Slope: 40 to 95 percent
Parent material: Residuum weathered from limestone
Vegetation: Wavyleaf oak, New Mexico muhly, green sotol

Properties and Qualities

Depth to restrictive feature: 11 to 46 cm to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)

Salinity maximum: Non-saline (about 0.7 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 9

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 1.7 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Breaks (R070CY115NM)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, mesic Aridic Lithic Haplustolls

Typical Profile

A—0 to 19 cm; very gravelly clay loam
R—19 to 44 cm; limestone bedrock

Rock outcrop

Setting

Landscape: Mountains
Slope: 40 to 95 percent
Parent material: Limestone

Properties and Qualities

Depth to restrictive feature: Lithic bedrock at surface
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Flooding frequency: None
Ponding frequency: None

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

MCB—McKittrick-Riverwash complex, flooded, 0 to 3 percent slopes

Map unit setting: Canyonlands (fig. 17)
Major Land Resource Area: MLRA 70C—Central New Mexico Highlands
Elevation: 1,511 to 1,960 m
Mean annual precipitation: 508 to 660 cm
Mean annual air temperature: 8 to 16 degrees C
Frost-free period: 135 to 250 days

Figure 17.—An area of McKittrick-Riverwash complex, flooded, 0 to 3 percent slopes, in McKittrick Canyon. An area of Lostpeak-Rock outcrop complex, 40 to 95 percent slopes, is on the mountainsides in the background. Vegetation includes little bluestem, yellow Indiangrass, bull muhly, pinyon ricegrass, pine muhly, sedges, sotol, apache plume, bigtooth maple, chinquapin oak, velvet ash, madrone, hoptree, alligator juniper, ponderosa pine, and pinyon pine.

Map Unit Composition

McKittrick: 31 percent
Riverwash: 22 percent
McKittrick: 20 percent
Minor components:
Unnamed soils—27 percent; not hydric

McKittrick soils, occasionally flooded

Setting

Landscape: Canyonlands
Landform: Flood-plain steps on valley floors
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Linear, convex
Aspect, representative: Southeast
Aspect range: All aspects
Slope: 0 to 3 percent
Parent material: Gravelly alluvium derived from limestone and dolomite
Vegetation: Bigtooth maple

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Moderate (about 3.0 LEP)
Salinity maximum: Non-saline (about 0.4 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 30

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: Occasional (see Water Features table)
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Moderate (about 6.7 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6e
Ecological site: Limestone Canyon (R070CY745TX)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Loamy-skeletal, carbonatic, superactive, mesic Fluventic Haplustolls

Typical Profile

A—0 to 12 cm; gravelly sandy loam
Bw—12 to 41 cm; very gravelly sandy loam
BC—41 to 157 cm; extremely cobbly coarse sandy loam

McKittrick soils, frequently flooded

Setting

Landscape: Canyonlands
Landform: Flood-plain steps on valley floors
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Linear, convex
Aspect, representative: Southeast
Aspect range: All aspects
Slope: 0 to 3 percent
Parent material: Gravelly alluvium derived from limestone and dolomite
Vegetation: Sideoats grama, black grama, juniper, little bluestem, mountain muhly, New Mexico feathergrass

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Moderate (about 3.0 LEP)
Salinity maximum: Non-saline (about 0.4 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 30

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: Frequent

Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Moderate (about 6.7 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6w
Ecological site: Gravelly (R070DY156NM)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Loamy-skeletal, carbonatic, superactive, mesic Fluventic Haplustolls

Typical Profile

A—0 to 12 cm; gravelly sandy loam
Bw—12 to 41 cm; very gravelly sandy loam
BC—41 to 157 cm; extremely cobbly coarse sandy loam

Riverwash

Setting

Landscape: Canyonlands
Slope: 0 to 1 percent
Parent material: Recent alluvium

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Unspecified
Natural drainage class: Excessively drained
Flooding frequency: Frequent
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

MPB—Monahans-Pajarito complex, 0 to 5 percent slopes

Map unit setting: Basins (fig. 18)
Major Land Resource Area: MLRA 42—Southern Desertic Basins, Plains, and Mountains
Elevation: 1,108 to 1,237 m
Mean annual precipitation: 150 to 319 cm
Mean annual air temperature: 15 to 19 degrees C
Frost-free period: 180 to 214 days

Map Unit Composition

Monahans: 60 percent
Pajarito: 21 percent
Minor components:
Corvus soils—3 percent; on relict stabilized gypsum dunes on basin floors; not hydric

Lark soils—3 percent; on dune fields; not hydric
Nasa soils—13 percent; on relict stabilized gypsum dunes on basin floors; not hydric

Monahans

Setting

Landscape: Basins
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Aspect, representative: West
Aspect range: All aspects
Slope: 0 to 5 percent
Parent material: Calcareous and gypsiferous coarse-loamy alluvium
Vegetation: Black grama, bush muhly, sand dropseed, spike dropseed, mesa dropseed

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Very slightly saline (about 2.6 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 2.0
Calcium carbonate equivalent (percent): 13

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None

Figure 18.—An area of Monahans-Pajarito complex, 0 to 5 percent slopes, on the lower end of the alluvial fans on the west side of the park. Vegetation in this map unit includes mesa dropseed, bush muhly, plains bristlegrass, threeawns, creosote bush, soaptree yucca, and fourwing saltbush.

Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 22.9 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7e
Ecological site: Sandy (R042XB012NM)
Hydric soil status: No
Hydrologic soil group: A
Soil classification: Coarse-loamy, mixed, superactive, thermic Typic Calcigypsids

Typical Profile

A—0 to 10 cm; fine sandy loam
Bk—10 to 33 cm; fine sandy loam
Bky—33 to 203 cm; fine sandy loam

Pajarito

Setting

Landscape: Basins
Landform: Alluvial fans
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Aspect, representative: West
Aspect range: All aspects
Slope: 0 to 5 percent
Parent material: Eolian sands and/or alluvium derived from limestone and sandstone

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 1.0 dS/m)
Sodicity maximum: Sodium adsorption ratio is about 1.0
Calcium carbonate equivalent (percent): 3

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 28.4 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7e
Ecological site: Sandy (R042XB012NM)
Hydric soil status: No
Hydrologic soil group: A
Soil classification: Coarse-loamy, mixed, superactive, thermic Typic Haplocambids

Typical Profile

A—0 to 28 cm; very fine sandy loam
Bw—28 to 98 cm; very fine sandy loam
Bk—98 to 203 cm; very fine sandy loam

PCG—Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky

Map unit setting: Piedmonts (fig. 19)
Major Land Resource Area: MLRA 70D—Southern Desert Foothills
Elevation: 1,370 to 1,995 m
Mean annual precipitation: 287 to 523 cm
Mean annual air temperature: 14 to 19 degrees C
Frost-free period: 203 to 255 days

Map Unit Composition

Pinery: 32 percent
Choza: 27 percent
Altuda: 20 percent
Minor components:
Murray soils—9 percent; on alluvial fans; not hydric
Rock outcrop—8 percent; not hydric
Unnamed soils—4 percent; not hydric

Altuda

Setting

Landscape: Piedmont
Landform: Hillslopes

Figure 19.—An area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky. The Pinery soil is on the steep fan at the base of the mountains, Altuda is at the base of the mountains and on ridges, and the Choza soil is on the less sloping area in the foreground. Vegetation includes sideoats grama, blue grama, curlyleaf muhly, New Mexico feathergrass, fragrant sumac, desert ceanothus, mountain mahogany, wavyleaf oak, black grama, hairy grama, cane bluestem, little bluestem, hairy grama, skunkbush sumac, sotol, pricklypear, redberry juniper, oaks, and pinyon pine.

Down-slope shape: Convex
Across-slope shape: Convex
Aspect, representative: South
Aspect range: All aspects
Slope: 10 to 60 percent
Parent material: Residuum weathered from limestone
Vegetation: Sideoats grama, curlyleaf muhly, blue grama, other forbs

Properties and Qualities

Depth to restrictive feature: 18 to 52 cm to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 0.5 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 20

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 2.9 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Limestone Hills (R070DY151NM)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, thermic Lithic Calciustolls

Typical Profile

A—0 to 12 cm; very gravelly loam
Bk—12 to 28 cm; very gravelly loam
R—28 to 53 cm; limestone bedrock

Pinery

Setting

Landscape: Piedmont
Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: Southeast
Aspect range: North to south (clockwise)
Slope: 5 to 20 percent
Parent material: Gravelly alluvium derived from limestone and dolomite
Vegetation: Sideoats grama, cane bluestem, blue grama, little bluestem, New Mexico feathergrass, other forbs

Properties and Qualities

Depth to restrictive feature: None within 150 cm
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 0.3 dS/m)

Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 15

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very high (about 16.7 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6e
Ecological site: Gravelly (R070DY156NM)
Hydric soil status: No
Hydrologic soil group: B
Soil classification: Loamy-skeletal, mixed, superactive, thermic Aridic Calciustolls

Typical Profile

A1—0 to 26 cm; gravelly loam
A2—26 to 48 cm; very gravelly loam
BCk—48 to 157 cm; extremely cobbly loam

Choza

Setting

Landscape: Piedmont
Landform: Fan remnants
Landform position (three-dimensional): Sideslope
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: Southeast
Aspect range: North to south (clockwise)
Slope: 5 to 20 percent
Parent material: Gravelly alluvium derived from limestone and dolomite
Vegetation: Curlyleaf muhly, blue grama, black grama, sideoats grama

Properties and Qualities

Depth to restrictive feature: 13 to 49 cm to petrocalcic
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline (about 0.3 dS/m)
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): 11

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 2.9 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 6s
Ecological site: Shallow (R070DY152NM)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, thermic, shallow Petrocalcic Calciustolls

Typical Profile

A1—0 to 15 cm; very gravelly loam
A2—15 to 26 cm; very gravelly loam
Bkm—26 to 51 cm; cemented material

VLG—Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes

Map unit setting: Mountains (fig. 20)
Major Land Resource Area: MLRA 70C—Central New Mexico Highlands
Elevation: 1,911 to 2,632 m
Mean annual precipitation: 508 to 660 cm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Figure 20.—An area of Lozen in the Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes, along the Blue Ridge Trail. Vegetation includes ponderosa pine, alligator juniper, oneseed juniper, oaks, pine muhly, mountain muhly, New Mexico muhly, bull muhly, little bluestem, big bluestem, yellow Indiangrass, finestem needlegrass, pinyon ricegrass, Arizona fescue, plains lovegrass, cliff fendlerbush, mountain mahogany, and New Mexico agave.

Map Unit Composition

Victorio: 51 percent
Lozen: 33 percent
Rock outcrop: 12 percent
Minor components:
Unnamed soils—4 percent; not hydric

Victorio

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: North
Aspect range: All aspects
Slope: 25 to 60 percent
Parent material: Colluvium and residuum weathered from limestone and dolomite

Properties and Qualities

Depth to restrictive feature: 18 to 49 cm to lithic bedrock
Shrink-swell potential: High (about 8.0 LEP)
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Low (about 4.0 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora (F070CY020TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Clayey-skeletal, mixed, superactive, mesic Lithic Argiustolls

Typical Profile

Oi—0 to 7 cm; decomposed plant material
A—7 to 17 cm; gravelly loam
Bt—17 to 47 cm; very cobbly clay loam and very cobbly clay
R—47 to 72 cm; limestone bedrock

Lozen

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges

Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: South
Aspect range: All aspects
Slope: 10 to 45 percent
Parent material: Colluvium and residuum weathered from limestone and dolomite
Vegetation: Ponderosa pine, little bluestem, yellow Indiangrass, alligator juniper

Properties and Qualities

Depth to restrictive feature: 11 to 44 cm to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Very low (about 1.1 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia (F070CY021TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, mesic Lithic Haplustolls

Typical Profile

A—0 to 12 cm; very gravelly loam
R—12 to 37 cm; limestone bedrock

Rock outcrop

Setting

Landscape: Mountains
Slope: 10 to 60 percent
Parent material: Limestone

Properties and Qualities

Depth to restrictive feature: Lithic bedrock at surface
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Flooding frequency: None
Ponding frequency: None

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

VLH—Victorio-Lozen-Rock outcrop complex, 40 to 95 percent slopes

Map unit setting: Mountains (fig. 21)
Major Land Resource Area: MLRA 70C—Central New Mexico Highlands
Elevation: 1,548 to 2,664 m
Mean annual precipitation: 508 to 660 cm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Map Unit Composition

Victorio: 35 percent
Lozen: 25 percent
Victorio: 20 percent
Rock outcrop: 20 percent

Victorio soils, 60 to 95 percent slopes

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges

Figure 21.—An area of Victorio soils in the Victorio-Lozen-Rock outcrop complex, 40 to 95 percent slopes, along the Tejas Trail. Vegetation includes Douglas fir, southwestern white pine, ponderosa pine, Gambel oak, Knowlton hophornbeam, Utah serviceberry, New Mexico muhly, Arizona fescue, and nodding brome.

Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: North
Aspect range: All aspects
Slope: 60 to 95 percent
Parent material: Colluvium and residuum weathered from limestone and dolomite

Properties and Qualities

Depth to restrictive feature: 40 to 52 cm to lithic bedrock
Shrink-swell potential: High (about 8.0 LEP)
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Moderate (about 6.2 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora (F070CY020TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Clayey-skeletal, mixed, superactive, mesic Lithic Argiustolls

Typical Profile

A—0 to 10 cm; very gravelly clay loam
Bt—10 to 42 cm; very cobbly clay
R—42 to 67 cm; limestone bedrock

Victorio soils, 40 to 60 percent slopes

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: North
Aspect range: All aspects
Slope: 40 to 60 percent
Parent material: Colluvium and residuum weathered from limestone and dolomite

Properties and Qualities

Depth to restrictive feature: 40 to 52 cm to lithic bedrock
Shrink-swell potential: High (about 8.0 LEP)
Salinity maximum: Non-saline

Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Moderate (about 6.2 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora (F070CY020TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Clayey-skeletal, mixed, superactive, mesic Lithic Argiustolls

Typical Profile

A—0 to 10 cm; very gravelly clay loam
Bt—10 to 42 cm; very cobbly clay
R—42 to 67 cm; limestone bedrock

Lozen

Setting

Landscape: Mountains
Landform: Mountain slopes, ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Aspect, representative: South
Aspect range: All aspects
Slope: 40 to 95 percent
Parent material: Colluvium and residuum weathered from limestone and dolomite

Properties and Qualities

Depth to restrictive feature: 40 to 45 cm to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Slowest capacity to transmit water (Ksat): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Depth to seasonal water table: Not present within 160 cm
Available water capacity (entire profile): Low (about 3.9 cm)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
Ecological site: Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia (F070CY021TX)
Hydric soil status: No
Hydrologic soil group: D
Soil classification: Loamy-skeletal, mixed, superactive, mesic Lithic Haplustolls

Typical Profile

A—0 to 43 cm; very gravelly loam
R—43 to 68 cm; limestone bedrock

Rock outcrop

Setting

Landscape: Mountains
Slope: 40 to 95 percent
Parent material: Limestone

Properties and Qualities

Depth to restrictive feature: Lithic bedrock at surface
Salinity maximum: Non-saline
Sodicity maximum: Non-sodic
Calcium carbonate equivalent (percent): No carbonates

Hydrologic Properties

Flooding frequency: None
Ponding frequency: None

Interpretive Groups

Land capability subclass (nonirrigated): Not assigned
Hydric soil status: No

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

There are no areas in Guadalupe Mountains National Park that meet the soil requirements for prime farmland.

Use and Management of the Soils

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

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

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

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

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

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

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation.

The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Land Management

In Table 5, Table 6, Table 7, and Table 8, interpretive ratings are given for various aspects of land management. The ratings are both descriptive and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified aspect of forestland management. *Well suited* indicates that the soil has features that are favorable for the specified management aspect and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified management aspect. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified management aspect. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified management aspect or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified aspect of forestland management (1.00) and the point at which the soil feature is not a limitation (0.00).

Ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as *well suited, moderately suited, poorly suited*, or *unsuited* to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column *soil rutting for equipment use* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of forestland equipment. The hazard is described as slight, moderate, or severe. A rating of "slight" indicates that the soil is subject to little or no rutting, "moderate" indicates that rutting is likely, and "severe" indicates that ruts form readily.

Ratings in the column *hazard of erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected,

that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface*) are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

Ratings in the column *suitability for mechanical site preparation and mechanical site restoration (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation and mechanical site restoration (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

Ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a low, moderate, or high potential for seedling mortality.

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961).

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or aesthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, 2e. The letter e shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by w, s, or c because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

The capability classification of the soils in this survey area is provided in the section Detailed Soil Map Units, and in Table 9.

Ecological Site Descriptions for Guadalupe Mountains National Park

The Natural Resources Conservation Service divides both forest and rangelands into ecological sites for the purposes of inventory, evaluation, and management. An ecological site is defined as a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. An ecological site is the product of all the environmental factors responsible for its development, and it has a set of key characteristics that are included in the ecological site description such as characteristic soils. Ecological sites incorporate state and transition models to describe the succession of community phases and ecological processes that affect the site and they are classified according to the potential native plant community, or reference plant community, which develops under natural conditions. Additional information about ecological sites can be found in the USDA-NRCS, National Range and Pasture Handbook, on the internet at http://www.glti.nrcs.usda.gov.

Ecological sites are classified as either forestland or rangeland ecological sites as shown in Table 10. For the purposes of developing ecological site descriptions, forestland is defined where the historic climax plant community was dominated by a minimum of 25 percent overstory canopy cover of tree species, as determined by a crown perimeter-vertical projection. The historic climax plant community in North America is defined as the plant community that existed at the time of European immigration and settlement. It developed in equilibrium with natural disturbances, such as drought, fire, and insects. During different points of disturbance, the historic plant community may be represented by different seral stages. Vegetation on forestland provides many habitat components, aids in controlling soil erosion, is suitable for grazing or browsing by wildlife, and offers scenic and recreational opportunities.

Rangeland ecological sites, on the other hand, do not have the potential to produce more than 25 percent forest canopy cover. Vegetation on rangeland provides many habitat components, aids in controlling soil erosion, is suitable for grazing or browsing by wildlife and domestic animals, and offers scenic and recreational opportunities. There are a total of 18 ecological sites delineated at Guadalupe Mountains National Park soil survey. Of those, 16 are classified as rangeland ecological sites and two are classified as forestland ecological sites.

General Description of Vegetation

The composition and production of the natural plant communities at Guadalupe Mountains National Park is determined primarily by varying soil types as determined by the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time. In many locations the park showcases abrupt changes in vegetation types because of differences in elevation, aspect, landform, and effective precipitation as shown in Figure 22.

Table 11 shows the relationship of slope, elevation, mean annual precipitation (map), landscape setting, and parent materials to the ecological site assigned to major components of the map units.

In general, some major vegetation formations within the park include Chihuahuan Desert shrublands and grasslands, mixed prairie grasslands, pinyon-juniper woodlands,

Figure 22.—Aspect and landform are important environment factors separating ecological sites within Guadalupe Mountains National Park. In this picture, the Limestone Mountain (North Aspect) forestland ecological site, consisting of mostly mixed conifers, occurs within the Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes map unit while the Breaks rangeland ecological site, consisting of mostly shrubs and grasses, occurs within the Lostpeak-Rock outcrop complex, 40 to 95 percent slopes map unit. Guadalupe Peak can be seen in the background.

riparian woodlands, mountain shrublands, ponderosa pine savannas, and a mixed conifer forest. These general vegetation formations do not follow any particular classification system but are used for the purposes of communicating during the development of ecological sites. Several ecological sites can occur within each of these broad categories of vegetation formations.

The Chihuahuan Desert shrublands occur primarily at the lower elevations (975 to 1,371 m) of the park mostly within the southwestern portion. Characteristic plants of these shrublands include creosote bush, lechuguilla, ocotillo, whitethorn acacia, gyp coldenia, black grama, and slim tridens. Soils are classified as Aridisols and are generally very gravelly and droughty. Specific areas in the park include the Patterson Hills, the surrounding alluvial fans, and shallow gypsum hills located within the salt basin. These areas are the most susceptible to disturbances such as overgrazing since natural recovery is slow or nearly impossible if compositional and/or functional thresholds are crossed.

The Chihuahuan Desert grasslands occur primarily at the lower elevations of the park (975 to 1,371 m) in association with desert shrublands. Characteristic plants include numerous varieties of dropseed, black grama, sideoats grama, alkali sacaton, fourwing saltbush, soaptree yucca, and western honey mesquite. Soils are classified as Aridisols and are generally deep and nongravelly. Specific areas in the park include the quartz sands and deep gypsum soils located within or near the salt basin. As with the associated shrublands, these areas are susceptible to disturbances such as overgrazing since natural recovery is slow or nearly impossible if compositional and/or functional thresholds are crossed.

The mixed prairie grasslands are found mostly at mid elevations (1,524 to 1,828 m) of the park. Characteristic plants include blue grama, sideoats grama, curlyleaf muhly, pine muhly, New Mexico feathergrass, finestem needlegrass, fragrant sumac, redberry juniper, oaks, and pinyon pine. Soils are classified as Mollisols and range from shallow to deep and gravelly to nongravelly. Specific areas of the park include the southern front range of the park around Pine Springs Visitor Center, Frijole Ranch Historical Museum, and clayey meadows in the northern part of the park around West Dog Canyon and Dog Canyon. Higher effective precipitation allows for higher productivity and resiliency than the desert shrublands and allows for increased management options such as the use of prescribed fire. However, these grasslands can be susceptible to juniper encroachment as well as other woody plants.

The pinyon-juniper woodlands are found mostly at mid elevations (1,828 to 2,133 m) of the park. Characteristic plants include oneseed juniper, pinyon pine, wavyleaf oak, cholla, blue grama, sideoats grama, pine muhly, New Mexico muhly, and New Mexico feathergrass. Soils are classified as Mollisols and mostly shallow to limestone bedrock. Specific areas of the park include the limestone hills and ridges around PX Flat. The PX Flat itself is in a woodland state but historically was probably a more open grassland with scattered trees. Cover of woody trees will fluctuate depending on fire frequency.

The riparian woodlands are found within the major canyons of the park including McKittrick, Pine Springs, and Dog Canyon. Characteristic plants include bigtooth maple, velvet ash, madrone, alligator juniper, rocky mountain juniper, ponderosa pine, hoptree, apache plume, catclaw mimosa, pine muhly, bull muhly, little bluestem, yellow Indiangrass, and pinyon ricegrass. Soils are Mollisols and mostly deep and cobbly. Depth to water table, landform, and amount of shade from canyon slopes effects plant community composition and structure.

Mountain shrublands, or chaparral, are found on very steep mountain escarpments. Elevation ranges from (1,584 to 2,590 m). Soils are classified as Mollisols and are shallow to limestone bedrock. The reference plant community is a mountain shrubland with few scattered trees. Characteristic plants include wavyleaf oak, mountain mahogany, desert ceanothus, sotol, sacahuista, saddlebush, mariola, fragrant sumac, New Mexico muhly, bull muhly, plains lovegrass, cane bluestem, curlyleaf muhly, New Mexico feathergrass, pinyon pine, and ponderosa pine. Variability in shrub dominance is likely attributed to differences in soil texture, aspect, elevation, and/or rock outcrop.

The mixed conifer forests occur on mountain slopes and ridgetops at the highest elevations (2,200 to 2,700 m) of the park. Soils are classified as Mollisols and are generally clayey or loamy and shallow to limestone bedrock. Characteristic trees include Douglas fir, ponderosa pine, southwestern white pine, and pinyon pine. Shrubs or small trees in the understory include Gambel oak, Knowlton hophornbeam, Mescalero currant, mountain mahogany, and Utah serviceberry. Canopy cover and composition of woody trees will fluctuate depending on natural disturbances such as fire.

Description of Rangeland and Annual Production Tables

Table 12 lists the ecological site for a particular soil component, the total annual production of vegetation in favorable, normal, and unfavorable years, the characteristic vegetation using common names, and the average species composition by annual production (percent of total annual air-dry weight) and by cover (crown perimeter-vertical projection).

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

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods. These production amounts can be used to calculate carrying capacity and stocking rates for management of domestic or wild animals, or to determine fuel-loading in preparation of prescribed burning plans or fire modeling.

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

Forest Productivity and Management

The table in this section can help forest managers plan the use of soils for managing forest ecosystems. They show the potential productivity of the soils for forest production and rate the soils according to the limitations that affect various aspects of forest management.

In Table 13, the potential productivity of merchantable or common trees on a soil is expressed as a site index and as a volume number. Site index average is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Site index base is a number that refers to the site index curve used to determine the site index for a specific tree species. Site index base age indicates the age used for the site curves. More detailed information regarding site index is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the internet at http://soils.usda.gov/technical/nfmanual/.

The volume of wood fiber, a number, is the yield likely to be produced by the most important tree species at the age of culmination of the mean annual increment (CMAI). It is the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. CMAI age is the point at which the stand reaches its maximum annual rate of growth. Forest trees are all trees that occur in a forest type, including the less common ones.

Rangeland and Forestland Ecological Sites

Following are short descriptions of the rangeland and forestland ecological sites occurring at Guadalupe Mountains National Park. The plants listed in this summary are common existing plants that characterize the site. The complete ecological site description will have much more detail about the plant community dynamics, production, ecological characteristics, and soil information. Full ecological site descriptions are available online at: http://esis.sc.egov.usda.gov/ESIS/. The scientific names for all common names used in this summary can be found in Table 14. Scientific nomenclature is derived from the USDA Plants Database available online at http://plants.usda.gov/.

LRR D, MLRA 42—Southern Desertic Basins, Plains, and Mountains

R042XB011NM—Deep Sand

This rangeland ecological site occurs on level to gently sloping eolian sand dunes. (fig. 23) Soils are deep loamy fine sands. The site is referred locally as the quartz sand dunes. The reference plant community is a dropseed dominated grassland with scattered shrubs and forbs. Common plants include spike dropseed, sand dropseed, mesa dropseed, giant dropseed, black grama, bush muhly, broom dalea, western honey mesquite, soaptree yucca, and croton. This site is correlated with the Copia soil component in map unit COC.

Figure 23.—Sand dropseed, spike dropseed, giant dropseed, grassland croton, western honey mesquite, and soaptree yucca occurring on an area of Copia loamy fine sand, 2 to 7 percent slopes. The Copia soils are in the Deep Sand ecological site, MLRA 42—Southern Desertic Basins, Plains, and Mountains.

R042XB007NM—Gyp Outcrop

This rangeland ecological site occurs on gently undulating relic and stabilized gypsum dunes. (fig. 24) Soils range from very shallow to shallow with periodic outcrops of gypsiferous rock. This site is characterized by a high percentage of a biological crust on the soil surface. The reference plant community is a very sparse dwarf shrubland consisting of mostly gypsofiles. Common plants include gyp grama, gyp dropseed, gyp coldenia, rough coldenia, and gyp moonpod. This site is correlated with the Corvus soil component in map unit CPB.

Figure 24.—Sparse vegetation growing on an area of Corvus-Peligro, 1 to 5 percent slopes. Plants pictured include rough coldenia, gyp dropseed, and gyp grama. This site is characterized by high amounts of biological crusts covering the soil surface. Pictured is the Corvus soil component that is in the Gyp Outcrop Ecological Site. MLRA 42—Southern Desertic Basins, Plains, and Mountains.

R042XB006NM—Gyp Upland

This rangeland ecological site occurs on nearly level to undulating relic playa dunes located on basin floors. (fig. 25) Soils are very deep, coarse-loamy, and were formed in eolian gypsiferous sediments. The reference plant community is a midgrass dominated grassland with scattered shrubs and forbs. Common plants include alkali sacaton, spike dropseed, gyp grama, fourwing saltbush, gyp coldenia, and tasajillo. This site is correlated with the Peligro soil component in map units CPB and LPC.

Figure 25.—Alkali sacaton and fourwing saltbush growing within the Corvus-Peligro, 1 to 5 percent slopes map unit. Pictured is the Peligro soil component that is in the Gyp Upland ecological site, MLRA 42—Southern Desertic Basins, Plains, and Mountains.

R042XB012NM—Sandy

This rangeland ecological site occurs on level to gently sloping alluvial fans at elevations between 1,097 to 1,219 m and is found mostly upslope from the salt basin dunes. (fig. 26) Soils are mostly deep sandy loams. The reference plant community is desert grassland with scattered forbs and shrubs. Associated plants include sand dropseed, mesa dropseed, bush muhly, plains bristlegrass, threeawns, creosote bush, soaptree yucca, and fourwing saltbush. This site is correlated with the Monahans and Pajarito soil components in map unit MPB.

Figure 26.—Sand dropseed, mesa dropseed, fourwing saltbush, and soaptree yucca occurring on an area of Monahans-Pajarito complex, 0 to 5 percent slopes. These soils are in the Sandy Ecological Site in MLRA 42—Southern Desertic Basins, Plains, and Mountains.

R042XB003NM—Vegetated Gypsum Dunes

This rangeland ecological site occurs on active gypsum dunes located within the salt basin. (fig. 27) Soils are deep gypsiferous sands. The reference plant community is a sparse shrubland with scattered grasses and forbs. Common plants include gyp grama, Indian ricegrass, frosted mint, soaptree yucca, and gyp coldenia. This site is correlated with the Lark soil component in map unit LPC.

Figure 27.—Frosted mint, gyp grama, and soaptree yucca occurring on gypsum dunes on an area of Lark-Peligro complex, 1 to 8 percent slopes. The Lark soils are in the Vegetated Gypsum Dunes Ecological Site in MLRA 42—Southern Desertic Basins, Plains, and Mountains.

LRR D, MLRA 42—Southern Desertic Basins, Plains, and Mountains

R042XC244TX—Gravelly

This rangeland ecological site occurs on gravelly alluvial fan remnants from limestone hills and mountains that are located primarily along Williams Ranch Road and adjacent areas. (fig. 28) Soils are deep, gravelly, and loamy. The reference plant community is desert grassland with scattered shrubs and forbs. Common plants include black grama, sideoats grama, bush muhly, slim tridens, creosote bush, skeletonleaf goldeneye, range ratany, lechuguilla, western honey mesquite, and tasajillo. This site is correlated to the Chispa soil component in map units CAD and CCD and the Chilicotal soil component in map unit CCD.

Figure 28.—Creosote bush, western honey mesquite, skeletonleaf goldeneye, black grama, and bush muhly occurring on an area of Chilicotal-Chispa complex, 3 to 13 percent slopes. These soils are in the Gravelly (Desert Grassland) Ecological Site, MLRA 42—Southern Desertic Basins, Plains, and Mountains. The historic Williams Ranch house can be seen in the background.

R042XC249TX—Limestone Hill and Mountain

This rangeland ecological site occurs on strongly rolling to steep limestone hills and mountains. (fig. 29) This site includes the Patterson Hills and the steep western most escarpments of the Guadalupe Mountains. Soils are loamy, gravelly, and very shallow. Runoff potential is very high. Outcrops of limestone bedrock are a common feature of this site. The reference plant community is a diverse shrubland with mid and shortgrasses and scattered forbs. Common plants include black grama, sideoats grama, sand dropseed, mariola, creosote bush, ocotillo, lechuguilla, rough ephedra, Gregg's coldenia, slim tridens, and pricklypear. This site is correlated to the Bissett soil component in map unit BRG.

Figure 29.—Creosote bush, ocotillo, lechuguilla, Gregg's coldenia, black grama, and slim tridens, growing on an area of Bissett-Rock outcrop complex, 15 to 60 percent slopes. The Bissett soils are in the Limestone Hill and Mountain Ecological Site, MLRA 42—Southern Desertic Basins, Plains, and Mountains.

R042XC007NM—Loamy

This rangeland ecological site occurs on gently undulating basin floors and alluvial fans. (fig. 30) Soils are very deep and mostly fine loamy. The reference plant community is grassland with scattered shrubs and forbs. Common plants include tobosa, burrograss, plains bristlegrass, creosote bush, tarbush, bush muhly, soaptree yucca, and western honey mesquite. This site is correlated to the Tenneco soil component in map unit CAD.

Figure 30.—Plains bristlegrass, bush muhly, tarbush, western honey mesquite, and soaptree yucca growing on Tenneco soils within the Chispa-Tenneco complex, 2 to 9 percent slopes map unit. Patterson Hills can be seen in the background. Tenneco soils are in the Loamy ecological site in MLRA 42—Southern Desertic Basins, Plains, and Mountains.

LRR G, MLRA 70C—Central New Mexico Highlands

F070CY020TX—Limestone Mountain (North Aspect)—(Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera ruipicola/ Muhlenbergia pauciflora

This forestland ecological site occurs on steep north facing slopes mostly above 2,286 m in elevation. (fig. 31) This site includes high elevation drainages such as at the junction of Tejas and Juniper Trails. Soils are mostly shallow to limestone bedrock and clayey. The reference plant community is a mixed conifer forest. The three conifers characterizing this site are Douglas fir, southwestern white pine, and ponderosa pine. Shrubs or small trees in the understory include Gambel oak, Knowlton hophornbeam, and Utah serviceberry. Limited sunlight allows for significant grass cover, some grasses that occur in this site include New Mexico muhly, Arizona fescue, and nodding brome. This site is correlated with the Victorio soil component in map units VLG and VLH.

Figure 31.—Douglas fir and southwestern white pine growing on an area of Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes. The Victorio soil is in the Limestone Mountain (North Aspect) Ecological Site, MLRA 70C—Central New Mexico Highlands.

F070CY747TX—Limestone Mountain (South Aspect), Pinus Ponderosa car. Scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/ Muhlenbergia dubia.

This forestland ecological site occurs on mountain slopes and ridgetops, at elevations generally above 2,286 m. (fig. 32) Aspects are predominantly south facing or neutral. Soils are mostly shallow to limestone bedrock, gravelly, and loamy. The reference plant community is a ponderosa pine savanna. Associated plants include pinyon pine, alligator juniper, oneseed juniper, wavyleaf oak, pine muhly, mountain muhly, New Mexico muhly, bull muhly, little bluestem, big bluestem, yellow Indiangrass, finestem needlegrass, pinyon ricegrass, Arizona fescue, plains lovegrass, cliff fendlerbush, mountain mahogany, and New Mexico agave. This site is correlated with the Lozen soil component in map units VLG and VLH.

Figure 32.—Ponderosa pine, pinyon pine, alligator juniper, wavyleaf oak, pine muhly, mountain muhly, little bluestem, and yellow Indiangrass on an area of Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes. The Lozen soils are within the Limestone Mountain (South Aspect) Ecological Site, MLRA 70C—Central New Mexico Highlands.

R070CY115NM—Breaks

This rangeland ecological site occurs on very steep mountain escarpments. (fig. 33) Elevation ranges from 1,584 to 2,590 m. Soils are shallow to limestone bedrock, loamy, and gravelly. Runoff potential is very high. The reference plant community is a mountain shrubland with few scattered trees. Variability in shrub dominance is likely attributed to differences in soil texture, aspect, elevation, and/or rock outcrop. Common plants include wavyleaf oak, mountain mahogany, desert ceanothus, sotol, sacahuista, saddlebush, mariola, fragrant sumac, New Mexico muhly, bull muhly, plains lovegrass, cane bluestem, curlyleaf muhly, and New Mexico feathergrass. This site is correlated to the Lostpeak soil component in map unit LRG.

Figure 33.—Wavyleaf oak, desert ceanothus, mountain mahogany, sotol, New Mexico muhly, and bull muhly growing within Lostpeak-Rock outcrop complex, 40 to 95 percent slopes map unit. The Lostpeak soils are in the Breaks ecological site, MLRA 70C—Central New Mexico Highlands.

R070CY745TX—Limestone Canyon

This rangeland ecological site occurs on nearly level flood plains and valley floors. (fig. 34) The site includes McKittrick Canyon, Pine Spring Canyon, and Dog Canyon. Soils are loamy to fine loamy, deep, and very cobbly. Reference plant communities vary within this site because of variability in depth to water table, landform, soils, and amount of daily sunlight. Much of the canyons can be classified as riparian woodlands. Common plants include little bluestem, yellow Indiangrass, bull muhly, pinyon ricegrass, choke-cherry, Jamaica sawgrass, pine muhly, sedges, sotol, apache plume, bigtooth maple, chinquapin oak, velvet ash, madrone, hoptree, alligator juniper, ponderosa pine, and pinyon pine. This site is correlated with the McKittrick soil component in map unit MCB.

Figure 34.—Sotol, bigtooth maple, chokecherry, ponderosa pine, little bluestem, Jamaica sawgrass growing on an area of McKittrick-Riverwash complex, flooded, 0 to 3 percent slopes. The McKittrick soils are in the Limestone Canyon Ecological Site, MLRA 70C—Central New Mexico Highlands.

R070CY746TX—Limestone Hill

This rangeland ecological site occurs on limestone hills located mostly around West Dog Canyon in the northwestern part of the park. (fig. 35) Soils are shallow to limestone bedrock, loamy, and gravelly. The reference plant community is mixed prairie grassland with scattered forbs, shrubs, and trees. Common plants include New Mexico feathergrass, agarito, pine muhly, curlyleaf muhly, New Mexico muhly, sideoats grama, sacahuista, mountain mahogany, sotol, pinyon pine, and oneseed juniper. This site is correlated with Biduya and Desario soil components in map unit BDG.

Figure 35.—Sacahuista, agarito, pine muhly, New Mexico muhly, New Mexico feathergrass, and sideoats grama on an area of Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes. The Biduya and Desario soils are in the Limestone Hill Ecological Site, MLRA 70C—Central New Mexico Highlands.

R070CY109NM—Loamy

This rangeland ecological site occurs on nearly level valley floors located around Dog Canyon, West Dog Canyon, and PX Flat. (fig. 36) Soils are very deep loams. The reference plant community is mixed prairie grassland with scattered shrubs, forbs, and trees. Common plants include blue grama, western wheatgrass, finestem needlegrass, New Mexico feathergrass, wolftail cholla, agarito, oneseed juniper, and pinyon pine. This site is correlated with the Lazarus soil component in map unit LAD.

Figure 36.—Blue grama, finestem needlegrass, wolftail, cholla, and agarito growing on an area of Lazarus loam, 2 to 9 percent slopes map unit. The Lazarus soil is in the Loamy ecological site, MLRA 70C—Central New Mexico Highlands.

LRR G, MLRA 70D—Southern Desert Foothills

R070DY156NM—Gravelly

This rangeland ecological site occurs on gravelly alluvial fans of higher limestone mountains. (fig. 37) This site is mapped mostly on the alluvial fans derived from Frijole Ridge. Slopes range from 5 to 20 percent. Soils are deep gravelly loams. The reference plant community is mixed prairie grassland with scattered shrubs, trees, and forbs. Common plants include sideoats grama, black grama, blue grama, hairy grama, cane bluestem, curlyleaf muhly, little bluestem, skeletonleaf, goldeneye, fragrant sumac, redberry juniper, oaks, and pinyon pine. This site is correlated with the Pinery soil component in map unit PCG.

Figure 37.—Sideoats grama, blue grama, cane bluestem, skeletonleaf, goldeneye, and redberry juniper occurring on an area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky. Pictured is the Pinery soil component that is in the Gravelly Ecological Site, MLRA 70D—Southern Desert Foothills.

R070DY151NM—Limestone Hills

This rangeland ecological site occurs on limestone hills and footslopes of higher mountains. (fig. 38) Slopes range from 10 to 60 percent. Soils are shallow, gravelly, and loamy. The reference plant community is mixed prairie grassland with scattered shrubs, forbs, and trees. Common plants include sideoats grama, blue grama, curlyleaf muhly, silver dalea, sotol, bull muhly, pine muhly, plains lovegrass, New Mexico feathergrass, fragrant sumac, desert ceanothus, mountain mahogany, wavyleaf oak, redberry juniper, and pinyon pine. This site is associated with the Altuda soil component in map unit PCG.

Figure 38.—Silver dalea, sotol, redberry juniper, sideoats grama, bull muhly, pine muhly, plains lovegrass growing on a recently burned hill side of Altuda soils within the Pinery, Choza and Altuda soils, 5 to 60 percent slopes map unit. Wilderness Ridge can be seen in the background. Altuda soils are in the Limestone Hills ecological site in MLRA 70D—Southern Desert Foothills.

R070DY749TX—Sandstone Hill

This rangeland ecological site occurs on sandstone hills and ridges located primarily around Guadalupe Canyon. (fig. 39) Slopes range from 10 to 60 percent. Soils are coarse loamy, shallow, and gravelly. The reference plant community is mixed prairie grassland with scattered shrubs, trees, and forbs. Common plants include sideoats grama, Warnock's grama, black grama, New Mexico feathergrass, saddlebush, sotol, New Mexico agave, curlyleaf muhly, mountain mahogany, skeletonleaf goldeneye, yucca, winterfat, mariola, and redberry juniper. This site is correlated to the Bonespring soil component in map unit BSG.

Figure 39.—Saddlebush, mountain mahogany, skeletonleaf goldeneye, sotol, New Mexico Agave, New Mexico feathergrass, Warnock's grama, and curlyleaf muhly growing within the Bonespring-Rock outcrop complex, 10 to 60 percent slopes map unit. The Bonespring soils are in the Sandstone Hill Ecological Site, MLRA 70D—Southern Desert Foothills.

R070DY152NM—Shallow

This rangeland ecological site occurs on gravelly alluvial fans of higher limestone mountains. (fig. 40) This site is mapped mostly on the alluvial fans derived from Frijole Ridge. Slopes range from 5 to 20 percent. Soils are loamy, gravelly, and very shallow to a petrocalcic horizon also known as a root restricting layer. The reference plant community is mixed prairie grassland with scattered shrubs, trees, and forbs. This site is similar to R070DY156NM Gravelly, but herbaceous plant production is less and curlyleaf muhly dominates the site. Other associated plants include hairy grama, black grama, skunkbush sumac, sotol, pricklypear, redberry juniper, wavyleaf oaks, and pinyon pine. This site is correlated to the Choza soil component in map unit PCG.

Figure 40.—Curlyleaf muhly, sotol, wavyleaf oak, redberry juniper, and pricklypear occurring on an area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky. Pictured is the Choza soil component which is in the Shallow Ecological Site, MLRA 70D—Southern Desert Foothills.

Recreation

The soils of the survey area are rated in Table 15 and Table 16 according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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

The information in Table 15 and Table 16 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Paths and trails for foot traffic and equestrian trails should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Mountain biking and off-road vehicle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a seasonal high water table, ponding, flooding, and texture of the surface layer.

Wildlife

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

Historically, the kinds and numbers of wildlife have changed considerably since the settlement by European man. Prior to early settlements, the grasslands and mountains of Guadalupe Mountains National Park supported elk, pronghorn antelope, bighorn sheep, mule deer, white-tailed deer, gray wolf, black bear, and mountain lion plus hundreds of species of smaller animals.

Guadalupe Mountains National Park supports an abundance of wildlife. The basic habitat needs of any wildlife population are food, cover, water and space in the right combination and arrangement. Each species of animal has its own unique requirements for these habitat elements. In order for wildlife to inhabit an area, the land must either naturally provide the habitat needs, or it must be managed by man so that specific habitat needs are met.

Soils have a great influence on the kinds and amounts of plants that are available for wildlife food and cover. The soils in the survey area are grouped into ecological sites according to the kinds, amounts and proportions of plants which the soils and climate can support as shown in Table 10. Ecological sites vary in their ability to meet habitat needs, and can be managed to either harm or benefit wildlife. Soils and geology influence the distribution of surface water used by wildlife. The past and present management of the land also influences wildlife habitat. Therefore, a good understanding of soils, ecological sites, and their response to management is important to proper wildlife habitat management. For detailed information on ecological sites, refer to the Ecological Site Descriptions for Guadalupe Mountains National Park section of this soil survey.

Wildlife is a valuable part of the natural resources in the survey area. Wildlife has aesthetic value, enriching the lives of people who enjoy seeing them. They have ecological value, with each species playing a role in the complex balance of nature. Some species may have scientific value that is not yet recognized. Some kinds of wildlife also have a legitimate economic value which encourages proper habitat management. The conservation of wildlife as well as the soil, water, and plant resources is an important part of man's stewardship of the land.

The Guadalupe Mountains rise sharply from the surrounding desert floor to form an island of outstanding diversity. Several different ecosystems, or life zones, are found within the park. These include the harsh Chihuahuan desert community, lush streamside woodlands of oaks and maples, rocky canyons, and mountaintop forests of ponderosa pine and Douglas fir. Together, these ecosystems provide habitat for 60 species of mammals, 289 species of birds, and 55 species of reptiles.

At first glance, the desert may seem barren and nearly devoid of life. A closer look however, will reveal that it actually supports an amazing diversity of wildlife. Desert animals are often difficult to view since many of them are nocturnal. Many desert animals adapt to the hot, dry environment by coming out after dark, when temperatures are much cooler and conditions are not quite so dry. Nocturnal desert animals include the kit fox, coyote, mountain lion, bobcat, badger, Texas banded gecko, and about 16 species of bats. Mule deer, javelinas, and black-tailed jackrabbits are seen early in the morning or late in the evening when temperatures are cooler.

Desert reptiles include the western diamondback rattlesnake, bullsnake, coachwhip snake, prairie lizard, collared lizard, crevice spiny lizard, and the Chihuahuan spotted whiptail. Almost all of the lizards found in the park can be seen during the day. Scorpions and desert centipedes are nocturnal hunters that search the night for insects, spiders, and small lizards. In the fall, tarantulas can often be seen looking for mates. The rest of the year, tarantulas rarely leave the shelter of their burrows.

One of the most unique and unexpected ecosystems in the Guadalupe Mountains is the riparian or streamside woodland. Riparian woodlands occur in places where there is water. Mule deer are one of the most common animals seen in the riparian areas. Nocturnal mammals such as skunks and raccoons can also be found here. Long-ear sunfish can be seen in some of the springs in the park, as well as in McKittrick Canyon. The stream through McKittrick Canyon is also home to a small population of rainbow trout. Although amphibians are rare in the desert, the Rio Grande leopard frog can occasionally be encountered near spring-fed pools in McKittrick Canyon, or at Manzanita and Smith Springs.

Rocky canyons are home to ringtails, rock squirrels, and a variety of reptiles including rock and black-tailed rattlesnakes, mountain patchnose snakes, and tree lizards.

On the mountaintops, over 914 m above the desert, one can find extensive pine forests. It is usually at least ten degrees cooler on the mountaintops than at the lower elevations. Mountaintop forests are home to animals such as elk, black bear, gray foxes, striped and hog-nosed skunks, porcupine, mule deer, mountain lions, and mountain short-horned lizards. For more information on the animals in the park, visit the website at http://www.nps.gov/gumo/naturescience/animals.htm

Wildlife Habitat

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

Table 17, Table 18, and Table 19 show the degree and kind of soil limitations that affect various kinds of habitat for wildlife. The tables show limitations of the soils for upland native herbaceous plants; upland desertic shrubs and trees; upland shrubs and vines; upland deciduous trees; upland coniferous trees; riparian herbaceous plants; and riparian shrubs, vines, and trees, This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting areas for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the element or kind of habitat. *Not limited* indicates that the soil has features that are very favorable for the element or kind of habitat. Good performance and very low maintenance can be expected. *Slightly limited* indicates that the soil has features that are favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified

use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Creating, improving, or maintaining habitat is impractical or impossible.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Ratings for *upland native herbaceous* plants indicate the limitation of the soils as a growing medium for a diverse upland herbaceous plant community. This community is adapted to soils that are drier than the common soils in moist riparian and wetland zones but that are not as dry as the soils in upland desert areas. The soil properties and features that affect the ability of these species to thrive include soil texture, available water capacity, the presence of excess salts in the soil, soil moisture and temperature regimes, depth to a high water table, and rock fragments on the soil surface. Examples of upland native herbaceous plants are gyp coldenia, black grama, slim tridens, dropseeds, black grama, sideoats grama, alkali sacaton, fourwing saltbush, soaptree yucca, blue grama, sideoats grama, curlyleaf muhly, pine muhly, New Mexico feathergrass, and finestem needlegrass

Ratings for *upland desertic shrubs and trees* provide guidelines for determining soil quality as a medium for growing a diverse upland herbaceous plant community which is adapted to soil conditions in an arid or semiarid environment that is drier than that common to moist riparian and wetland zones and subhumid, humid, or tropical areas. Soil properties and features that affect the ability of these species to thrive include: soil texture, available water capacity, depth to high water table, the presence of excess salts in the soil, soil reaction (pH), soil moisture and temperature regimes, and the presence of rock fragments at the soil surface. Examples of upland desertic shrubs and trees are creosote bush, lechuguilla, ocotillo, whitethorn acacia, and western honey mesquite

Ratings for *upland shrubs and vines* indicate the limitation of the soils as a growing medium for a diverse upland shrub and vine community. This community is adapted to soils that are drier than those common in the moist riparian and wetland zones but that are not as dry as those in upland desert areas. The soil properties and features that affect the ability of these species to thrive include soil texture, content of organic matter, available water capacity, depth to bedrock or a cemented pan, the presence of excess salts in the soil, soil moisture and temperature regimes, depth to a high water table, and rock fragments on the soil surface. Examples of upland shrubs and vines are fragrant sumac, redberry juniper, oaks, oneseed juniper, pinyon pine, wavyleaf oak, cholla, Gambel oak, Knowlton hophornbeam, Mescalero currant, and Utah serviceberry

Ratings for *upland deciduous trees* provide guidelines for determining soil quality as a medium for growing a diverse upland deciduous tree community that meet specific local habitat requirements for targeted and non-targeted species of wildlife. Typically, deciduous trees require better soil conditions than geographically related conifers. The soil properties and features that affect the ability of these species to thrive include available water capacity, depth to high water table, depth to bedrock or pan, and soil moisture and temperature regime. Examples of upland deciduous trees are bigtooth maple, velvet ash, and madrone

Ratings for *upland coniferous trees* provide guidelines for determining soil quality as a medium for growing a diverse upland coniferous tree community that meet specific local habitat requirements for targeted and non-targeted species of wildlife. Typically, coniferous trees can subsist in harsher soil conditions than geographically related hardwoods and the soil properties and features that affect the ability of these species to thrive include available water capacity, depth to high water table, depth to bedrock or

pan, and soil moisture and temperature regime. Examples of upland coniferous trees are Douglas fir, ponderosa pine, and southwestern white pine

Ratings for *riparian herbaceous plants* indicate the limitation of the soils as a growing medium for herbaceous plants that are adapted to soil conditions that are wetter than those common in the drier upland areas. The soils suitable for this habitat generally are on flood plains, in depressions, on bottomland, in drainageways adjacent to streams, or in any other area where the soil either is saturated for some period during the year or is subject to periodic overflow from ponding or flooding. The soil properties and features that affect the ability of riparian herbaceous plants to persist include soil texture, content of organic matter, depth to a high water table, the frequency and duration of ponding and flooding, the presence of excess salts in the soil, rock fragments, and the soil temperature regime. Examples of riparian herbaceous plants are pine muhly, bull muhly, little bluestem, yellow Indiangrass, big bluestem, and pinyon ricegrass

Ratings for *riparian shrubs, vines, and trees* indicate the limitation of the soils as a growing medium for shrubs, vines, and trees that are adapted to soil conditions that are wetter than those common in the drier upland areas. The soils suitable for this habitat generally are on flood plains, in depressions, on bottomland, in drainageways adjacent to streams, in areas of springs and seeps, or in any other area where the soil is either saturated for some period during the year or is subject to periodic overflow from ponding or flooding. The soil properties and features that affect the ability of riparian shrubs, vines, and trees to persist include available water capacity, depth to a high water table, the frequency and duration of ponding and flooding, the presence of excess salts in the soil, and the soil temperature regime. Examples of riparian shrubs, vines, and trees are bigtooth maple, velvet ash, madrone, alligator juniper, rocky mountain juniper, ponderosa pine, hoptree, apache plume, and catclaw mimosa.

Hydric Soils

In this section, hydric soils are defined and described and the hydric soils in the survey area, if present, are listed.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 1995). These criteria are used to identify a phase of a soil series that normally is associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 1998) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties

are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils in this survey area are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and others, 1998).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

There are no hydric soils identified in Guadalupe Mountains National Park.

Engineering

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

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

and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 20 and Table 21 shows the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel,

crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Landscaping requires soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sanitary Facilities

Table 22 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in down slope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Construction Materials

Table 23 and Table 24 provides information about the soils as potential sources of gravel, sand, topsoil, reclamation material, and roadfill. Normal compaction, minor processing, and other standard construction practices are assumed.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In Table 23, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good, fair*, or *poor* as potential sources of sand and gravel. A rating of good or fair means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good, fair*, or *poor* as potential sources of topsoil, reclamation material, and roadfill. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

Reclamation source is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or

unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

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

The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil source is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

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

Water Management

Table 25 provides information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Pond reservoir areas (fig. 17) hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage

potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

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

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

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

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

The estimates of soil properties are shown in tables. They include engineering properties, and physical and chemical properties.

Engineering Properties

Table 26 provides the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

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

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

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

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches across is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches across and 3 to 10 inches across are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical Soil Properties

Table 27 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle-size (sand, silt, and clay) is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle-sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In the table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In the table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In Table 27, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle-size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar or 1/10 bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less

than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Permeability (*K-sat*)* refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K-sat). The estimates in the table indicate the rate of water movement, in inches per hour, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

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

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

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In Table 27, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion Properties

Erosion factors are shown in Table 28 as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of several factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Depth to the upper and lower boundaries of each layer is indicated.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 mm in size.

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

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. A description of the wind erodibility groups is available in the National Soil Survey Handbook (http://soils.usda.gov/technical/handbook/)

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Soil Properties

Table 29 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter (dS/m) or decisiemens per meter (dS/m) at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production,

the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Soil Organic Carbon

Table 30 provides estimates of soil total carbon. Soil carbon is soil organic carbon and soil inorganic carbon.

Soil organic carbon (SOC) is carbon (C) in soil that originated from a biological source, such as plants, animals, or microorganisms. SOC is found in both organic and mineral soil layers. The term “soil organic carbon” refers only to the carbon occurring in soil organic matter (SOM). Soil organic carbon makes up about one-half the weight of soil organic matter. The rest of SOM is mostly oxygen, nitrogen, and hydrogen.

Soil inorganic carbon (SIC) is carbon found in soil carbonates, usually as calcium carbonate layers in the soil or as clay-sized fractions throughout the soil. Carbonates in soils are most commonly found in areas where evaporation rates exceed precipitation as is the case in most desert environments. Usually the carbonates accumulated from carbonatic dust or from solution when wetter climates existed. Soil inorganic carbon also exists in soils forming from marl in all regions of the country.

The SOC and SIC contents are reported in kilogram per meter to a 2-meter depth or to a representative depth of either hard bedrock or a cemented horizon. The SOC and SIC values are on a whole soil basis, corrected for rock fragments. SOC and SIC are reported on a volumetric whole soil basis, corrected for representative rock fragments in the database. The soil organic carbon is converted from horizon soil organic matter content of the less than 2 mm fraction of the soil. If soil organic matter in the database is NULL, SOC is assumed to be zero. The soil inorganic carbon is converted from horizon calcium carbonate content of the less than 2mm fraction of the soil. If horizon calcium carbonate in the database is NULL, SIC is assumed to be zero. A weighted average of all horizons is used in the calculations.

SOC can be an indicator of overall soil fertility and soil quality that affects ecosystem function. SOM is also the main reservoir for most plant nutrients like phosphorus and nitrogen. Managing for SOC by managing for SOM increases these elements and increases soil resiliency.

Soil organic matter binds soil particles together, which increases soil porosity and infiltration. This allows better root penetration and water flow in to the soil. Greater inflow of water decreases soil erosion and water runoff potential.

Greater SOC levels improve not only soil quality but the quality of air and water. Soil acts as a filter and improves water quality. Fertile soils that support plant life remove carbon dioxide (CO_2) from the atmosphere and increase oxygen levels by photosynthesis. Maintaining soil organic carbon levels reduces carbon (C) release in to the atmosphere which can lessen the effects of global warming.

SIC influences the types of plants that will grow. High SIC levels are usually associated also with higher soil pH which limits the types of plants that will thrive.

Soil carbonates, the source of SIC, also binds soil particles together, but also fills voids in the soil that can reduce soil porosity. Compacted soil carbonates may restrict root penetration and water flow in to the soil.

Water Features

Table 31 provides estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 31 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 31 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

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

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible

under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

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

Soil Features

Table 32 provides estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1998 and 1999). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 33 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is *Argiustolls* (*Arg* meaning presence of an argillic horizon, plus *ustolls*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Lithic* identifies the subgroup that typifies the great group. *Lithic* means the presence of a shallow Lithic contact. An example is *Lithic Argiustolls*.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is *clayey-skeletal, mixed, superactive, mesic Lithic Argiustolls.*

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993). Many of the

technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1999) and in "Keys to Soil Taxonomy" (Soil Survey Staff, 1998). Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

Altuda Series

Classification: Loamy-skeletal, mixed, superactive, thermic Lithic Calciustolls
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderate and moderately slow
Landform: Limestone hills and mountains
Parent material: Residuum and colluvium from Permian age limestone
Slope: 5 to 65 percent
Elevation: 1,370 to 1,995 m
Mean annual precipitation: 287 to 523 mm
Mean annual air temperature: 14 to 19 degrees C
Frost-free period: 203 to 255 days

Typical Pedon

Altuda very gravelly loam in an area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, map unit PCG; on lower third of mountainflank on mountain range sloping 12 percent at 1,827 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Peak, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 52 minutes, 59.65 seconds North and Longitude 104 degrees, 50 minutes, 6.40 seconds West, NAD 83. UTM Easting: 515594 m, UTM Northing: 3527505 m, UTM Zone 13.

A—0 to 12 cm; very dark grayish brown (10YR 3/2) very gravelly loam, very dark brown (10YR 2/2), moist; weak fine and medium subangular blocky structure; friable, soft, slightly sticky, nonplastic; many very fine and fine roots; 5 percent fine platy strongly cemented carbonate masses with sharp boundaries around rock fragments; 15 percent subangular very strongly cemented 76 to 150 mm limestone fragments, and 30 percent subangular very strongly cemented 5 to 75 mm limestone fragments; EC is 0.5 dS/m; strongly effervescent; slightly alkaline; clear smooth boundary.

Bk—12 to 28 cm; pale brown (10YR 6/3) very gravelly loam, yellowish brown (10YR 5/4), moist; weak fine and medium granular structure; friable, soft, slightly sticky, nonplastic; common very fine and fine roots; 5 percent fine prominent platy moderately cemented carbonate masses with sharp boundaries around rock fragments, and 5 percent medium prominent irregular strongly cemented carbonate nodules with sharp boundaries; 15 percent subangular very strongly cemented 76 to 150 mm limestone fragments, and 40 percent subangular very strongly cemented 5 to 75 mm limestone fragments; strongly effervescent; abrupt smooth boundary.

R—28 to 53 cm; white (10YR 8/1) bedrock, very pale brown (10YR 8/3), moist; very high excavation difficulty; slightly effervescent.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Aridic ustic moisture regime
Mean annual soil temperature: 15 to 20 degrees C
Thickness of mollic epipedon: 12 to 48 cm
Depth to calcic horizon: 4 to 27 cm
Depth to lithic contact: 18 to 48 cm

Particle-size control section (weighted average):
Coarse fragments: 35 to 75 percent total
Gravel size: 5 to 40 percent
Cobble size: 10 to 40 percent
Calcium carbonate equivalent: 15 to 35 percent by weight

A horizon

Hue: 7.5YR or 10YR,
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3, dry or moist
Texture of the fine-earth fraction: Loam, silt loam
Clay content: 20 to 35 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR,
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3, dry or moist
Texture of the fine-earth fraction: Loam, silt loam
Clay content: 20 to 35 percent
Calcium carbonate: Coatings on fragments in the Bk horizon range from a few threads, spherical masses, and films to 5 mm thick pendants on the underside of coarse fragments
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated limestone and dolomite

Biduya Series

Classification: Loamy-skeletal, mixed, superactive, mesic Aridic Lithic Haplustolls
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Hills, ridges
Parent material: Loamy residuum and colluvium weathered from Permian Limestone and Dolomite bedrock
Slope: 10 to 25 percent
Elevation: 1,832 to 2,441 m
Mean annual precipitation: 330 to 381 mm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

Biduya very cobbly loam (fig. 41) in an area Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes, map unit BDG; on lower third of a hill in a mountain range sloping 15 percent at 2,012 m elevation in rangeland. Culberson County, TX; USGS PX Flat, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 58 minutes, 56 seconds North and Longitude 104 degrees, 53 minutes, 47 seconds West, NAD 83. UTM Easting: 509798, UTM Northing; 3538481, UTM Zone 13.

Figure 41.—Profile of Biduya very cobbly loam, in an area of Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes. The soil has a gravelly mollic epipedon over a lithic contact. The parent material is fractured limestone bedrock. (Scale in CM-centimeters)

A—0 to 13 cm very dark grayish brown (10YR 3/2) very cobbly loam, very dark brown (10YR 2/2), moist; weak fine and medium subangular blocky structure; friable, slightly sticky, nonplastic; common very fine and fine roots; 15 percent angular indurated 5 to 75 mm limestone fragments and 35 percent angular indurated 76 to 250 mm limestone fragments; strongly effervescent; moderately alkaline, very abrupt smooth boundary.
R—13 to 38 cm; indurated limestone bedrock.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Aridic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C
Thickness of mollic epipedon: 10 to 32 cm
Depth to lithic contact: 10 to 32 cm
Particle-size control section (weighted average):
Clay content: 15 to 29 percent
Rock fragment content: 35 to 70 percent
Gravel size: 20 to 70 percent
Cobble size: 0 to 50 percent

A horizon

Hue: 7.5YR or 10YR

Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 or 3 dry, 1 to 3 moist
Texture of the fine-earth fraction: Loam, silt loam, clay loam
Clay content: 15 to 29 percent
Coarse fragments: 20 to 70 percent
Effervescence: None to violent
Reaction: Slightly alkaline or moderately alkaline

Bw horizon (where present)

Hue: 7.5YR or 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 to 4 dry, 1 to 3 moist
Texture of the fine-earth fraction: Loam, silt loam, clay loam
Clay content: 21 to 31 percent
Coarse fragments: 5 to 50 percent
Effervescence: None to strong
Reaction: Slightly alkaline

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated limestone and dolomite

Bissett Series

Classification: Loamy-skeletal, mixed, superactive, thermic Lithic Ustic Haplocalcids
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills, mountains
Parent material: Residuum weathered from limestone
Slope: 15 to 60 percent
Elevation: 1,192 to 2,111 m
Mean annual precipitation: 254 to 381 mm
Mean annual air temperature: 15 to 19.0 degrees C
Frost-free period: 187 to 239 days

Typical Pedon

Bissett loam (fig. 42) in an area of Bissett-Rock outcrop complex, 15 to 60 percent slopes, map unit BRG; on a convex backslope on a hill sloping 28 percent at 1,454 m elevation in rangeland. Culberson County, TX; USGS Patterson Hills, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 51 minutes, 28.46 seconds North and Longitude 104 degrees, 53 minutes, 36.35 seconds West, NAD 83. UTM Easting: 510081 m, UTM Northing: 3524691 m, UTM Zone 13.

A—0 to 4 cm; brown (10YR 5/3) loam, brown (10YR 4/3), moist; moderate medium granular structure; very friable, soft, slightly sticky, slightly plastic; common fine roots throughout; EC is 0.6 dS/m; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk—4 to 34 cm; brown (10YR 4/3) very gravelly loam, brown (10YR 4/3), moist; weak medium subangular blocky structure; very friable, soft, slightly sticky, nonplastic; common very fine and fine roots; 10 percent medium distinct irregular moderately cemented carbonate masses with sharp boundaries in matrix; 40 percent nonflat subangular indurated 2 to 75 mm limestone fragments; EC is 1.4 dS/m; strongly effervescent; moderately alkaline; very abrupt smooth boundary.

R—34 to 59 cm; limestone bedrock.

Figure 42.—Profile of Bissett gravelly loam, in an area of Bissett-Rock outcrop complex, 15 to 60 percent slopes. This pedon has a calcic horizon starting at about 13 cm and a lithic contact at about 29 cm. The parent material is fractured limestone bedrock. (Scale in CM-centimeters)

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Ustic aridic moisture regime
Mean annual soil temperature: 16 to 20.0 degrees C
Thickness of ochric epipedon: 4 to 25 cm
Depth to calcic horizon: 4 to 14 cm
Depth to lithic contact: 18 to 34 cm
Particle-size control section:
- *Rock fragment content*: 35 to 60 percent
  - *Gravel size:* 10 to 60 percent
  - *Cobble size:* 0 to 50 percent

Calcium carbonate equivalent: 15 to 30 percent by volume

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Loam, clay loam
Clay content: 25 to 35 percent

Coarse fragments: 25 to 60 percent, but average greater than 35 percent
Other features: Coarse fragments have few to many coatings of calcium carbonate and pendants on lower surfaces
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 3 to 5, dry or moist
Chroma: 2 or 3, dry or moist
Texture: Loam, clay loam
Clay content: 25 to 35 percent
Coarse fragments: 25 to 60 percent, but average greater than 35 percent
Other features: Coarse fragments have few to many coatings of calcium carbonate and pendants on lower surfaces
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated limestone and dolomite

Bonespring Series

Classification: Loamy-skeletal, mixed, superactive, calcareous, thermic Aridic Lithic Ustorthents
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Hills, hillslopes, ridges
Parent material: Loamy residuum and colluvium weathered from Permian sandstone bedrock
Slope: 10 to 60 percent
Elevation: 1,346 to 2,461 m
Mean annual precipitation: 287 to 523 mm
Mean annual air temperature: 14 to 19 degrees C
Frost-free period: 203 to 255 days

Typical Pedon

Bonespring very gravelly sandy loam (fig. 43) in an area of Bonespring-Rock outcrop complex, 10 to 60 percent slopes, map unit BSG; on a hill sloping 31 percent at 1,711 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Pass, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 52 minutes, 13 seconds North and Longitude 104 degrees, 50 minutes, 41 seconds West, NAD 83. UTM Easting: 514692 m, UTM Northing: 3526072 m, UTM Zone 13.

A1—0 to 9 cm; light brown (7.5YR 6/3) very channery sandy loam, brown (7.5YR 4/3), moist; weak fine and medium granular structure; soft, friable, nonsticky, nonplastic; common very fine and fine roots; 5 percent very angular strongly cemented 76 to 250 mm sandstone fragments, and 50 percent very angular strongly cemented 5 to 75 mm sandstone fragments; violently effervescent; slightly alkaline; clear smooth boundary.
A2—9 to 28 cm; light brown (7.5YR 6/4) extremely gravelly sandy loam, brown (7.5YR 5/4), moist; weak fine granular structure; loose, loose, nonsticky, nonplastic; common very fine and fine roots; 5 percent very angular strongly

Figure 43.—Profile of Bonespring very channery sandy loam. This pedon has a lithic contact at 18 cm. The parent material is fractured sandstone bedrock. (Scale in CM-centimeters)

cemented 76 to 250 mm sandstone fragments, and 70 percent flat very angular strongly cemented 5 to 75 mm sandstone fragments; violently effervescent; moderately alkaline; clear smooth boundary.

R—28 to 53 cm; strongly cemented sandstone bedrock; common very fine and fine roots at top of horizon.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Aridic ustic moisture regime
Soil temperature: 15 to 20 degrees C
Thickness of ochric epipedon: 8 to 32 cm
Depth to lithic contact: 8 to 32 cm
Particle-size control section (weighted average):
Clay content: 11 to 21 percent
Rock fragment content: 35 to 75 percent, mostly gravel-size sandstone

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 6 dry, 3 to 5 moist
Chroma: 2 to 4 dry, 1 to 6 moist

Texture of the fine-earth fraction: Sandy loam, fine sandy loam, very fine sandy loam, or loam
Clay content: 11 to 21 percent
Effervescence: Very slight to violent
Reaction: Slightly alkaline or moderately alkaline

B horizon (where present)

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 4 to 5 moist
Chroma: 4 to 6 dry or moist
Texture of the fine-earth fraction: Sandy loam, fine sandy loam, or loam
Clay content: 13 to 21 percent
Effervescence: Very slight to violent
Reaction: Slightly alkaline or moderately alkaline

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated sandstone

Chilicotal Series

Classification: Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Piedmont slopes below hills and mountains
Parent material: Alluvium derived from limestone and dolomite
Slope: 3 to 13 percent
Elevation: 1,142 to 1,724 m
Mean annual precipitation: 254 to 381 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 187 to 239 days

Typical Pedon

Chilicotal gravelly loam in an area of Chilicotal-Chispa complex, 3 to 13 percent slopes, map unit CCD; on a linear side slope on a fan sloping 10 percent at 1,409 m elevation in rangeland. Culberson County, TX; USGS Patterson Hills, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 51 minutes, 17.04 seconds North and Longitude 104 degrees, 52 minutes, 47.48 seconds West, NAD 83. UTM Easting: 511366 m, UTM Northing: 3524340 m, UTM Zone 13.

A—0 to 21 cm; light yellowish brown (10YR 6/4) gravelly loam, yellowish brown (10YR 5/4), moist; weak fine and medium granular structure; very friable, soft, slightly sticky, nonplastic; common fine and medium roots; 15 percent subrounded 5 to 76 mm limestone fragments; EC is 0.4 dS/m; violently effervescent; slightly alkaline; clear smooth boundary.
Bk1—21 to 39 cm; pale brown (10YR 6/3) very cobbly loam, light yellowish brown (10YR 6/4), moist; weak fine subangular blocky structure; very friable, soft, slightly sticky, nonplastic; common fine and medium roots; finely disseminated carbonate, and 5 percent medium carbonate nodules around rock fragments; 25 percent subrounded 5 to 76 mm limestone fragments, and 30 percent subrounded 76 to 250 mm limestone fragments; EC is 0.3 dS/m; violently effervescent; moderately alkaline; abrupt smooth boundary.
Bk2—39 to 55 cm; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3), moist; weak fine subangular blocky structure; very friable, soft, slightly sticky,

nonplastic; common fine roots; finely disseminated carbonates, 3 percent medium carbonate masses, 5 percent medium carbonate nodules around rock fragments, and 5 percent coarse carbonate nodules; 20 percent subrounded 5 to 76 mm limestone fragments, and 20 percent subrounded 76 to 250 mm limestone fragments; EC is 0.9 dS/m; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bk3—55 to 157 cm; very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3), moist; weak fine granular structure; very friable, soft, slightly sticky, nonplastic; common fine and medium, and common coarse roots; finely disseminated carbonates, 5 percent medium carbonate nodules around rock fragments, 20 percent medium carbonate masses, and 5 percent coarse carbonate nodules throughout; 33 percent subrounded 5 to 76 mm limestone fragments; EC is 1.8 dS/m; violently effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Ustic aridic moisture regime
Soil temperature: 16 to 20 degrees C
Thickness of ochric epipedon: 6 to 28 cm
Depth to calcic horizon: 6 to 48 cm
Solum thickness: Greater than 203 cm
Particle-size control section (weighted average):
Clay content: 15 to 27 percent
Rock fragment content: 35 to 70 percent
Gravel size: 10 to 55 percent
Cobble size: 0 to 55 percent
Calcium carbonate equivalent: 15 to 40 percent

A horizon

Hue: 10YR
Value: 4 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Calcium carbonate equivalent: 10 to 30 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bw horizon (where present)

Hue: 10YR
Value: 4 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Calcium carbonate equivalent: 10 to 30 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bk horizon

Hue: 10YR
Value: 4 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Calcium carbonate equivalent: 15 to 40 percent
Other features: Below 102 cm, most pedons have underlying layers of varying thickness, fine-earth textures, and size and content of coarse fragments
Effervescence: Strong or violent
Reaction: Moderately alkaline

Chispa Series

Classification: Fine-loamy, mixed, superactive, thermic Ustic Haplocalcids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Ridges and fans on broad plains and valleys
Parent material: Alluvium derived from limestone and dolomite
Slope: 3 to 13 percent
Elevation: 1,142 to 1,724 m
Mean annual precipitation: 254 to 381 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 187 to 239 days

Typical Pedon

Chispa fine sandy loam in an area of Chilicotal-Chispa complex, 3 to 13 percent slopes, map unit CCD; on a linear backslope on a fan sloping 5 percent at 1,256 m elevation in rangeland. Hudspeth County, TX; USGS P X Flat, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 52 minutes, 33.97 seconds North and Longitude 104 degrees, 55 minutes, 26.66 seconds West, NAD 83. UTM Easting: 507181 m, UTM Northing: 3526705 m, UTM Zone 13.

A—0 to 8 cm; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4), moist; weak fine granular structure; 2 percent nonflat subrounded indurated 2 to 75 mm limestone fragments; EC is 0.3 dS/m; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bk1—8 to 19 cm; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4), moist; weak fine granular structure; 2 percent nonflat subrounded indurated 2 to 75 mm limestone fragments; EC is 0.3 dS/m; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—19 to 48 cm; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4), moist; weak fine granular structure; 2 percent carbonate, finely disseminated; 4 percent nonflat subrounded indurated 2 to 75 mm sandstone fragments, and 5 percent nonflat subrounded indurated 2 to 75 mm limestone fragments; EC is 0.9 dS/m; violently effervescent; moderately alkaline; clear smooth boundary.

Bk3—48 to 157 cm; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4), moist; weak fine granular structure; 3 percent carbonate, finely disseminated; 6 percent nonflat subrounded indurated 2 to 75 mm limestone fragments, and 7 percent nonflat subrounded indurated 2 to 75 mm sandstone fragments; EC is 2.0 dS/m; violently effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Ustic aridic moisture regime
Mean annual soil temperature: 15.5 to 20 degrees C
Thickness of ochric epipedon: 7 to 22 cm
Depth to calcic horizon: 8 to 46 cm
Solum thickness: 150 cm to more than 203 cm
Particle-size control section (weighted average):
Clay content: 18 to 25 percent
Rock fragment content: 0 to 20 percent
Calcium carbonate equivalent: 10 to 20 percent

A horizon

Hue: 7.5YR or 10YR
Value: 4 to 6, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Loam, fine sandy loam
Effervescence: Strong or violent
Reaction: Moderately alkaline

Bk horizon

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 3 to 6, dry or moist
Texture: Loam, fine sandy loam
Carbonates: Below 25 cm, the volume of weakly cemented masses of calcium carbonate ranges from 5 to 30 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline

Choza Series

Classification: Loamy-skeletal, mixed, superactive, thermic, shallow Petrocalcic Calciustolls
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Piedmont slopes, alluvial fans
Parent material: Fan alluvium from limestone sources
Slope: 5 to 20 percent
Elevation: 1,370 to 1,995 m
Mean annual precipitation: 287 to 523 mm
Mean annual air temperature: 14 to 19 degrees C
Frost-free period: 203 to 255 days

Typical Pedon

Choza very gravelly loam (fig. 44) in an area of Pinery, Choza, and Altuda soils, 5 to 20 percent slopes, map unit PCG; on a convex alluvial fan remnant sloping 5 percent at 1,678 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Peak, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 54 minutes, 31 seconds North and Longitude 104 degrees, 47 minutes, 57 seconds West, NAD 83. UTM Easting: 518989, UTM Northing; 3530309, UTM Zone 13.

A1—0 to 15 cm; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2), moist; moderate fine and medium granular structure; soft, friable, slightly sticky, moderately plastic; 5 percent subrounded 76 to 250 mm limestone fragments, and 30 percent subrounded 5 to 75 mm limestone fragments; strongly effervescent; moderately alkaline, clear smooth boundary.
A2—15 to 26 cm; brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3), moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, moderately plastic; 5 percent subrounded 76 to 250 mm limestone fragments, and 30 percent subrounded 5 to 75 mm limestone fragments; strongly effervescent; moderately alkaline, very abrupt smooth boundary.

Figure 44.—Profile of Choza very gravelly loam, in an area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes. This soil has a thin very gravelly mollic epipedon over a petrocalcic horizon. The parent material is fan alluvium from the mountains. (Scale in CM-centimeters)

Bkm—26 to 51 cm; very pale brown (10YR 8/2) cemented material, very pale brown (10YR 8/2), moist; 1 mm thick prominent irregular indurated cemented carbonate laminae on top of horizon.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Aridic ustic moisture regime
Mean annual soil temperature: 15 to 20 degrees C
Thickness of mollic epipedon: 13 to 38 cm
Depth to petrocalcic horizon: 13 to 38 cm
Particle-size control section (weighted average):
Clay content: 12 to 32 percent
Rock fragment content: 35 to 70 percent limestone

A horizon

Hue: 7.5YR or 10YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 2 or 3 dry, 1 to 3 moist
Texture of the fine-earth fraction: Fine sandy loam, loam, sandy clay loam
Clay content: 12 to 32 percent
Coarse fragments: 35 to 65 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon (where present)

Hue: 7.5YR or 10YR
Value: 4 to 8 dry, 3 to 7 moist
Chroma: 2 to 4 dry or moist
Texture of the fine-earth fraction: Loam, sandy clay loam
Clay content: 20 to 25 percent
Coarse fragments: 35 to 45 percent
Effervescence: Strong or violent
Reaction: Moderately alkaline or strongly alkaline

Bkm horizon

Hue: 7.5YR or 10YR
Value: 7 or 8 dry or moist
Chroma: 2 or 3 dry or moist
Texture of the fine-earth fraction: Cemented material
Clay content: 20 to 25 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Copia Series

Classification: Mixed, thermic Typic Torripsamments
Depth class: Very deep
Drainage class: Excessively drained
Permeability: Moderately rapid
Landform: Dunes and shrub-coppice dunes
Parent material: Eolian sands
Slope: 2 to 7 percent
Elevation: 1,108 to 1,181 m
Mean annual precipitation: 150 to 319 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 180 to 214 days

Typical Pedon

Copia loamy fine sand in an area of Copia loamy fine sand, 2 to 7 percent slopes, map unit COC; on convex dune in a dune field sloping 4 percent at 1,118 m elevation in rangeland. Hudspeth County, TX; USGS PX Flat, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 56 minutes, 17.91 seconds North and Longitude 104 degrees, 58 minutes, 43.03 seconds West, NAD 83. UTM Easting: 502021 m, UTM Northing: 3533598 m, UTM Zone 13.

A—0 to 4 cm; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4), moist; weak fine granular structure; very friable, soft, nonsticky,

nonplastic; EC is 0.3 dS/m; slightly effervescent; moderately alkaline; abrupt smooth boundary.
C1—4 to 50 cm; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4), moist; structureless; loose, loose, nonsticky, nonplastic; EC is 0.1 dS/m; slightly effervescent; strongly alkaline; gradual smooth boundary.
C2—50 to 203 cm; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4), moist; structureless; loose, loose, nonsticky, nonplastic; EC is 0.1 dS/m; slightly effervescent; strongly alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic aridic soil moisture regime
Texture: Dominantly fine sand or loamy fine sand throughout. Thin horizons of loamy sand may be present in some pedons, but texture in the particle-size control section averages fine sand or loamy fine sand with less than 11 percent silt plus clay.

A horizon

Hue: 7.5YR
Value: 6 or 7, dry or moist
Chroma: 4 to 6, dry or moist
Effervescence: None to slight
Reaction: Moderately alkaline

C horizon

Hue: 7.5YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 6 or 8, dry or moist
Effervescence: Slight or strong
Reaction: Strongly alkaline

Corvus Series

Classification: Loamy, hypergypsic, thermic, shallow Typic Petrogypsids
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Relict gypsum dunes and fan piedmonts
Parent material: Eolian sands derived from gypsum
Slope: 1 to 5 percent
Elevation: 1,104 to 1,123 m
Mean annual precipitation: 150 to 319 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 180 to 214 days

Typical Pedon

Corvus gypsiferous very fine sandy loam in an area of Corvus-Peligro complex, 1 to 5 percent slopes, map unit CPB; on a relict dune on a basin floor sloping 1 percent at 1,107 m elevation in rangeland. Hudspeth County, TX; USGS P X Flat, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 52 minutes, 40.87 seconds North and Longitude 104 degrees, 59 minutes, 50.09 seconds West, NAD 83. UTM Easting: 500260 m, UTM Northing: 3526915 m, UTM Zone 13.

Ay—0 to 6 cm; light yellowish brown (10YR 6/4) gypsiferous very fine sandy loam, dark yellowish brown (10YR 4/4), moist; weak fine granular structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots; EC is 2.1 dS/m; slightly effervescent; slightly alkaline; very abrupt smooth boundary.

By1—6 to 41 cm; light gray (10YR 7/2) gypsiferous fine sandy loam, pale brown (10YR 6/3), moist; weak fine and medium subangular blocky structure; friable, soft, nonsticky, nonplastic; common very fine and fine roots; 3 percent medium distinct irregular gypsum crystals; EC is 2.3 dS/m; slightly effervescent; moderately alkaline; clear smooth boundary.

By2—41 to 49 cm; light gray (10YR 7/1) gypsiferous loamy fine sand, pale brown (10YR 6/3), moist; weak fine and medium subangular blocky structure; very firm, hard, extremely weakly cemented, nonsticky, nonplastic; low excavation difficulty; 15 percent medium distinct irregular gypsum crystals; EC is 5.7 dS/m; strongly effervescent; strongly alkaline; abrupt smooth boundary.

Bym—49 to 74 cm; white (10YR 8/1) gypsiferous material, yellow (10YR 8/8), moist; weak fine and medium platy structure; very rigid, extremely hard, very strongly cemented, nonsticky, nonplastic; extremely high excavation difficulty; common very fine and fine roots top of horizon; EC is 5.8 dS/m; strongly effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic aridic soil moisture regime
Mean annual soil temperature: 15.5 to 20.0 degrees C
Thickness of ochric epipedon: 5 to 13 cm
Depth to gypsic horizon: 5 to 22 cm
Depth to petrogypsic horizon: 13 to 49 cm
Particle-size control section (weighted average):
- *Clay content:* 8 to 15 percent
- *Gypsum content*: 60 to 95 percent

Electrical conductivity: 2 to 6 dS/m
SAR: 0 to 5

Ay horizon

Hue: 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 1 to 4, dry or moist
Texture: Gypsiferous very fine sandy loam, gypsiferous sandy loam, gypsiferous fine sandy loam
Gypsum: 60 to 90 percent
EC: 2 to 3 dS/m
SAR: 0 to 4

By horizon

Hue: 10YR
Value: 6 to 8 dry, 5 to 8 moist
Chroma: 1 to 4, dry or moist
Texture: Gypsiferous very fine sandy loam, gypsiferous sandy loam, gypsiferous fine sandy loam
Gypsum: 60 to 95 percent
EC: 2 to 6 dS/m
SAR: 0 to 5

Bym horizon

Hue: 10YR
Value: 6 to 8 dry, 5 to 8 moist
Chroma: 1 to 4, dry or moist
Gypsum: 80 to 95 percent
EC: 2 to 6 dS/m
SAR: 0 to 5

Cy horizon (where present)

Hue: 10YR
Value: 6 to 8 dry, 5 to 8 moist
Chroma: 1 to 4, dry or moist
Texture: Gypsiferous very fine sandy loam, gypsiferous sandy loam, gypsiferous fine sandy loam
Gypsum: 60 to 95 percent
EC: 2 to 6 dS/m
SAR: 0 to 5

Desario Series

Classification: Loamy-skeletal, mixed, superactive, mesic Lithic Calciustolls
Depth class: Shallow
Drainage class: Well drained
Permeability: Moderately slow
Landform: Hills, ridges, mesas, plateaus
Parent material: Residuum weathered from limestone
Slope: 20 to 50 percent
Elevation: 1,832 to 2,441 m
Mean annual precipitation: 330 to 381 mm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

Desario gravelly loam (fig. 45) in an area of Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes, map unit BDG; on a hill in a mountain range sloping 16 percent at 1,989 m elevation in rangeland. Culberson County, TX; USGS P X Flat, Texas, 7.5 minute topographic quadrangle; Latitude 31 degrees, 58 minutes, 43.53 seconds North and Longitude 104 degrees, 53 minutes, 17.70 seconds West, NAD 83. UTM Easting: 510558 m, UTM Northing: 3538087 m, UTM Zone 13.

A—0 to 12 cm; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2), moist; moderate fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; common very fine and fine roots; 20 percent subangular moderately cemented 5 to 75 mm limestone fragments; violently effervescent; clear smooth boundary.

Bk—12 to 31 cm; brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3), moist; moderate fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; common very fine and fine roots; 5 percent medium strongly cemented carbonate nodules around rock fragments, and 5 percent medium spherical strongly cemented carbonate nodules throughout; 10 percent subangular strongly cemented 76 to 250 mm limestone fragments, and 30 percent subangular moderately cemented 5 to 75 mm limestone fragments; violently effervescent; clear smooth boundary.

Figure 45.—Profile of Desario gravelly loam, in an area of Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes. The soil has a gravelly mollic epipedon over a very gravelly calcic horizon over a lithic contact. The parent material is fractured limestone bedrock. (Scale in CM-centimeters)

R—31 to 56 cm; indurated limestone bedrock, fractured at intervals of 100 cm to less than 200 cm; extremely high excavation difficulty.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C
Thickness of mollic epipedon: 10 to 31 cm
Depth to calcic horizon: 10 to 31 cm
Depth to lithic contact: 29 to 50 cm
Particle-size control section (weighted average):
Clay content: 18 to 27 percent
Rock fragment content: 35 to 85 percent

A horizon

Hue: 7.5YR, or 10YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 2 or 3, dry or moist
Texture: Loam
Rock fragments: 20 to 35 percent
Effervescence: Slight to strong
Reaction: Slightly alkaline to strongly alkaline

Bk horizon

Hue: 7.5YR, or 10YR
Value: 4 to 7 dry, 3 to 6 moist
Chroma: 2 to 4, dry or moist
Texture: Loam or sandy loam
Rock fragments: 35 to 55 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline to strongly alkaline

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated limestone or sandstone

Lark Series

Classification: Gypsic, thermic Typic Torripsamments
Depth class: Very deep
Drainage class Excessively drained
Permeability: Very rapid
Landform: Vegetated dunes on dune fields
Parent material: Sandy gypsiferous eolian deposits
Slope: 5 to 8 percent
Elevation: 1,106 to 1,130 m
Mean annual precipitation: 150 to 319 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 180 to 214 days

Typical Pedon

Lark gypsiferous fine sand in an area of Lark-Peligro complex, 1 to 8 percent slopes, map unit LPC; on a dune sloping 5 percent at 1,110 m elevation in rangeland. Hudspeth County, TX; USGS P X Flat, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 54 minutes, 20.07 seconds North and Longitude 104 degrees, 59 minutes, 37.14 seconds West, NAD 83. UTM Easting: 500600 m, UTM Northing: 3529970 m, UTM Zone 13.

Ay—0 to 27 cm; light gray (10YR 8/2) gypsiferous fine sand, light gray (10YR 8/2), moist; single grain; EC is 2.0 dS/m; noneffervescent; moderately alkaline; clear smooth boundary.
Cy1—27 to 67 cm; white (10YR 8/1) gypsiferous fine sand, white (10YR 8/1), moist; single grain; EC is 2.1 dS/m; noneffervescent; moderately alkaline; diffuse irregular boundary.
Cy2—67 to 203 cm; white (10YR 8/1) gypsiferous fine sand, white (10YR 8/1), moist; single grain; EC is 2.1 dS/m; noneffervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic aridic soil moisture regime
Mean annual soil temperature: 16.0 to 20.0 degrees C
Particle-size control section (weighted average):
Clay content: 0 to 2 percent
Gypsum content: 60 to 100 percent

Ay horizon

Hue: 10YR or 2.5Y
Value: 8 dry, 7 to 8 moist
Chroma: 1 to 4, dry or moist
Texture: Gypsiferous sand, gypsiferous fine sand, gypsiferous coarse sand
Clay content: 0 to 2 percent
Calcium carbonate equivalent: 0 percent
Gypsum content: 60 to 100 percent
Salinity: Very slight to moderate
Reaction: Moderately alkaline

Cy horizon

Hue: 10YR or 2.5Y
Value: 8 or 9 dry, 7 to 8.5 moist
Chroma: 1 to 4, dry or moist
Texture: Gypsiferous sand, gypsiferous fine sand, gypsiferous coarse sand
Clay content: 0 to 2 percent
Calcium carbonate equivalent: 0 percent
Gypsum content: 60 to 100 percent
Salinity: Very slight to moderate
Reaction: Slightly alkaline or moderately alkaline

Lazarus Series

Classification: Fine-silty, mixed, superactive, mesic Pachic Argiustolls
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Canyons, terraces, drainageways
Parent material: Alluvium from limestone sources
Slope: 2 to 9 percent
Elevation: 1,834 to 2,104 m
Mean annual precipitation: 508 to 660 mm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

Lazarus loam (fig. 46) in an area of Lazarus loam, 2 to 9 percent slopes, map unit LAD; in a canyon sloping 3 percent at 1,928 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Peak, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 58 minutes, 48 seconds North and Longitude 104 degrees, 52 minutes, 09 seconds West, NAD 83. UTM Easting: 512360, UTM Northing: 3538225, UTM Zone 13.

Figure 46.—Profile of Lazarus loam, 1 to 8 percent slopes. This soil has a thick loam mollic epipedon and a clay loam argillic horizon. The parent material is alluvium from the surrounding hills and mountains. (Scale in CM-centimeters)

A—0 to 19 cm; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2), moist; moderate fine and medium granular structure; soft, friable, slightly sticky, slightly plastic; common very fine and fine roots; neutral, clear smooth boundary.

Bt1—19 to 38 cm; dark brown (7.5YR 3/2) clay loam, very dark brown (7.5YR 2.5/2), moist; moderate fine and medium subangular blocky structure; slightly hard,

friable, moderately sticky, slightly plastic; common very fine and fine roots; 10 percent distinct clay films on all ped faces; neutral, clear smooth boundary.

Bt2—38 to 62 cm; dark brown (7.5YR 3/2) clay loam, very dark brown (7.5YR 2.5/2), moist; strong fine and medium subangular blocky structure; slightly hard, firm, moderately sticky, moderately plastic; common very fine and fine roots; 20 percent distinct clay films on all ped faces; slightly acid, gradual smooth boundary.

Bt3—62 to 109 cm; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/4), moist; strong fine and medium subangular blocky structure; slightly hard, firm, moderately sticky, slightly plastic; common very fine and fine roots; 10 percent distinct clay films on all ped faces; slightly acid, clear smooth boundary.

Bt4—109 to 203 cm; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/4), moist; weak fine and medium subangular blocky structure; soft, friable, slightly sticky, nonplastic; 5 percent distinct clay films on all ped faces; slightly acid.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C
Thickness of mollic epipedon: 52 to 150 cm
Depth to argillic horizon: 10 to 27 cm
Particle-size control section (weighted average):
Clay content: 20 to 34 percent
Rock fragment content: 0 to 20 percent limestone

A horizon

Hue: 7.5YR or 10YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 1 to 3 dry and moist
Texture of the fine-earth fraction: Fine sandy loam, loam, silt loam, sandy clay loam, silty clay loam
Clay content: 14 to 34 percent
Coarse fragments: 10 to 45 percent
Effervescence: None to strong
Reaction: Neutral to slightly alkaline

Bt horizon

Hue: 7.5YR or 10YR
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 2 to 4 dry, 1 to 4 moist
Texture of the fine-earth fraction: Loam, silt loam, sandy clay loam, silty clay loam, clay loam
Clay content: 16 to 34 percent
Coarse fragments: 35 to 50 percent
Effervescence: None to strong
Reaction: Slightly acid to slightly alkaline

Bk horizon (where present)

Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 4 dry and moist
Texture of the fine-earth fraction: Fine sandy loam, loam, silt loam, sandy clay loam, silty clay loam, clay loam
Clay content: 8 to 12 percent

Coarse fragments: 35 to 80 percent
Effervescence: Very slight to violent
Reaction: Slightly alkaline

Lostpeak Series

Classification: Loamy-skeletal, mixed, superactive, mesic Aridic Lithic Haplustolls
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Mountainsides, ridges, escarpments
Parent material: Colluvium and residuum weathered from Permian age limestone and dolomite
Slope: 40 to 95 percent
Elevation: 1,426 to 2,647 m
Mean annual precipitation: 330 to 381 mm
Mean annual air temperature: 8 to 14 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

Lostpeak very gravelly clay loam (fig. 47) in an area of Lostpeak-Rock outcrop complex, 40 to 95 percent slopes, map unit LRH; on an escarpment sloping 62 percent at 1,770 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Peak, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 57 minutes, 29 seconds North and Longitude 104 degrees, 46 minutes, 16 seconds West, NAD 83. UTM Easting: 521638, UTM Northing: 3535818, UTM Zone 13.

A—0 to 19 cm; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark brown (10YR 2/2), moist; weak fine granular structure; soft, friable, slightly sticky, nonplastic; common very fine and fine roots; 3 percent subangular indurated 76 to 250 mm limestone fragments, and 40 percent subangular indurated 5 to 75 mm limestone fragments; very slightly effervescent; strongly alkaline, very abrupt smooth boundary.
R—19 to 44 cm; indurated limestone bedrock.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Aridic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C
Thickness of mollic epipedon: 11 to 35 cm
Depth to lithic contact: 11 to 46 cm
Particle-size control section (weighted average):
Clay content: 14 to 29 percent
Rock fragment content: 35 to 65 percent
Gravel size: 20 to 40 percent
Cobble size: 0 to 65 percent

A horizon

Hue: 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 or 3 dry, 2 moist
Texture of the fine-earth fraction: Loam, clay loam
Clay content: 14 to 29 percent
Coarse fragments: 35 to 65 percent

Figure 47.—Profile of the Lostpeak very gravelly clay loam, in an area of Lostpeak-Rock outcrop complex, 40 to 95 percent slopes. The soil has a very gravelly mollic epipedon over a lithic contact. The parent material is fractured limestone bedrock. (Scale in CM-centimeters)

Effervescence: Very slight to violent
Reaction: Moderately alkaline or strongly alkaline

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated limestone and dolomite

Lozen Series

Classification: Loamy-skeletal, mixed, superactive, mesic Lithic Haplustolls
Depth class: Very shallow and shallow
Drainage class: Well drained
Permeability: Moderate
Landform: Mountainsides, ridges

Parent material: Residuum and colluvium weathered from Permian Limestone and Dolomite bedrock
Slope: 10 to 95 percent
Elevation: 1,584 to 2,664 m
Mean annual precipitation: 508 to 660 mm
Mean annual air temperature: 8.0 to 14.0 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

Lozen very gravelly loam in an area of Victorio-Lozen-Rock outcrop complex, 40 to 95 percent slopes, map unit VLH; on upper third of mountain slope on mountain range sloping 50 percent at 2,658 m elevation in forestland. Culberson County; USGS Guadalupe Peak, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 55 minutes, 10.07 seconds North and Longitude 104 degrees, 50 minutes, 3.08 seconds West, NAD 83. UTM Easting: 515624 m, UTM Northing: 3531512 m, UTM Zone 13.

A1—0 to 22 cm; very dark brown (10YR 2/2) very gravelly loam, black (10YR 2/1) moist; moderate fine and medium granular structure; soft, friable, slightly sticky, slightly plastic; many very fine and fine roots; 10 percent subangular 251 to 600 mm limestone fragments and 60 percent subangular 76 to 250 mm limestone fragments; slightly alkaline; diffuse smooth boundary.
A2—22 to 43 cm; very dark brown (10YR 2/2) very cobbly loam, black (10YR 2/1), moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; 20 percent subangular 251 to 600 mm limestone fragments and 55 percent subangular 76 to 250 mm limestone fragments; slightly alkaline; very abrupt irregular boundary.
R—43 to 68 cm; indurated limestone bedrock.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C
Thickness of mollic epipedon: 11 to 45 cm
Depth to lithic contact: 11 to 45 cm
Particle-size control section (weighted average):
Clay content: 13 to 33 percent
Rock fragment content: 35 to 80 percent
Gravel size: 5 to 65 percent
Cobble size: 5 to 70 percent
Stone size: 0 to 50 percent

A horizon

Hue: 7.5YR or 10YR
Value: 2 to 4 dry, 2 or 3 moist
Chroma: 1 to 4 dry, 1 to 3 moist
Texture of the fine-earth fraction: Sandy loam, loam, silt loam, clay loam
Clay content: 12 to 33 percent
Coarse fragments: 25 to 80 percent
Effervescence: None or very slight
Reaction: Slightly alkaline

Bw horizon (where present)

Hue: 7.5YR or 10YR

Value: 3 to 5 dry, 2 to 4 moist
Chroma: 2 to 4 dry, 1 to 4 moist
Texture of the fine-earth fraction: Sandy loam, loam, sandy clay loam, clay loam
Clay content: 10 to 34 percent
Coarse fragments: 35 to 75 percent
Effervescence: None or very slight
Reaction: Slightly alkaline

R horizon

Fractures: Greater than 10 cm (4 in) apart
Bedrock kind: indurated limestone and dolomite

McKittrick Series

Classification: Loamy-skeletal, carbonatic, superactive, mesic Fluventic Haplustolls
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Canyons, drainageways
Parent material: Gravelly alluvium
Slope: 0 to 3 percent
Elevation: 1,511 to 1,960 m
Mean annual precipitation: 508 to 660 mm
Mean annual air temperature: 8.0 to 14.0 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

McKittrick gravelly sandy loam (fig. 48) in an area of McKittrick-Riverwash complex, flooded, 0 to 3 percent slopes, map unit MCB; on drainageway in a canyon sloping 2 percent at 1,560 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Peak, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 59 minutes, 10 seconds North and Longitude 104 degrees, 46 minutes, 10 seconds West, NAD 83. UTM Easting: 521785 m, UTM Northing: 3538931 m, UTM Zone 13.

A—0 to 12 cm; dark grayish brown (10YR 3/2) gravelly sandy loam, very dark gray (10YR 3/1), moist; moderate fine subangular blocky structure; friable, slightly sticky, nonplastic; many very fine and fine, and common medium and coarse roots; 10 percent subrounded very strongly cemented 76 to 250 mm limestone fragments, and 15 percent subrounded very strongly cemented 2 to 75 mm limestone fragments; strongly effervescent; neutral, clear smooth boundary.

Bw—12 to 41 cm; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2), moist; moderate fine subangular blocky structure; friable, slightly sticky, nonplastic; many very fine and fine, and common medium and coarse roots; finely disseminated carbonate; 15 percent subrounded very strongly cemented 76 to 250 mm limestone fragments, and 30 percent subrounded very strongly cemented 2 to 75 mm limestone fragments; strongly effervescent; slightly alkaline, gradual smooth boundary.

BC—41 to 157 cm; dark yellowish brown (10YR 4/4) extremely cobbly coarse sandy loam, dark yellowish brown (10YR 3/4), moist; weak fine granular structure; loose, nonsticky, nonplastic; common very fine and fine, and common medium and coarse roots; finely disseminated carbonate; 35 percent subrounded very strongly cemented 2 to 75 mm limestone fragments, and 45 percent subrounded very strongly cemented 76 to 250 mm limestone fragments; strongly effervescent; slightly alkaline.

Figure 48.—Profile of McKittrick gravelly sandy loam, in an area of McKittrick-Riverwash complex, flooded, 0 to 3 percent slopes. This soil has a thick gravelly mollic epipedon over a very gravelly subsurface horizon. The parent material is alluvium from the surrounding hills and mountains. (Scale in CM-centimeters)

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C

Thickness of mollic epipedon: 21 to 45 cm
Particle-size control section (weighted average):
Clay content: 14 to 29 percent
Rock fragment content: 35 to 80 percent limestone

A horizon

Hue: 10YR
Value: 2 or 3 dry and moist
Chroma: 2 or 3 dry, 1 to 3 moist
Texture of the fine-earth fraction: Fine sandy loam, loam, silt loam
Clay content: 10 to 27 percent
Coarse fragments: 10 to 45 percent
Effervescence: None to strong
Reaction: Neutral to slightly alkaline

Bk horizon

Hue: 10YR
Value: 2 to 5 dry and moist
Chroma: 2 or 3 dry, 2 to 4 moist
Texture of the fine-earth fraction: Fine sandy loam, loam, silt loam
Clay content: 10 to 24 percent
Coarse fragments: 35 to 50 percent
Effervescence: Slight to strong
Reaction: Slightly alkaline or moderately alkaline

BCk horizon

Hue: 10YR
Value: 2 to 5 dry and moist
Chroma: 2 to 4 dry or moist
Texture of the fine-earth fraction: Coarse sandy loam, sandy loam
Clay content: 8 to 12 percent
Coarse fragments: 35 to 80 percent
Effervescence: Strong
Reaction: Slightly alkaline or moderately alkaline

Monahans Series

Classification: Coarse-loamy, mixed, superactive, thermic Typic Calcigypsids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Upland plains
Parent material: Eolian sands
Slope: 0 to 5 percent
Elevation: 1,108 to 1,237 m
Mean annual precipitation: 150 to 319 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 180 to 214 days

Typical Pedon

Monahans fine sandy loam in an area of Monahans-Pajarito complex, 0 to 5 percent slopes, map unit MPB; on an alluvial fan on basin floor sloping 2 percent at 1,125 m elevation in rangeland. Hudspeth County, TX; USGS P X Flat, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 54 minutes, 43.88 seconds North and

Longitude 104 degrees, 58 minutes, 12.58 seconds West, NAD 83. UTM Easting: 502821 m, UTM Northing: 3530703 m, UTM Zone 13.

A—0 to 10 cm; pale brown (10YR 6/3) very fine sandy loam, yellowish brown (10YR 5/4), moist; weak fine granular structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots; EC is 0.6 dS/m; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bk—10 to 33 cm; pale brown (10YR 6/3) fine sandy loam, yellowish brown (10YR 5/4), moist; weak fine and medium granular structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots; finely disseminated carbonate; EC is 0.3 dS/m; strongly effervescent; moderately alkaline; diffuse smooth boundary.

Bky1—33 to 104 cm; very pale brown (10YR 7/3) fine sandy loam, light yellowish brown (10YR 6/4), moist; weak fine granular structure; very friable, soft, nonsticky, nonplastic; few very fine and fine roots; finely disseminated carbonate and finely disseminated gypsum; EC is 2.1 dS/m; strongly effervescent; moderately alkaline; diffuse smooth boundary.

Bky2—104 to 203 cm; light gray (10YR 7/2) fine sandy loam, light yellowish brown (10YR 6/4), moist; weak fine and medium granular structure; very friable, soft, nonsticky, nonplastic; few very fine and fine roots; finely disseminated carbonate and finely disseminated gypsum; EC is 3.5 dS/m; strongly effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic aridic moisture regime
Mean annual soil temperature: 16.0 to 20.0 degrees C
Thickness of ochric epipedon: 12 to 48 cm
Depth to gypsic horizon: 12 to 72 cm
Depth to calcic horizon: 12 to 72 cm
Solum thickness: 150 cm to more than 203 cm
Calcium carbonate plus gypsum: Averages less than 40 percent by weight
Texture: Fine sandy loam, loam
Particle-size control section (weighted average):
Silicate clay content: 7 to 18 percent

A horizon

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 2 to 4, dry or moist
Texture: Very fine sandy loam or fine sandy loam
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bk horizon or (Bw horizon, where present)

Hue: 7.5YR or 10YR
Value: 5 to 7, dry or moist
Chroma: 3 to 6, dry or moist
Texture: Very fine sandy loam or fine sandy loam
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Bky horizon

Hue: 7.5YR or 10YR
Value: 6 to 8, dry or moist

Chroma: 2 to 6, dry or moist
Texture: Very fine sandy loam, fine sandy loam, or loam
Calcium carbonate: 10 to 20 percent visible calcium carbonate in the form of fine, weakly cemented concretions and masses
Calcium carbonate equivalent: 10 to 20 percent
Gypsum: 5 to 15 percent of visible gypsum crystals
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Pajarito Series

Classification: Coarse-loamy, mixed, superactive, thermic Typic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Upland plains, bajadas, and alluvial fans
Parent material: Sandy to moderately sandy mixed sediments
Slope: 0 to 5 percent
Elevation: 1,108 to 1,237 m
Mean annual precipitation: 150 to 319 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 180 to 214 days

Typical Pedon

Pajarito very fine sandy loam in an area of Monahans-Pajarito complex, 0 to 5 percent slopes, map unit MPB; on an alluvial fan on a basin floor sloping 0 percent at 1,116 m elevation in rangeland. Culberson County, TX; USGS P X Flat, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 54 minutes, 43.33 seconds North and Longitude 104 degrees, 58 minutes, 40.98 seconds West, NAD 83. UTM Easting: 502075 m, UTM Northing: 3530686 m, UTM Zone 13.

A—0 to 28 cm; pale brown (10YR 6/3) very fine sandy loam, yellowish brown (10YR 5/4), moist; weak fine granular structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bw—28 to 98 cm; very pale brown (10YR 7/4) very fine sandy loam, light yellowish brown (10YR 6/4), moist; weak fine and medium subangular blocky structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots, and common medium roots; 2 percent fine prominent irregular carbonate masses with sharp boundaries throughout; violently effervescent; moderately alkaline; diffuse smooth boundary.
Bk—98 to 203 cm; very pale brown (10YR 7/4) very fine sandy loam, light yellowish brown (10YR 6/4), moist; weak fine subangular blocky structure; very friable, soft, nonsticky, nonplastic; few very fine and fine roots; 3 percent fine prominent irregular carbonate masses with sharp boundaries throughout; violently effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic aridic moisture regime
Mean annual soil temperature: 16.0 to 20.0 degrees C
Thickness of ochric epipedon: 10 to 28 cm
Depth to secondary carbonate: 10 to 28 cm
Solum thickness: 150 cm to more than 203 cm

A horizon

Hue: 2.5YR, 5YR, 7.5YR, or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6, dry or moist
Texture: Very fine sandy loam
Effervescence: Slight or strong
Reaction: Neutral to moderately alkaline

Bw horizon

Hue: 2.5YR, 5YR, 7.5YR, or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6, dry or moist
Texture: Very fine sandy loam
Effervescence: Slight or strong
Reaction: Neutral to moderately alkaline

Bk horizon

Hue: 2.5YR, 5YR, 7.5YR, or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 to 6, dry or moist
Texture: Very fine sandy loam
Effervescence: Slight or strong
Reaction: Neutral to moderately alkaline

Peligro Series

Classification: Coarse-gypseous, hypergypsic, thermic Leptic Haplogypsids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Relict playa dunes, interdunes on basin floors
Parent material: Eolian gypsiferous sediments
Slope: 1 to 5 percent
Elevation: 1,104 to 1,123 m
Mean annual precipitation: 150 to 319 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 180 to 214 days

Typical Pedon

Peligro very fine sandy loam in an area of Corvus-Peligro complex, 1 to 5 percent slopes, map unit CPB; on a dune field, valley floor sloping 1 percent at 1,115 m elevation in rangeland. Hudspeth County, TX; USGS Linda Lake North, Texas 7.5 minute topographic quadrangle; Latitude 31 degrees, 53 minutes, 24.90 seconds North and Longitude 105 degrees, 00 minutes, 36.37 seconds West, NAD 83. UTM Easting: 499045 m, UTM Northing: 3528271 m, UTM Zone 13.

A—0 to 5 cm; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3), moist; weak medium subangular blocky structure; 1 percent fine prominent irregular gypsum crystals with sharp boundaries; EC is 1.8 dS/m; very slightly effervescent; slightly alkaline; abrupt wavy boundary.

By1—5 to 47 cm; white (2.5Y 8/1) fine sandy loam, pale yellow (2.5Y 8/2), moist; weak fine granular structure; 22 percent fine prominent irregular gypsum crystals with sharp boundaries, and 15 percent medium prominent irregular weakly

cemented gypsum crystal clusters with sharp boundaries; EC is 2.6 dS/m; slightly effervescent; moderately alkaline; gradual smooth boundary.

By2—47 to 89 cm; white (2.5Y 8/1) very fine sandy loam, pale yellow (2.5Y 8/2), moist; weak fine granular structure; 42 percent fine prominent weakly cemented gypsum crystals, and 8 percent medium prominent irregular weakly cemented gypsum crystal clusters with clear boundaries; EC is 4.2 dS/m; slightly effervescent; moderately alkaline; clear smooth boundary.

By3—89 to 112 cm; pale yellow (2.5Y 8/3) fine sandy loam, pale yellow (2.5Y 7/3), moist; weak fine granular structure; 3 percent fine prominent irregular extremely weakly cemented reddish yellow (5YR 6/6), moist, masses of oxidized iron with sharp boundaries in matrix; 42 percent fine prominent weakly cemented gypsum crystals, and 8 percent medium prominent irregular weakly cemented gypsum crystal clusters with sharp boundaries; EC is 4.7 dS/m; strongly effervescent; moderately alkaline; clear smooth boundary.

Cy—112 to 203 cm; pale yellow (2.5Y 8/2) very fine sandy loam, light gray (2.5Y 7/2), moist; weak fine granular structure; 21 percent fine prominent irregular strongly cemented gypsum masses with sharp boundaries, and 58 percent fine prominent weakly cemented gypsum crystals; EC is 5.1 dS/m; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic aridic moisture regime
Mean annual soil temperature: 16.0 to 20.0 degrees C
Thickness of ochric epipedon: 5 to 18 cm
Depth to gypsic horizon: 5 to 18 cm
Particle-size control section (weighted average):
Clay content: 5 to 15 percent
Coarse fragment content: None

A horizon

Hue: 10YR
Value: 4 to 7 dry, 4 to 6 moist
Chroma: 3 or 4 dry or moist
Texture: Very fine sandy loam, fine sandy loam, sandy loam
Effervescence: Very slight or slight
Reaction: Slightly alkaline or moderately alkaline

By horizon

Hue: 10YR
Value: 6 to 8 dry, 5 to 8 moist
Chroma: 1 to 4, dry or moist
Texture: Loamy sand, very fine sandy loam, fine sandy loam, sandy loam
Gypsum percentage: 70 to 95 percent
Calcium carbonate equivalent: 0 to 8 percent (in the less than 2 mm fraction)
Effervescence: Slight or strong
Reaction: Slightly alkaline or moderately alkaline

Cy horizon

Hue: 10YR
Value: 7 to 8 dry, 6 to 7 moist
Chroma: 1 to 4, dry or moist
Texture: Fine sand, loamy sand, fine sandy loam
Coarse fragments: None

Gypsum percentage: 70 to 95 percent
Calcium carbonate equivalent: 0 to 8 percent (in the less than 2 mm fraction)
Effervescence: Slight to violent
Reaction: Slightly alkaline or moderately alkaline

Pinery Series

Classification: Loamy-skeletal, mixed, superactive, thermic Aridic Calciustolls
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Piedmont slopes, alluvial fans
Parent material: Fan alluvium from limestone sources
Slope: 5 to 20 percent
Elevation: 1,370 to 1,995 m
Mean annual precipitation: 287 to 523 mm
Mean annual air temperature: 14 to 19 degrees C
Frost-free period: 203 to 255 days

Typical Pedon

Pinery gravelly loam in an area of Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, map unit PCG; on an alluvial fan sloping 6 percent at 1,741 m elevation in rangeland. Culberson County, TX; USGS Guadalupe Peak, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 52 minutes, 54 seconds North and Longitude 104 degrees, 49 minutes, 44 seconds West, NAD 83. UTM Easting: 516191, UTM Northing: 3527324, UTM Zone 13.

A1—0 to 26 cm; very dark grayish brown (10YR 3/2) very gravelly loam, very dark brown (10YR 2/2), moist; weak fine and medium granular structure; soft, friable, many very fine and fine roots throughout; 5 percent subangular indurated 76 to 190 mm limestone fragments, and 10 percent subangular indurated 5 to 75 mm limestone fragments; strongly effervescent; moderately alkaline, diffuse smooth boundary.

A2—26 to 48 cm; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3), moist; weak fine and medium granular structure; soft, friable, common very fine and fine roots throughout; 10 percent subangular indurated 76 to 190 mm limestone fragments, and 30 percent subangular indurated 5 to 75 mm limestone fragments; strongly effervescent; moderately alkaline; clear smooth boundary.

BCk—48 to 157 cm; light yellowish brown (10YR 6/4), extremely cobbly loam, yellowish brown (10YR 5/4), moist; weak fine granular structure; slightly hard, firm; finely disseminated carbonates, and 5 percent carbonate nodules around rock fragments; 25 percent subangular indurated 5 to 75 mm limestone fragments, and 35 percent rounded indurated 76 to 250 mm limestone fragments; violently effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Aridic ustic moisture regime
Mean annual soil temperature: 15 to 20 degrees C
Thickness of mollic epipedon: 19 to 48 cm
Depth to calcic horizon: 19 to 48 cm
Particle-size control section (weighted average):
Clay content: 14 to 29 percent
Rock fragment content: 35 to 70 percent limestone fragments

A horizon

Hue: 7.5YR or 10YR
Value: 3 to 5 dry, 2 or 3 moist
Chroma: 2 to 4 dry, 2 or 3 moist
Texture of the fine-earth fraction: Loam, silt loam, clay loam
Clay content: 12 to 32 percent
Effervescence: Very slight to violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon (where present)

Hue: 7.5YR or 10YR
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 2 to 6 dry or moist
Texture of the fine-earth fraction: Loam, silt loam, clay loam, silty clay loam
Clay content: 14 to 29 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

BCk horizon

Hue: 7.5YR or 10YR
Value: 3 to 6 dry, 2 to 5 moist
Chroma: 2 to 6 dry or moist
Texture of the fine-earth fraction: Loam, silt loam, clay loam, silty clay loam
Clay content: 14 to 29 percent
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Tenneco Series

Classification: Fine-loamy, mixed, superactive, thermic Ustic Haplocambids
Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate to moderately slow
Landform: Flood plains and alluvial fans
Parent material: Alluvium derived from limestone
Slope: 2 to 5 percent
Elevation: 1,121 to 1,377 m
Mean annual precipitation: 254 to 381 mm
Mean annual air temperature: 15.0 to 19.0 degrees C
Frost-free period: 187 to 239 days

Typical Pedon

Tenneco very fine sandy loam in an area of Chispa-Tenneco complex, 2 to 9 percent slopes, map unit CAD; on a convex tread of a terrace sloping 2 percent at 1,341 m elevation in rangeland. Culberson County, TX; USGS Patterson Hill, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 50 minutes, 36.65 seconds North and Longitude 104 degrees, 53 minutes, 42.38 seconds West, NAD 83. UTM Easting: 509925 m, UTM Northing: 3523095 m, UTM Zone 13.

A—0 to 13 cm; pale brown (10YR 6/3) very fine sandy loam, dark yellowish brown (10YR 4/4), moist; moderate fine granular structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots, and common medium roots; EC is 0.3 dS/m; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw1—13 to 72 cm; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3), moist; weak fine and medium subangular blocky structure; very friable, soft, nonsticky, nonplastic; common very fine and fine roots; EC is 0.5 dS/m; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bw2—72 to 110 cm; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4), moist; weak fine and medium subangular blocky structure; friable, soft, nonsticky, nonplastic; common very fine and fine roots; 2 percent fine distinct carbonate masses around rock fragments; EC is 4.5 dS/m; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bk—110 to 203 cm; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4), moist; weak fine and medium subangular blocky structure; friable, soft, nonsticky, nonplastic; common very fine and fine roots; 3 percent fine threadlike carbonate masses; EC is 7.7 dS/m; strongly effervescent; moderately alkaline.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Ustic aridic soil moisture regime
Mean annual soil temperature: 16.0 to 20.0 degrees C
Thickness of ochric epipedon: 10 to 15 cm
Depth to secondary carbonate: 45 to 72 cm
Solum thickness: 150 cm to more than 203 cm
Particle-size control section (weighted average):
Clay content: 18 to 25 percent
Calcium carbonate equivalent: 5 to 15 percent

A horizon

Hue: 10YR
Value: 4 to 6 dry, 3 or 4 moist
Chroma: 3 or 4, dry or moist
Texture: Very fine sandy loam or loam
Effervescence: Slight to strong
Reaction: Slightly alkaline or moderately alkaline

Bw horizon

Hue: 7.5YR or 10YR
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 3 or 4, dry or moist
Texture: Very fine sandy loam or loam
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Bk horizon (and C horizon, where present)

Hue: 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 3 or 4, dry or moist
Texture: Loam
Effervescence: Strong or violent
Reaction: Slightly alkaline or moderately alkaline

Victorio Series

Classification: Clayey-skeletal, mixed, superactive, mesic Lithic Argiustolls
Depth class: Very shallow and shallow
Drainage class: Well drained

Permeability: Moderately slow
Landform: Mountainsides, ridges
Parent material: Colluvium and residuum weathered from Permian age limestone and dolomite
Slope: 10 to 95 percent
Elevation: 1,584 to 2,664 m
Mean annual precipitation: 508 to 660 mm
Mean annual air temperature: 8.0 to 14.0 degrees C
Frost-free period: 135 to 250 days

Typical Pedon

Victorio gravelly loam (fig. 49) in an area of Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes, map unit VLG; on a mountain flank sloping 25 percent at 2,363 m elevation in forestland. Culberson County, TX; USGS Guadalupe Peak, TX 7.5 minute topographic quadrangle; Latitude 31 degrees, 55 minutes, 09 seconds North and Longitude 104 degrees, 50 minutes, 25 seconds West, NAD 83. UTM Easting: 515110 m, UTM Northing: 3531485 m, UTM Zone 13.

Oi—0 to 7 cm; very dark brown (10YR 2/2) gravelly slightly decomposed plant material, black (10YR 2/1), moist; loose, loose; 20 percent subrounded indurated 10 to 76 mm limestone fragments; abrupt smooth boundary.
A—7 to 17 cm; very dark gray (10YR 3/1) gravelly loam, black (10YR 2/1), moist; moderate fine granular structure; soft, friable, slightly sticky, slightly plastic; 30 percent subrounded indurated 10 to 76 mm limestone fragments; neutral; clear smooth boundary.
Bt1—17 to 30 cm; brown (7.5YR 4/2) very cobbly clay loam, dark brown (7.5YR 3/2), moist; strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; 30 percent distinct clay films on all faces of peds; 60 percent subrounded indurated 250 to 600 mm limestone fragments; neutral, clear smooth boundary.
Bt2—30 to 47 cm; light brown (7.5YR 6/4) very cobbly clay, brown (7.5YR 5/4), moist; strong fine and medium subangular blocky structure; hard, firm, moderately sticky, moderately plastic; 35 percent distinct clay films on all faces of peds; 60 percent subrounded indurated 250 to 600 mm limestone fragments; neutral, very abrupt smooth boundary.
R—47 to 72 cm; indurated limestone bedrock.

Range in Characteristics

(Depths given are measured from the mineral soil surface)

Soil moisture: Typic ustic soil moisture regime
Mean annual soil temperature: 9.0 to 15.0 degrees C
Thickness of mollic epipedon: 16 to 49 cm
Depth to argillic horizon: 8 to 21 cm
Depth to lithic contact: 19 to 49 cm
Particle-size control section (weighted average):
Clay content: 36 to 49 percent
Rock fragment content: 40 to 80 percent
Gravel size: 5 to 55 percent
Cobble size: 10 to 70 percent
Stone size: 0 to 65 percent

Figure 49.—Profile of Victorio gravelly loam, in an area of Victoria-Lozen-Rock outcrop complex, 10 to 60 percent slopes. The soil has a gravelly mollic epipedon and a very cobbly argillic horizon over a lithic contact. The parent material is fractured limestone bedrock. Some pedons have a thin O horizon. (Scale in CM-centimeters)

Oi horizon (where present)

Hue: 10YR
Value: 2 or 3 dry and moist
Chroma: 1 to 3 dry and moist
Texture of the fine-earth fraction: Slightly decomposed plant material

A horizon

Hue: 7.5YR or 10YR
Value: 3 or 4 dry, 2 or 3 moist
Chroma: 1 to 4 dry, 1 to 3 moist
Texture of the fine-earth fraction: Loam, clay loam, or clay
Clay content: 22 to 43 percent
Coarse fragments: 10 to 65 percent
Reaction: Neutral or slightly alkaline

Bt horizon

Hue: 7.5YR or 10YR
Value: 3 to 6 dry, 3 or 4 moist
Chroma: 2 to 4 dry and moist
Texture of the fine-earth fraction: Clay loam or clay
Clay content: 34 to 54 percent
Coarse fragments: 40 to 80 percent
Reaction: Neutral

R layer

Fractures: Greater than 10 cm apart
Bedrock kind: Indurated limestone and dolomite

Formation of the Soils

In this section, the factors of soil formation to include parent material, living organisms, topography, climate, and time are discussed and are related to the formation of the soils in Guadalupe Mountains National Park. Also, the processes of horizon differentiation and the surface geology within the survey area are described.

Factors of Soil Formation

Soil is a dynamic medium forming a living shell of varying thickness over the rocky crust of the Earth. Soil, as used in this publication, is a natural body or a collection of natural bodies on the earth's surface, containing living matter and supporting or capable of supporting plant life. Its upper limit is air or shallow water. At its margins it grades to deep water or to barren areas of rock. Soil grades at its lower limit to bedrock or to earthy materials virtually devoid of roots, animals, or marks of other biologic activity (Soil Survey Staff, 1998; Soil Survey Staff, 1999; Soil Survey Staff, 2003; Soil Survey Staff, 2010).

Soil is the result of the interaction of five soil forming factors (Birkeland, 1984; Jenny, 1941). These factors determine the unique properties and characteristics of a soil at any given location. The five soil forming factors are: (1) the type and mineralogical composition of the parent material; (2) the living organisms on and in the soil; (3) the topography or relief features of a landscape; (4) the different climates that the soil has been exposed to; and (5) the length of time these development forces have acted upon the soil. The interrelationship of these factors is very complex and it is difficult to isolate the effects of any one factor. The effect of the factors also varies from place to place, but the interaction of the factors ultimately determines the kind of soil that forms. The term "pedogenesis" (soil genesis) is often used to connote the process of soil formation.

Parent Material

Parent material is the unconsolidated organic and mineral matter in which soil forms. Parent materials influence or wholly determine the color, texture, mineralogy, structure, consistency, reaction, erodibility, and natural fertility of soil.

Most mineral matter is ultimately derived from some type of rock. Guadalupe Mountains National Park has landscapes that in some areas are dominated by exposed bedrock. The vast majority of the bedrock types present here are limestone rocks. Smaller areas of sandstone bedrock occur. These rock layers are grouped together into mappable units called formations. Physical and chemical weathering of rocks in these exposed geologic formations, accompanied by natural erosion, provides an abundant source of loose rock debris for the parent materials of soils.

Since the parent materials derived from particular geologic formations have specific characteristics, the soils that form in them tend to also have specific characteristics that are related to or derived from these materials. Certain properties such as mineralogy and soil color are strongly influenced by the initial nature of the parent materials. Such properties are especially evident in dry regions where the rate of chemical alteration of most minerals is slow because of the lack of abundant soil moisture.

The soils in Guadalupe Mountains National Park formed in several types of parent material. Some soils have formed in only one type of material, while many others have formed in a combination of several types. The parent materials present are alluvium, residuum, colluvium, and eolian material. Each of these materials is discussed in the following paragraphs.

Alluvium is sediment that has been moved by running water. It may have been moved many miles or only a few feet. In this survey area, it commonly is derived from bedrock such as limestone, but it may also be derived from existing soils which are undergoing accelerated erosion.

Common landforms in this survey area where alluvium is a dominant parent material are flood plains, alluvial fans, and stream terraces. The fan remnants that have formed petrocalcic horizons in the Frijole Ranch area of the survey area are a distinctive feature denoting much older age. Some soils in Guadalupe Mountains National Park are forming in young, relatively unaltered Holocene alluvium and therefore lack diagnostic subsurface horizons.

Alluvial deposits are typically stratified because of the fluctuating nature of the processes involving erosion, transportation, and deposition of sediments. This inherent stratification is clearly evident in very young alluvial deposits, but is less evident in deposits where pedogenesis has altered or obscured it. Differences in particle or grain sizes because of stratification play an important role in the diagnostic horizons that may form in a soil. For example, calcic horizons in soils commonly form over or within layers having distinct differences in grain size. This effect is because of the change in the size of the pores from one strata or layer to the next, which affects water flow. These different layers slow the movement of soil water and allow compounds such as calcium carbonate held in suspension to be withdrawn into large soil pores where they accumulate over time.

Residuum is material formed in place by the physical and chemical weathering of bedrock. Common landform positions in this survey where residuum contributes to the soil material are mountains, hills, and escarpments.

Colluvium is material that has been moved down steep slopes by mass wasting processes. It is composed of material that has rolled, slid, or fallen down slope because of the influence of gravity. The size fractions of particles in most colluvial deposits are large and the material is unsorted. The rock fragments in colluvium are usually angular, except where the fragments are derived from rock formations or unconsolidated deposits that have preexisting, rounded fragments. Most often, colluvium is an important soil parent material on backslopes.

Eolian material is sediment that has been transported by wind. Thick eolian deposits are commonly composed of sand- and silt-sized particles, but may also be composed of aggregated clay-size particles. Eolian materials are sorted through transport where finer materials such as silt and very fine sand may move many miles from the source but coarser materials such as fine or medium sand will be deposited much closer to the source. Calcium carbonate and other chemical compounds such as sodium sulfate are also moved and redeposited by wind in the form of dust (Gile, et al., 1981; Harden, et al., 1991). Such atmospheric additions of dry clay and fine silt-size particles have a significant cumulative effect over a long period of time, especially on stable landform positions. Labile calcium released by calcareous dust into the soil water may combine with the sulfate anion present in saline soils to form accumulations of secondary gypsum.

Living Organisms

Plant, animal, and microbial life affect many soil processes such as the physical and chemical weathering of bedrock and parent material, the rates of organic matter decomposition and biochemical transformation, and plant nutrient cycling. Plant roots grow into bedrock and parent material, breaking it loose into individual particles and

exerting strong pressures to force open joints in rock and unconsolidated materials, making them more porous. Organic matter is incorporated into the soil solum through root growth and death and also provides organic mulch at the soil surface by plant litter. In ecosystems with poor soil nutrition or low available moisture, plants can cycle nutrients from great depths or pull water from relatively dry materials in the soil, making them available to other plants and animals.

Animals have an impact on soil formation. Creatures such as ants, earthworms, cicada larvae, mice, moles, prairie dogs, and badgers live and burrow in the soil. Their activities mix layers and concentrate soil particles, while also increasing porosity, permeability, and recycling plant matter and nutrients. Certain soil bacteria participate symbiotically with plants in the basic enzymatic transformations of nitrification, and nitrogen fixation and are responsible for reduction and oxidation processes that induce sulfur oxidation, iron mobilization, and many other biochemical and geochemical transformations in the soil (Brady, 1974). Actinomycetes are bacteria-like fungi that are of great importance in the decomposition of soil organic matter and are also partly responsible for the aroma of fresh soil. Certain species of fungi may aid or speed the accumulation of calcium carbonate within desert soils (Monger et al., 1991).

Field research by ecologists is revealing the importance that algae and spore producing plants play in the health and stability of fragile soils in dry regions. Cryptogamic soil crusts form on and directly under the soil surface when symbiotic communities of algae, fungi, mosses, and lichens flourish. These crusts are characteristically dark and lumpy and can become well developed on sandy, saline, or gypsiferous soils which lack gravel lags or desert pavements. Cryptogamic crusts are important because they provide surface aggregation that stabilizes and protects otherwise sparsely vegetated soils from the hazards of water erosion and soil blowing (Anderson et al, 1982; Brotherson et al, 1983). Other benefits which cryptogam crusts provide is adding organic matter, fixing atmospheric nitrogen, increasing water infiltration, and protecting moisture within the upper inch of soil (Dunne, 1989). The soils Corvus and Peligro in the Salt Basin area of the park are examples of soils having a cryptogamic soil crust.

Humans alter the soil by building structures, manipulating rangeland plants for livestock, harvesting or chaining trees, and by leveling, tilling, planting, and irrigating for crop production. All of these activities can cause serious soil erosion and ecosystem degradation if land users are not careful and do not practice good soil conservation techniques. An example of this is in West Dog Canyon where a gully has formed along an old road leading to an old homestead.

Topography

Topography has an important influence on soil formation, because of both slope gradient and aspect. Slope gradient determines the rate of surface runoff and the hazard of soil erosion by water as well as the internal drainage of soils. The Bonespring soil has a high rate of surface runoff and a severe hazard of water erosion because of steep slopes, resulting in only minimal soil development. By contrast, the well developed Lazarus soil has a slow rate of surface runoff and only a slight hazard of water erosion because of it being on more gentle slopes.

The aspect, or geographic direction a slope faces, can also affect soil formation. In the northern hemisphere, steep north-facing slopes have cooler, more moderate temperatures and more effective soil moisture than steep south-facing slopes.

Topography affects the micro-climatic factors of soils in areas of deeply entrenched canyons. The phenomenon of nighttime cold air drainage into canyons effectively lengthens the frost-free period of soils on adjacent uplands, while shortening the period for the soils on the canyon floors. Upper McKittrick Canyon is an example of this affect.

Climate

Climate plays an important role in the formation of soils. Climate is a dynamic factor that fluctuates diurnally, monthly and yearly in the mid-latitudes in response to the seasons. It has also undergone significant global changes over the long span of geologic time. A change in climate alters the balance of other soil forming factors, and soils often display morphologic features that formed under the influence of past climates. Many soils in dry regions which have argillic horizons overlying well developed calcic horizons probably display the effects of former climates. The early Holocene epoch was a time of continent-wide climatic change where increasingly arid conditions, especially in the western parts of the United States, caused additions of calcium carbonate to engulf the argillic horizons of many soils (Gile, 1981).

A wide range of soil temperature and moisture regimes exist within this survey area. Soil temperature regimes in the survey area range from thermic at low and middle elevations to mesic on the highest elevations. Temperature affects the rate of biological activity, the rate of decomposition of organic matter, and the rate of certain chemical reactions. Within these temperature regimes, rates of many processes can effectively double for every 10 degree C. rise in temperature (Brady, 1974).

Regional and local weather patterns determine when, what types, and in what amounts precipitation will fall. Guadalupe Mountains National Park has a distinct pattern of precipitation with significant amounts of moisture coming in late summer and early fall. Soils at the higher elevations receive much more winter precipitation than those at lower elevations. Moisture coming in the winter in the form of snow and gentle rain avoid high rates of evaporation and can penetrate deeply into soil profiles; consequently, higher elevation soils undergo greater degrees of leaching. Spring months are normally dry and windy with little rainfall. The strong spring winds intensify the dry climate and deplete soil moisture through high evaporation rates. Moisture coming in summer when evapotranspiration rates are high penetrates to only very shallow depths. Summer moisture typically comes as heavy rainfall from high-intensity thunderstorms of short duration. These summer monsoon storms, occurring between July and September, are isolated in extent and undependable in occurrence. Much of the moisture that falls from such high intensity storms runs off the soil surfaces and is unavailable for plant growth.

Soil moisture affects the types of native vegetation present, the rate of biologic activity, the rate of leaching of chemical compounds, and the degree of illuviation of soil colloids. Within certain limits, increasing amounts of soil moisture will result in greater soil development by increasing the amounts and rates of processes acting upon it.

Time

The length of time that parent materials have been exposed to the effects of climate and living organisms is an important factor in soil development. Soil age is the measure of this length of time and is important in identifying soil properties and characteristics. In general, the longer duration of time that a soil has been forming, the stronger degree of expression its diagnostic horizons will have.

The development of carbonate (Bk) horizons of pedogenic origin is a common occurrence in the survey area and is closely related to soil age (Gile, et al., 1981). The formation of Bk horizons can be divided into several identifiable and differentiable stages of maturity of which qualitative and sometimes quantitative age distinctions can be made between soils. This is often a useful and important tool in identifying landform types and positions.

Processes of Horizon Differentiation

The soil profile records the activities of the soil-forming factors. A succession of layers or horizons is formed, extending from the surface down to the parent material. The horizons differ in one or more properties, for example, thickness, color, texture, structure, consistence, porosity, and reaction.

Most profiles consist of three major horizons, designated the A, B, and C horizons. In some young soils, the B horizons have not developed. In other soils, a Bkm horizon, which is an indurated calcium carbonate horizon, is present. Several processes are involved in the formation of horizons. In Guadalupe Mountains National Park, the main processes are leaching and accumulation of calcium carbonate and bases, and formation and translocation of silicate clay minerals. In most soils, several processes are active.

The A horizon is the surface layer. It is either a horizon of maximum accumulation of organic matter, called the A horizon, or a horizon of maximum leaching of materials, called the E horizon. None of the soils in the survey area has an E horizon, mainly because rainfall is not sufficient for maximum leaching.

The B horizon lies directly below the A horizon. It is the horizon of maximum accumulation of dissolved or suspended materials, for example, iron, clay, or calcium carbonate. It can be an altered horizon whose structure is distinct from that of the A horizon but shows little evidence of clay translocation or accumulation. An example of a B horizon in which calcium carbonate has accumulated and concentrated is a Bk horizon. A B horizon that contains a significant amount of carbonate accumulations to the point that it is cemented is called a Bkm horizon. An example of this is the Choza soil. A B horizon that contains a significant amount of clay accumulation is called a Bt horizon. It is generally firmer than the horizons directly above and below, and has blocky structure. Victorio and Lazarus series are the only soils which contain a Bt horizon. The By horizons have an accumulation of gypsum salts, which affects soil structure, water movement, and plant growth. Corvus, Peligro, and Monahans soils are examples of gypsum-affected soils. Subsurface horizons that show little evidence of accumulation, but have been altered in some way by the soil forming processes are Bw horizons. Pajarito and Pinery soils have these horizons.

The C horizon is relatively unchanged by the soil forming processes. Lark, Copia and McKittrick soils are examples.

An R layer underlies many of the soils in the survey area and is generally indurated limestone or sandstone bedrock. Victorio, Lozen, Lostpeak, Bonespring, Biduya, and Desario soils are examples.

Surface Geology

This section describes the rocks and unconsolidated deposits that appear on the digital geologic map of Guadalupe Mountains National Park, the environment in which those units were deposited, and the timing of geologic events that created the present landscape.

Geologic History

A portion of the rock record, spanning more than 1 billion years, is preserved in the Delaware Basin. These deposits range in age from the 1.3 billion year old Precambrian basement to the 10,000-year-old Holocene sediments of the Pecos River Valley. This geologic summary focuses on about 50 million years of this record, that is, the rocks of the Permian Period (299 to 251 million years ago). Because an estimated 95 percent of all the outcrops in the Delaware Basin date from this period,

more is known about the Permian age rocks than all of the pre-Permian rocks combined.

Globally speaking, the supercontinent Pangaea had not yet broken apart during the Permian Period, and Texas and New Mexico occupied the western edge of this landmass near the equator. A vast Permian ocean, called the Tethys Ocean, surrounded Pangaea; a narrow inlet connected this ocean to the “Permian Basin,” which consisted of four subbasins: Val Verde, Midland, Delaware, and Marfa. The Delaware Basin contained the 240-km- (150-mi) long, 120-km- (75-mi) wide Delaware Sea. This sea was the depositional setting for the rocks now exposed in Guadalupe Mountains National Park.

Before and during the Cisuralian Epoch, the Delaware Basin subsided rapidly, accumulating sediments that would form limestone (e.g., Bone Spring and Victorio Peak Formations), dolomite (e.g., Yeso Formation), and shale (e.g., Cutoff Formation). Starting in the Cisuralian and continuing into the Guadalupian, these sediments record marine transgressions (e.g., San Andres Formation) and regressions (e.g., Grayburg Formation). Some of this material was deposited in incised submarine canyons, such as the Brushy Basin and Cutoff Formations; the Cutoff Formation is also notable for its debris flows. Ultimately, 3 to 5 km (2 to 3 mi) of sediments accumulated in the Permian Delaware Basin. Also during Cisuralian time, a reef bordering the Delaware Sea began to develop at the margins of the basin, and the general backreef-reefbasin sequence was established. Initially the reef was not a reef in the strictest sense of the word. Multiple reefs, really banks of carbonate sand, accumulated locally along the margins of the basin. These banks became the foundation upon which the later, more massive, Guadalupian reefs grew. The earlier “reef” banks were composed of mainly fusulinid foraminifers, oolitic grainstone, or other high-energy carbonate material.

As the ocean floor continued to slowly sink, reef deposits grew upward, remaining relatively near the water’s surface. By middle to late Guadalupian time, the sea had receded to the confines of the Delaware Basin, and conditions became favorable for massive reef growth. Over millions of years, calcareous sponges, algae, and other lime secreting marine organisms, along with calcium carbonate that precipitated from the water (a source of lime recently discovered to be primary in this process) built up to form the 640-km (400-mi) long, horseshoe-shaped Capitan Reef. This “stratigraphic reef” contains a small organic component and larger inorganic component bound together into a wave resistant structure. The Capitan Reef was a barrier reef in the Guadalupe, Apache, and Glass Mountains, but was broken into discontinuous mound-like structures by submarine canyons on the north and east sides of the basin. Part of the reef environment is the “forereef,” where the massive reef grew over its own debris. The forereef was composed of material from the front (seaward) side of the reef that had broken away from the steep slope, slipped to the bottom, and collected as sediments. The Goat Seep and Capitan Formations are the rock units composing the Guadalupian Reef.

Behind the reef, a broad, shallow shelf or “backreef” composed of eolian, tidal flat, and lagoon deposits formed. The Guadalupian backreef consists of the Grayburg, Queen, Seven Rivers, Yates, and Tansill Formations. Based on variations in the types of sediments composing these rock units, geologists have divided the backreef into four environments: outer shelf, shelf crest, inner shelf, and evaporite shelf. The evaporite shelf was the area nearest the shore and consisted of coastal sabkha and playa settings; as characterizes such settings, eolian processes were probably active. The deposits are red siltstone and evaporites (e.g., gypsum and some halite). The red color of the clastic deposits of the evaporite shelf is because of the oxidation of iron in the very shallow, nearshore zone. An abrupt transition of rock type from evaporites (sabkha) to dolomite (lagoon) occurs between the evaporite shelf and inner shelf. The inner shelf consisted of tidal flats and lagoons. Heading basinward,

the shelf crest, sometimes called the pisolite shoal, existed a few miles behind the reef front. The shelf crest represents an alternately emerged and submerged, peritidal environment characterized by pisolite and tepee structures. Finally, the immediate backreef or outer shelf was located seaward from the shelf crest where the water became deeper. The outer shelf is noted for a thickening of sediment (i.e., interbedded siliciclastics) adjacent to the reef and its increasing, basinward dipping of strata towards the reef.

The Cherry Canyon and Bell Canyon Formations represent the strata of the Guadalupian age Delaware Basin. Earlier (Cisuralian) basin deposits are the Bone Spring and Cutoff Formations. Because of differences in lithology, geologists have separated the basin setting into the “basin” and “basin margin”. Reef sediments (i.e., limestone and dolomite) interfinger with basin sediments (i.e., siltstone and sandstone) in the basin margin. The basin sediments are primarily siliciclastics (rather than carbonates or fine-grained sedimentary rocks as in the basin margin), which is indicative of the long, anastomosing channels that covered much of the basin floor.

During the 10-million-year span of Guadalupian time, the Delaware Basin decreased in size. Sedimentation blocked the connection to the Permian Ocean and left the Delaware Basin as the last site of deep-water sedimentation and massive reef growth. Eventually the sea began to recede and by evaporation the water became saltier, killing the reef-building organisms. Normal marine carbonate deposition in the Delaware Basin ceased at the end of Guadalupian time.

With an abrupt end to its growth, the reef was buried in thousands of feet of sediments during Lopingian time. Rivers deposited debris and playa lakes evaporated, infilling the basin and forming the Castile and Salado Formations. Dolomites and evaporites of the Rustler Formation were deposited later in mudflats. Ultimately sedimentation entombed the reef for millions of years.

The Delaware Basin remained buried as part of a stable platform during the Mesozoic Era, but faulting on the west side of the basin resulted in the uplift of the Guadalupe Mountains about 26 million years ago. Uplifts exhumed the Capitan Reef and created the Western Escarpment, which runs from Bartlett Peak to El Capitan and includes the 2,666 m Guadalupe Peak, the highest mountain in Texas. During uplifts, sediments were shed onto the High Plains and the ancestral Pecos River Valley. Stream erosion has removed softer sediment and lowered the region to its present level. In addition, caves in the area formed in the limestone units; the largest are those in Carlsbad Caverns National Park. Wind and rain also helped to erode softer overlying sediments, leaving the more resistant limestone of the reef exposed. Because of the steep relief and sparse vegetation, landslides have eroded some hillsides, a process of mass wasting that continues in the present.

The uplift took place in several stages. After the first uplift, consequent streams formed on the sloping surface of the mountain block, and some of their courses are preserved with little modification today. Material washed from the mountains after the first uplift was deposited in the nearby lower areas and is probably represented by the oldest unconsolidated rocks of the Salt Basin. These materials are probably of Pliocene age.

A second period of uplift probably took place in late Pliocene or early Pleistocene time and raised the mountains nearly to their present height. This uplift gave rise in places to new consequent streams, which flowed along fault troughs. It also caused renewed degradation in the mountains. The resistant rocks of the Guadalupe Mountains were incised by deep canyons, and the less resistant rocks of the Delaware Mountains were worn down to a plain of about the same altitude as the present canyon bottoms.

In Pleistocene time, perhaps as a result of fluctuation in climate, a part of this lower country was buried under a sheet of gravel. Deposition of coarse-grained

deposits took place west of the mountains also, partly as a result of climatic change but mainly in response to the uplift of the adjacent mountains. During this period the Salt Basin was probably covered by standing water, for the upper surface of the fine-grained deposits that form its floor has a conspicuous levelness, such as could not have been caused by streams or subaerial agencies. Faint beach ridges present in the Salt Basin indicate the existence of a lake in late Pleistocene time.

In late Pleistocene time, the area was again disturbed. Renewed movements of small amount took place along some of the faults on the west flank of the mountains, and some of the previously formed unconsolidated deposits were displaced. The disturbance also caused renewed dissection of the land surfaces. Erosion and sedimentation that followed this time of disturbance have shaped the mountains into their present form. (King, n.d.)

An expansion of the park boundary in 1987 added about 4,050 ha (10,000 ac) to the park's western boundary and resulted in a significant portion of the red quartz and white gypsum dunes becoming incorporated into Guadalupe Mountains National Park. The National Park Service, various organizations, and individuals had long been interested in preservation of these dunes because of their scenic beauty. As the only area of gypsum dunes in United States outside of White Sands National Monument in New Mexico, these dunes are also geologically significant. In addition, the dunes contain unusual plant associations and rare species, marking their biological significance.

In 1948, P. B. King described the dunes as "a conspicuous feature of the basin floor". Reaching a maximum height of 9 m (30 ft) in the northern area, the quartz dunes spread over the edge of the basin floor and appear to be moving up the slopes of the bajada to the east. The overall form and depressions within the dunes are irregular. Many of the dune surfaces are bare and ripple marked, though mesquite and yucca commonly grow between the dunes.

One possible origin of dune sand is reworked Permian sandstone of the Delaware Mountain Group. This model is based on observations that the sands are spatially restricted with the distribution of sand correlating with the toes of alluvial fans that drain the western slopes of the Guadalupe and Delaware Mountains on the eastern margin of Salt Basin. An absence of eolian sands in areas where runoff from the mountains is blocked by foothills further supports this model.

In 1999, Wilkins and Currey proposed a second source for the dune sands: thin sheets of reworked sands originally deposited on the basin floor at the mouths of ephemeral tributaries (i.e., in a delta). This model is based on observations of pockets of loose, drifting sand, similar to those found in the red dunes, the channel, and on the delta front of Eight-Mile Draw—a large, ephemeral tributary located across the playa floor to the south-southwest (i.e., upwind) of the quartz dunes area.

In addition to these quartz sand deposits, gypsum, deflated from the playa surface, forms active dunes in the northeastern portion of the basin. These dunes are much less extensive than the dunes of quartz sand; only one large tract in the Salt Basin covers about 10 km^2 (4 mi^2). The northeastern end of the tract is a crescent-shaped ridge a mile across, made up of white, shifting dunes, bare of vegetation, with an appearance similar to the well-known White Sands area of the Tularosa Basin in New Mexico. The gypsum sand dunes include an active front approximately 15 m (50 ft) high. These dunes are advancing to the northeast as evidenced by the alignment of the limbs of the parabolas. To the southwest, nearer the playa margins, the gypsum dunes are mostly stable and covered with vegetation. (Keller, 2008)

Soil Relationship to Geology and Landforms

The dominate landform in the park is the high mountains formed by Permian reef deposits. Because of the elevation this area has cooler temperatures and increased

moisture which in turn affects the type of vegetation and soils that occur. It is referred to as a sky island in that they are cooler moist areas with a mixed conifer forest surrounded by the arid Chihuahua desert at lower elevations (fig. 50).

The Victorio and Lozen soils are located in these high forest covered mountains. These soils are in two map units that differ only in the range of slopes. The map unit Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes, is generally located in the area bounded by the Bush Mountain Trail on the high west and south-facing escarpment, the Tejas Trail on the east and the Blue Ridge Trail on the north. It is also located in the forested area from Dog Canyon up to Lost Peak just to the east of Tejas Trail. It is characterized by rugged steep slopes with relatively open ridge tops.

The map unit Victorio-Lozen-Rock outcrop complex, 40 to 95 percent slopes, is generally located on the canyon walls of North and South McKittrick canyons and the north-facing slopes below Guadalupe, Shumard, and Bartlett Peaks. It is characterized by very rugged, very steep slopes with numerous cliff faces. The north-facing slopes along the Guadalupe Peak Trail are examples of this map unit.

The map unit Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes is primarily mapped over the Carlsbad group with smaller areas of the Goat Seep and Capitan Limestone Formations. The map unit Victorio-Lozen-Rock outcrop complex, 40 to 95 percent slopes is primarily mapped over the Capitan Limestone Formation with a few areas over the Carlsbad group.

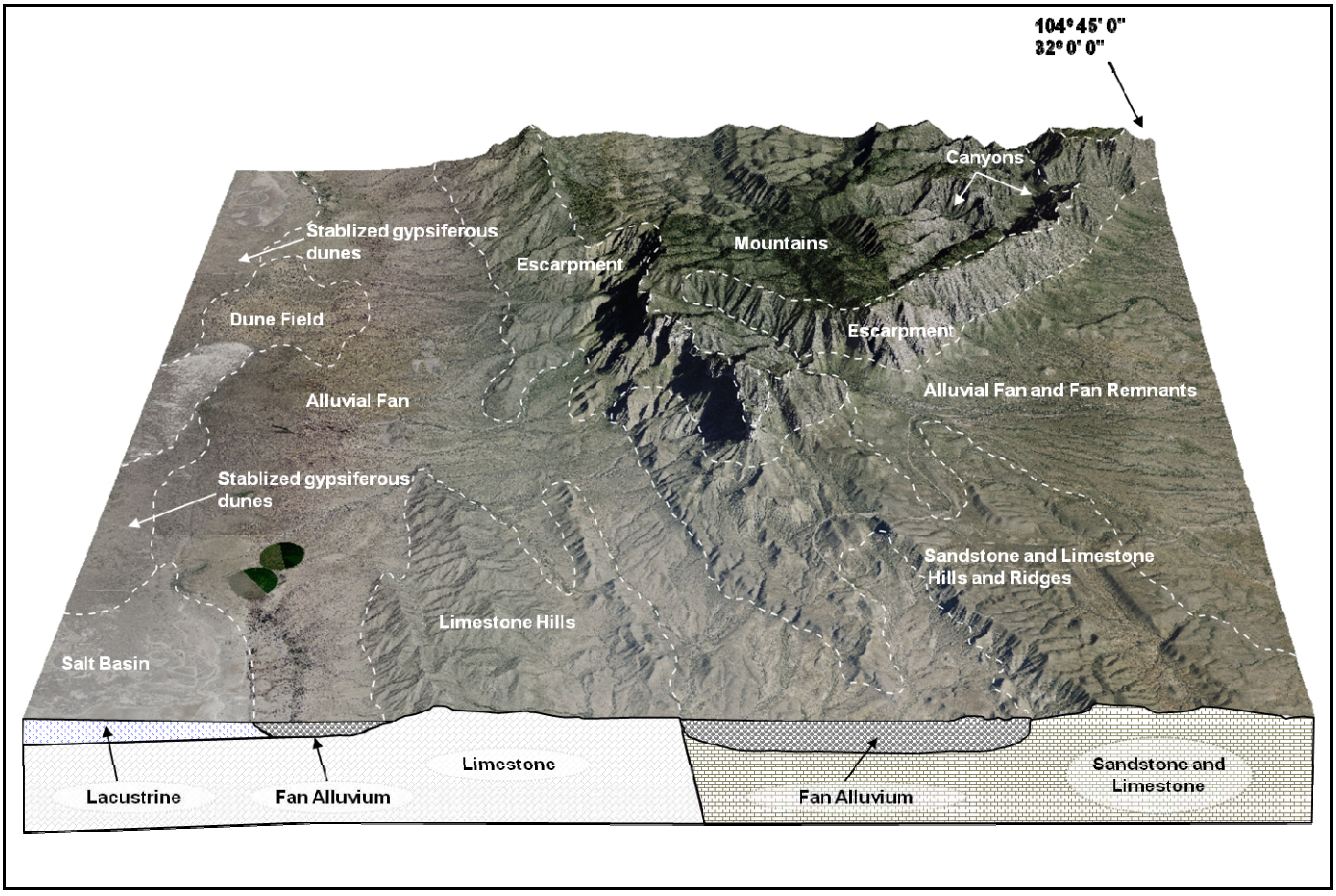


Figure 50.—Pattern of landforms and underlying materials in Guadalupe Mountains National Park.

The Victorio soil formed in stabilized colluvium over residuum on the steep side slopes of ridges and mountainsides. It has a thin slightly decomposed organic layer formed from pine needles and grasses. Below this, is loam or clay loam mollic horizon high in organic matter followed by a clay loam or clay argillic horizon above a limestone bedrock layer. All horizons have a high percentage of gravels and cobbles, averaging over 35 percent by volume. The Lozen soils formed in residuum along ridge tops, shoulders, and stabilized ledges on lower slopes. It has a thin loam or clay loam mollic surface directly over a limestone bedrock layer. All horizons have a high percentage of gravels and cobbles, averaging over 35 percent by volume. Areas of unrecognized soils include deep colluvial material and soils that do not meet the color requirements for a mollic surface.

North from these map units but still over the Permian reef geologies, the map units change to Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes and Lazarus loam, 2 to 9 percent slopes. These map units are at a slightly lower elevation which affects the moisture and temperature. These soils are slightly drier with a mountain savanna and meadow vegetation zone. These map units are generally located in the area bounded by Cutoff Ridge to the west, Manzanita Ridge to the east, the forested area to the south, and the park boundary to the north. Another smaller area is located along Bush Mountain Trail between Manzanita Ridge and the Dog Canyon campgrounds. It is characterized by steep rolling hills and ridges with an open grassland and scattered juniper. It is dominantly mapped over the Carlsbad group to the east and Goat Seep Limestone members to the west.

The Biduya soil formed in residuum on the summits, shoulders, and upper sideslopes of hills and ridges. It has a thin loam mollic surface directly over a limestone bedrock layer. All horizons have a high percentage of gravels and cobbles, averaging over 35 percent by volume. The Desario soil formed in colluvium over residuum on the sideslopes of hills and ridges. It has a thin loam mollic surface followed by a loamy calcic horizon above a limestone bedrock layer. All horizons have a high percentage of gravels and cobbles, averaging over 35 percent by volume.

The Lazarus soil formed from alluvium on valley floors and valley sides. It is a very deep soil that has a thick loamy mollic surface followed by a clay loam argillic horizon. The mollic epipedon extends into the upper part of the argillic horizon in most pedons. This soil is very productive.

The transition from these high country map units to the low elevation areas of the park is very abrupt and marked by a very steep escarpment. The elevation change ranges up to 914 m in a very short horizontal distance. This escarpment was formed from the uplift of the reef deposits. The soil series Lostpeak is the only named soil mapped on these escarpments.

The Lostpeak-Rock outcrop complex, 40 to 95 percent slopes map unit occurs on all of the higher elevations very steep escarpments in the park. On the escarpments on the west side of the park it is mapped on the Victorio Peak and Goat Seep Limestone members along the southern portion of the escarpment gaining elevation toward Bush Mountain, then on the east facing escarpment on the Capitan Limestone member and into Pine Springs Canyon and on the south-facing slope in McKittrick Canyon. This map unit is characterized by very steep slopes and cliffs. This map unit also occurs on the escarpment in West Dog Canyon and below McKittrick Ridge Trail. The Lostpeak soil formed in colluvium over residuum on the mountain flanks and escarpments. It has a thin loam mollic surface above a limestone bedrock layer. All horizons have a high percentage of gravels and cobbles, averaging over 35 percent by volume. This soil is shallow over limestone and does not form any subsurface diagnostic horizons. Other unrecognized soils on the escarpment are very shallow Entisols and areas of deep colluvium.

The map unit Bissett-Rock outcrop complex, 15 to 60 percent slopes, is mapped along the northern portion of the west escarpment on the Victorio Peak and Goat Seep Limestone members. The escarpment in this area is not as steep as it is in other parts of the park. This area is characterized by a steep west facing slope dissected by numerous canyons and draws The Bissett in this area tends to have a thinner surface and by consequence does not always meet the thickness requirements to form a calcic horizon. In these areas the minor component Mabray was found. On the lower one-third of the escarpment at an elevation of 1,450 m and lower, areas of gypsum were found interbedded with the Victorio Peak member. The source of the gypsum is presumed to be eolian from the salt basin to the west. Another possible source could be that this area was the contact between the evaporites (sabkha) and dolomite (lagoon) as discussed in the geology section above.

Below the east-facing escarpments are the strongly sloping alluvial fans and fan remnants. Within these fans are areas of more resistant bedrock controlled ridges and small hills. It is dissected by dry arroyos that expose the unconsolidated materials washed from the mountains.

The Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky map unit occurs on the fans below the east escarpment and up into Pine Springs Canyon. This area is characterized by strongly sloping dissected fans and fan remnants with ridges and hills of the Bell and Cherry Canyon Formation. Many of the springs in the park are located in this map unit. The Pinery soil occurs on the proximal end of the fans and in the Young Quaternary alluvial deposits in association with the drains. This soil is very deep and has a loamy mollic surface followed by a thick calcic horizon averaging over 35 percent gravels. The Choza soil occurs on the fan remnants over the Old Quaternary deposits. This soil is shallow with a loamy mollic surface horizon over a cemented caliche layer. The Altuda soil occurs on the toeslope of the mountainflank and small ridges and hills within the fan over the Bell and Cherry Canyon Formations. This soil is shallow with a thin loamy mollic epipedon followed by a thin loamy calcic horizon over limestone bedrock.

South, below the El Capitan Peak the map unit changes to Bonespring-Rock outcrop complex, 10 to 60 percent slopes. This map unit generally follows the El Capitan Trail from Guadalupe Canyon to Shumard Canyon over the Brushy Creek, Bell Canyon, and Cherry Canyon Formations. It is characterized by steep ridges, escarpments, and large barren sandstone ledges and cliffs. The Bonespring soil has a thin surface horizon directly over sandstone bedrock. The soil averages over 35 percent flat very angular channers. Other unrecognized soils in this map unit are very shallow Mollisols and areas of deep colluvium.

Southwest, below the ledge created by the Brushy Creek Formation the map unit changes to Chilicotal-Chispa complex, 3 to 13 percent slopes. It is also at this point where the moisture regime changes considerably. The vegetation changes from grassland with scattered juniper to an arid Chihuahua desert vegetation.

The Chilicotal-Chispa complex, 3 to 13 percent slopes map unit occurs on Young Quaternary alluvial deposits and Young Quaternary fan and colluvium deposits. This area is characterized by moderately sloping dissected fans and fan remnants. The Chilicotal soil has a loamy ochric surface followed by a thick loamy calcic horizon averaging over 35 percent gravels. The Chispa soil has a loamy ochric surface followed by a thick loamy calcic horizon averaging less than 35 percent gravels. At depths below 100 cm, some of the pedons described contained gypsum. A possible explanation for the presence of this gypsum, is that it is eolian gypsum dunes similar to those in the salt flats area of the park but of much older age. As the mountains were uplifted the fan deposits buried these dunes.

The south end of the park contains the Patterson Hills. They are an isolated range of hills running southeast to the northwest. The map unit Bissett-Rock outcrop complex, 15 to 60 percent slopes is mapped on the Capitan member where it forms the Patterson

Hills. This Capitan Limestone is identical to the Guadalupe Peak area but at a very much lower elevation. The Bissett soil occurs on all positions of the hills. This soil is shallow with a thin loamy ochric epipedon followed by a thin calcic horizon over limestone bedrock. The Bissett soil in the Patterson hills tends to have a well developed calcic compared to those on the west escarpment. Similar to the map unit along the western escarpment, the toeslopes of this map unit in the Patterson hills were underlain by gypsum in spots.

West of this area the map units change to the hottest and driest units in the park. This part of the park is referred to as the salt basin. This area is characterized by deep sandy and sandy loam soils. Moving from east to west the first map unit encountered is the Monahans-Pajarito complex, 0 to 5 percent slopes. It occurs on eolian sands reworked alluvial fan deposits. The Monahans soil is very deep with sandy loam ochric epipedon followed by a sandy loam calcic horizon and gypsic horizon. The Pajarito soil is very deep with a sandy loam surface horizon followed by a sandy loam cambic horizon. The next map unit to the west is the Lark-Peligro complex, 1 to 8 percent slopes. This map unit contains the white gypsum sand dunes. The Lark soil is very deep gypsum sand forming the dunes that are actively blowing covered with scattered vegetation. The Peligro soil is very deep with a sandy loam ochric epipedon followed by a sandy loam gypsic horizon. This soil is in the interdune area and is presumed to be the source of the gypsum particles forming the dunes. A few of the described pedons had redoximorphic features indicating the presence of a water table at some point in time. Just to the north of this gypsum dune map unit is the Copia loamy fine sand, 2 to 7 percent slopes, that is also dunes but are composed of quartz sand. The Copia soil is very deep quartz sand forming the dunes that are actively blowing covered with scattered vegetation. West of these two dune fields is the Corvus-Peligro complex, 1 to 5 percent slopes map unit. It occurs on gently undulating relict sand dunes. The Corvus soil is shallow with a sandy loam ochric epipedon followed by a gypsic horizon over a petrogypsic horizon. The Peligro soil is very deep with a sandy loam ochric epipedon followed by a sandy loam gypsic horizon. Both of these soils are presumed to be a source of gypsum sand for the gypsum sand dunes.

All of the soils in this soil survey, including the eight new soil series, Biduya, Bonespring, Choza, Lostpeak, Lozen, McKittrick, Pinery, and Victoria, were established in the park. It is possible that more areas of these soils occur in similar settings in other portions of the Guadalupe Mountains. The soils, however, have not yet been mapped elsewhere and are therefore currently unique to Guadalupe Mountains National Park.

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the "National Soil Survey Handbook" which is available in local offices of the Natural Resources Conservation Service or on the Internet at http://soils.usda.gov/technical.

ABC soil. A soil having an A, a B, and a C horizon.

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

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium. Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Anastomosing. (a) Pertaining to a network of branching and rejoining fault surfaces or surface traces. (b) Said of the channel pattern of a *braided stream*. (Jackson, 1997)

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo. The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect. The direction toward which a slope faces. Also called slope aspect.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in centimeters (cm), in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 7.5
Low	7.5 to 15.0
Moderate	15.0 to 22.5
High	22.5 to 30.0
Very high	more than 30.0

Backslope. The position that forms the steepest and generally linear, middle portion of a hill slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology). A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane. A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle-size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

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

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

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

Breaks. A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

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

Caliche. A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canyon. A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Cement rock. Clayey limestone used in the manufacture of cement.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Cisuralian. A series of the Standard Global Chronostratigraphic Scale; Lower Permian (below Guadalupian Series; above Carboniferous System). (Jackson, 1997)

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 depletions. See Redoximorphic features.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

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

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility). See Linear extensibility.

Colluvium. Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

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

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are compounds making up concretions. See Redoximorphic features.

Conglomerate. A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 25 cm and 100 or 200 cm.

Corrosion (geomorphology). A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations). Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cutbanks cave (in tables)**.** The walls of excavations tend to cave in or slough.

Debris Flow [mass movement]. The process, associated sediments (debris flow deposit) or resultant landform characterized by a very rapid type of flow dominated by a sudden downslope movement of a mass of rock, soil, and mud (more than 50 percent of the particles are more than 2mm), and whether saturated or comparatively dry, behaves much as a viscous fluid when moving. (Schoeneberger and Wysocki, 2010)

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables)**.** A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Dolomite [rock]. A carbonate sedimentary rock consisting chiefly (more than 50 percent by weight or by areal percentages under the microscope) of the mineral dolomite. (Jackson, 1997)

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained*, and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw. A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Earthy fill. See Mine spoil.

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

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit. Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Epipedon. The epipedon (Gr. epi, over, upon, and pedon, soil) is a horizon that forms at or near the surface and in which most of the rock structure has been destroyed. It is darkened by organic matter or shows evidence of eluviation, or both.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

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

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

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

Erosion pavement. A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface. A land surface shaped by the action of erosion, especially by running water.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Fan remnant. A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

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

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable

according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

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

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) longitude

Flood plain. The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms. A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain step. An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial. Of or pertaining to rivers or streams; produced by stream or river action.

Foothills. A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope. The concave surface at the base of a hill slope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Foraminifers. Any protozoan belonging to the subclass of Sarcodina, order Foraminiferida, characterized by the presence of a test of one to many chambers composed of secreted calcite (rarely silica or aragonite) or of agglutinated particles. Most foraminifers are marine but freshwater forms are known. Range, Cambrian to Holocene. Colloquially shortened to *forum*. Pl: foraminifera; informally foraminifers. Latin, "foramen (pl. foramina)", small opening, + "-fer", carrier. (Jackson, 1997)

Forb. Any herbaceous plant not a grass or a sedge.

Fusulinid. Any foraminifer belonging to the suborder Fusulinia, family Fusulinidae, characterized by a multichambered elongate calcareous microgranular test, commonly resembling the shape of a grain of wheat. Range, Middle Pennsylvanian to Upper Permian. (Jackson, 1997)

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grainstone. A mud-free (less than 1 percent of material with diameters less than 20 micrometers), grain-supported, carbonate sedimentary rock. It may be current-laid or formed by mud being washed out from previously deposited sediment, or it may result from mud being bypassed while locally produced particles accumulated. (Jackson, 1997)

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gyp. A synonym of gypsum. Also spelled gyps. (Jackson, 1997)

Gyprock. Obsolete synonym of rock *gypsum*. (Jackson, 1997)

Gypsiferous. Gypsum-bearing, as gypsiferous shales. (Jackson, 1997)

Gypsum. A widely distributed mineral consisting of aquated calcium sulfate ($CaSO_4$-$2H_2O$. It is the commonest sulfate mineral, and is frequently associated with halite and andhydrite in evaporites, forming thick, extensive beds interstratified with limestone, shale, and clay (esp. in rock of Permian and Triassic age). Gypsum is soft (hardness of 2 on the Mohs scale); it is white or colorless when pure, but commonly has tints of gray, red, yellow, blue, or brown. It occurs massive (alabaster), fibrous (satin spar), or in monoclinic crystals (selenite). Gypsum is used chiefly as a soil amendment, as a retarder in portland cement, and in making Plaster of Paris. Greek "gypsos", chalk. (Jackson, 1997)

Halite. A cubic mineral: NaCl. It is native salt, occurring in massive, granular, compact, or cubic-crystalline forms, and having a distinctive salty taste. Halite is typically colorless, but certain occurrences provide red, yellow, blue, etc. colors owing to impurities and/or "color centers" in the structure. Symbol: Hl. Synonym: *common salt, rock salt*. (Jackson, 1997)

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim (in tables)**.** Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology). A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hill. A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hill slope. A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

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

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology). A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream. A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

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

Iron depletions. See Redoximorphic features.

Knoll. A small, low, rounded hill rising above adjacent landforms.

K-sat. Saturated hydraulic conductivity. (See Permeability.)

Landslide. A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables)**.** Rock fragments 7.6 cm or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Mass movement. A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. See Redoximorphic features.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

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

Mesa. A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

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

Miscellaneous area. A kind of map unit that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common*, and *many; size—fine, medium*, and *coarse*; and *contrast—faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch)*; medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch)*;* and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain. A generic term for an elevated area of the land surface, rising more than 300 m above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. See Redoximorphic features.

Nose slope (geomorphology). A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Oolitic. Pertaining to an oolite, or to a rock or mineral made up of ooliths; e.g., an "oolitic ironstone", in which iron oxide or iron carbonate has replaced the calcium carbonate of an oolitic limestone. (Jackson, 1997)

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan*, and *traffic pan*.

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

Peat. Unconsolidated material, largely undecomposed organic matter that has accumulated under excess moisture. (See Fibric soil material.)

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

Pedon. The smallest volume that can be called "a soil." A pedon is three-dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in micrometers per second, are as follows:

Impermeable	less than 0.01 µm/s
Very slow	0.01 to 0.42 µm/s
Slow	0.42 to 1.41 µm/s
Moderately slow	1.41 to 4.23 µm/s
Moderate	4.23 inch to 14.11 µm/s
Moderately rapid	14.11 to 42.36 µm/s
Rapid	42.36 to 705.00 µm/s
Very rapid	more than 705.00 µm/s

Petrogypsic horizon. A continuous, strongly cemented, massive, gypsic horizon cemented by calcium sulfate. It can be chipped with a spade when dry. Dry fragments do not slake in water and it is impenetrable to roots. (Jackson, 1997)

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables)**.** Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pisolite [sediment]. (a) A sedimentary rock, usually a limestone, made up chiefly of pisoids cemented together. (b) A term often used for a *pisolith*, or one of the spherical particles of a pisolite. Greek "pisos" "pea". (Jackson, 1997)

Pitting (in tables)**.** Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology). A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits

are fine grained and may or may not have a high water table and saline conditions.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

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

Pore linings. See Redoximorphic features.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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

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

Proximal [sedimentology] (adjective). Said of a sedimentary deposit consisting of coarse clastics and deposited nearest the source area. (Jackson, 1997)

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

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. See Redoximorphic features.

Redoximorphic depletions. See Redoximorphic features.

Redoximorphic features. Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   a. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; and
   b. Masses, which are noncemented concentrations of substances within the soil matrix; and
   c. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   a. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; and
   b. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix. See Redoximorphic features.

Regolith. All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief. The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill. A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser. The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

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

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sabkha. (a) A supratidal environment of sedimentation, formed under arid to semiarid conditions on restricted coastal plains just above normal high-tide level (a saline marine marsh). It is the gradational zone between the land surface and the intertidal environment. Sabkha are characterized by evaporite-saline minerals, tidal-flood, and eolian deposits, and are found on many modern coastlines, e.g. Persian Gulf, Gulf of California. (b) Any flat area, coastal or interior, where, through deflation and evaporation, saline minerals crystallize near or at the

surface. (c) In the rock record, a sabkha facies may be indicated by evaporites, absence of fossils, thin flat-pebble conglomerates, stromatolitic laminae, desiccation features such as mud cracks, and diagenetic modifications, for example disrupted bedding, dissolution and replacement phenomena, and dolomitzation. The sabkha environment may have been significant in the formation of certain petroleum and sulfide-mineral deposits. (Jackson, 1997)

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saturated hydraulic conductivity (K-sat). See Permeability.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sedimentary rock. A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The convex, erosional surface near the top of a hill slope. A shoulder is a transition from summit to backslope.

Shrink-swell (in tables)**.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrub-coppice dunes. A small, streamlined dune that forms around brush and clump vegetation. (Jackson, 1997)

Side slope (geomorphology). A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

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

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Siliciclastic. Pertaining to clastic noncarbonated rocks "which are almost exclusively silicon-bearing, either as forms of quartz or as silicates." (Jackson, 1997)

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

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides (pedogenic). Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope alluvium. Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill (in tables)**.** The slow filling of ponds, resulting from restricted permeability in the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na+ to Ca ++ + Mg++. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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

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

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

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

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless soils are either single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Substratum. See Underlying material.

Subsurface layer. Any surface soil horizon (A, E, A2, A3, A4) below the surface layer.

Summit. The topographically highest position of a hill slope. It has a nearly level (planar or only slightly convex) surface.

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

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace (geomorphology). A steplike surface, bordering a valley floor or shoreline that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

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

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

Toeslope. The gently inclined surface at the base of a hill slope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hill slope continuum that grades to valley or closed-depression floors.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread. The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Upland. An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hill slope continuum.

Underlying material. The part of the soil below the solum.

Valley fill. The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

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

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

Tables

Table 1.--Temperature and Precipitation

(Recorded for the period 1979-2000 at Dell City, Texas)

Month	Temperature (Degrees F)						Precipitation (Inches)				
				2 years in 10 will have				2 years in 10 will have			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than	Minimum temperature less than	Average number of growing degree days*	Average	less than	more than	Average number of days w/0.1 or more	Average number of days w/0.1 or more of snow
January	59.1	26.4	42.7	77	9	0	0.41	0.03	0.70	1	0.4
February	64.7	30.7	47.7	82	12	0	0.35	0.16	0.53	1	0.2
March	71.6	35.6	53.6	89	17	54	0.26	0.08	0.41	1	0.0
April	79.4	42.6	61.0	95	24	440	0.20	0.00	0.35	0	0.0
May	88.4	52.8	70.6	103	38	618	1.12	0.24	1.85	2	0.0
June	96.3	60.8	78.5	109	48	724	1.13	0.00	2.03	2	0.0
July	96.6	65.1	80.9	108	45	961	1.28	0.36	2.13	3	0.0
August	93.7	63.5	78.6	104	55	727	1.56	0.67	2.40	3	0.0
September	88.2	56.4	72.3	101	40	669	1.48	0.46	2.35	3	0.0
October	79.7	44.6	62.2	95	25	378	0.91	0.14	1.67	2	0.0
November	67.1	32.8	50.0	84	15	180	0.57	0.06	1.06	1	0.1
December	58.3	26.0	42.1	75	5	0	0.55	0.00	0.86	1	0.0
Yearly:											
Average	78.6	44.8	61.7	---	---	---	---	---	---	---	---
Extreme	115	-5	---	110	4	---	---	---	---	---	---
Total	---	---	---	---	---	4,751	9.81	5.94	12.58	20	0.7

Average number of days per year with at least 1 inch of snow on the ground: 0.7

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold: 50.0 degrees F)

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Dell City, Texas)

Probability	Temperature		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 3	April 14	April 27
2 years in 10 later than--	March 27	April 9	April 22
5 years in 10 later than--	March 13	March 31	April 13
First freezing temperature in fall:			
1 year in 10 earlier than--	October 26	October 19	October 13
2 years in 10 earlier than--	November 1	October 24	October 18
5 years in 10 earlier than--	November 12	November 3	October 27

Table 3.--Growing Season

(Recorded for the period 1971-2000 at Dell City, Texas)

Probability	Daily Minimum Temperature		
	Number of days higher than 24°F	Number of days higher than 28°F	Number of days higher than 32°F
	Days	Days	Days
9 years in 10	214	201	180
8 years in 10	224	207	186
5 years in 10	242	218	197
2 years in 10	261	230	208
1 year in 10	270	236	214

Table 4.--Acres/Hectares and Proportionate Extent of the Map Units

Map symbol	Map unit name	Acres	Hectares	Percent
BDG	Biduya-Desario-Rock outcrop complex, 10 to 50 percent slopes-	6,410	2,596	7.3
BRG	Bissett-Rock outcrop complex, 15 to 60 percent slopes--------	12,611	5,107	14.3
BSG	Bonespring-Rock outcrop complex, 10 to 60 percent slopes-----	3,686	1,493	4.2
CAD	Chispa-Tenneco complex, 2 to 9 percent slopes----------------	1,657	671	1.9
CCD	Chilicotal-Chispa complex, 3 to 13 percent slopes------------	13,375	5,417	15.2
COC	Copia loamy fine sand, 2 to 7 percent slopes-----------------	2,303	933	2.6
CPB	Corvus-Peligro complex, 1 to 5 percent slopes----------------	5,156	2,088	5.8
LAD	Lazarus loam, 2 to 9 percent slopes--------------------------	1,015	411	1.1
LPC	Lark-Peligro complex, 1 to 8 percent slopes------------------	1,462	592	1.7
LRH	Lostpeak-Rock outcrop complex, 40 to 95 percent slopes-------	10,860	4,398	12.3
MCB	McKittrick-Riverwash complex, flooded, 0 to 3 percent slopes-	521	211	0.6
MPB	Monahans-Pajarito complex, 0 to 5 percent slopes-------------	7,982	3,233	9.0
PCG	Pinery, Choza, and Altuda soils, 5 to 60 percent slopes, very rocky----------	6,090	2,466	6.9
VLG	Victorio-Lozen-Rock outcrop complex, 10 to 60 percent slopes-	8,166	3,307	9.3
VLH	Victorio-Lozen-Rock outcrop complex, 40 to 95 percent slopes-	6,981	2,827	7.9
	Total----------	88,275	35,751	100.0

* Less than 0.1 percent.

Table 5.--Land Management--Planting

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting with equipment use	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Biduya	42	Unsuited		Unsuited		Slight	
		Restrictive layer	1.00	Rock fragments	1.00	Strength	0.10
		Rock fragments	0.50	Slope	0.50		
				Restrictive layer	0.50		
Desario	28	Moderately suited		Unsuited		Moderate	
		Slope	0.50	Slope	1.00	Low strength	0.50
				Rock fragments	0.50		
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Bissett	45	Poorly suited		Unsuited		Slight	
		Rock fragments	0.75	Rock fragments	1.00	Strength	0.10
		Slope	0.50	Slope	1.00		
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Unsuited		Unsuited		Moderate	
		Restrictive layer	1.00	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	1.00		
		Sandiness	0.50	Sandiness	0.50		
		Slope	0.50	Restrictive layer	0.50		
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Well suited		Moderately suited		Severe	
				Rock fragments	0.50	Low strength	1.00
				Slope	0.50		
Tenneco	33	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
CCD:							
Chilicotal	51	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		
Chispa	28	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
COC:							
Copia	90	Moderately suited		Moderately suited		Moderate	
		Sandiness	0.50	Sandiness	0.50	Low strength	0.50
				Slope	0.50		
CPB:							
Corvus	43	Well suited		Well suited		Severe	
						Low strength	1.00

Table 5.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting with equipment use	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Peligro	27	Well suited		Well suited		Severe Low strength	 1.00
LAD:							
Lazarus	80	Well suited		Well suited		Severe Low strength	 1.00
LPC:							
Lark	50	Moderately suited Sandiness	 0.50	Moderately suited Sandiness Slope	 0.50 0.50	Moderate Low strength	 0.50
Peligro	40	Well suited		Moderately suited Slope	 0.50	Moderate Low strength	 0.50
LRH:							
Lostpeak	70	Unsuited Restrictive layer Slope Rock fragments Stickiness; high plasticity index	 1.00 0.50 0.50 0.50	Unsuited Slope Rock fragments Restrictive layer Stickiness; high plasticity index	 1.00 0.75 0.50 0.50	Moderate Low strength	 0.50
Rock outcrop	25	Not rated		Not rated		Not rated	
MCB:							
McKittrick, occasionally flooded	31	Moderately suited Rock fragments	 0.50	Moderately suited Rock fragments	 0.50	Moderate Low strength	 0.50
McKittrick, frequently flooded	20	Moderately suited Rock fragments	 0.50	Moderately suited Rock fragments	 0.50	Moderate Low strength	 0.50
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Well suited		Well suited		Severe Low strength	 1.00
Pajarito	21	Well suited		Well suited		Severe Low strength	 1.00
PCG:							
Altuda	20	Unsuited Restrictive layer Slope Rock fragments	 1.00 0.50 0.50	Unsuited Slope Rock fragments Restrictive layer	 1.00 0.50 0.50	Moderate Low strength	 0.50
Pinery	32	Well suited		Moderately suited Rock fragments Slope	 0.50 0.50	Moderate Low strength	 0.50

Table 5.--Land Management--Planting--Continued

Map symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting with equipment use	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Choza	27	Unsuited		Moderately suited		Moderate	
		Restrictive layer	1.00	Slope	0.50	Low strength	0.50
				Rock fragments	0.50		
				Restrictive layer	0.50		
VLG:							
Victorio	51	Unsuited		Unsuited		Severe	
		Restrictive layer	1.00	Slope	1.00	Low strength	1.00
		Stickiness; high plasticity index	0.75	Rock fragments	0.75		
		Slope	0.50	Stickiness; high plasticity index	0.75		
		Rock fragments	0.50	Restrictive layer	0.50		
Lozen	33	Unsuited		Poorly suited		Moderate	
		Restrictive layer	1.00	Slope	0.75	Low strength	0.50
		Rock fragments	0.50	Rock fragments	0.75		
				Restrictive layer	0.50		
Rock outcrop	12	Not rated		Not rated		Not rated	
VLH:							
Victorio, 60 to 95 percent slopes	35	Moderately suited		Unsuited		Moderate	
		Slope	0.50	Slope	1.00	Low strength	0.50
		Stickiness; high plasticity index	0.50	Rock fragments	0.50		
		Rock fragments	0.50	Stickiness; high plasticity index	0.50		
Victorio, 40 to 60 percent slopes	20	Moderately suited		Unsuited		Moderate	
		Stickiness; high plasticity index	0.50	Slope	1.00	Low strength	0.50
		Slope	0.50	Rock fragments	0.50		
		Rock fragments	0.50	Stickiness; high plasticity index	0.50		
Lozen	25	Moderately suited		Unsuited		Moderate	
		Slope	0.50	Slope	1.00	Low strength	0.50
		Rock fragments	0.50	Rock fragments	1.00		
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 6.--Land Management--Hazard of Erosion and Suitability for Roads

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Hazard of erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Biduya	42	Moderate Slope/erodibility	 0.50	Moderate Slope/erodibility	 0.50	Poorly suited Slope	 1.00
Desario	28	Moderate Slope/erodibility	 0.50	Severe Slope/erodibility	 0.95	Poorly suited Slope	 1.00
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Bissett	45	Severe Slope/erodibility	 0.75	Severe Slope/erodibility	 0.95	Poorly suited Slope Rock fragments	 1.00 0.50
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Severe Slope/erodibility	 0.75	Severe Slope/erodibility	 0.95	Poorly suited Slope	 1.00
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength Slope	 0.50 0.50
Tenneco	33	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength Slope	 0.50 0.50
CCD:							
Chilicotal	51	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Slope	 0.50
Chispa	28	Slight		Severe Slope/erodibility	 0.95	Moderately suited Slope Low strength	 0.50 0.50
COC:							
Copia	90	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Sandiness	 0.50
CPB:							
Corvus	43	Slight		Slight		Well suited	
Peligro	27	Slight		Slight		Well suited	
LAD:							
Lazarus	80	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength	 0.50

Table 6.--Land Management--Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LPC:							
Lark	50	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Sandiness	0.50
Peligro	40	Slight		Moderate		Well suited	
				Slope/erodibility	0.50		
LRH:							
Lostpeak	70	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	25	Not rated		Not rated		Not rated	
MCB:							
McKittrick, occasionally flooded	31	Slight		Slight		Moderately suited	
						Flooding	0.50
McKittrick, frequently flooded	20	Slight		Slight		Poorly suited	
						Flooding	1.00
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
Pajarito	21	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
PCG:							
Altuda	20	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
Pinery	32	Slight		Moderate		Poorly suited	
				Slope/erodibility	0.50	Slope	1.00
Choza	27	Slight		Moderate		Poorly suited	
				Slope/erodibility	0.50	Slope	1.00
VLG:							
Victorio	51	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
Lozen	33	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
Rock outcrop	12	Not rated		Not rated		Not rated	

Table 6.--Land Management--Hazard of Erosion and Suitability for Roads--Continued

Map symbol and soil name	Pct. of map unit	Hazard of erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
VLH:							
Victorio, 60 to 95 percent slopes	35	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
Victorio, 40 to 60 percent slopes	20	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
Lozen	25	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 7.--Land Management--Mechanical Site Preparation and Mechanical Site Restoration

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation and Restoration (Deep)		Mechanical Site Preparation and Restoration (Surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Unsuited		Poorly suited	
		Restrictive layer	1.00	Rock fragments	0.50
		Slope	0.50	Slope	0.50
				Restrictive layer	0.50
Desario	28	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	0.50
		Slope	0.50		
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	1.00
		Slope	1.00	Rock fragments	0.50
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	1.00
		Slope	1.00	Rock fragments	0.50
				Restrictive layer	0.50
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Well suited		Well suited	
Tenneco	33	Well suited		Well suited	
CCD:					
Chilicotal	51	Well suited		Poorly suited	
				Rock fragments	0.50
Chispa	28	Well suited		Well suited	
COC:					
Copia	90	Well suited		Well suited	
CPB:					
Corvus	43	Well suited		Well suited	
Peligro	27	Well suited		Well suited	
LAD:					
Lazarus	80	Well suited		Well suited	

Table 7.--Land Management--Mechanical Site Preparation and Mechanical Site Restoration--Continued

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation and Restoration (Deep)		Mechanical Site Preparation and Restoration (Surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
LPC:					
Lark	50	Well suited		Well suited	
Peligro	40	Well suited		Well suited	
LRH:					
Lostpeak	70	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Rock fragments	0.50
				Restrictive layer	0.50
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Poorly suited		Poorly suited	
		Rock fragments	0.50	Rock fragments	0.50
McKittrick, frequently flooded	20	Poorly suited		Poorly suited	
		Rock fragments	0.50	Rock fragments	0.50
Riverwash	22	Not rated		Not rated	
MPB:					
Monahans	60	Well suited		Well suited	
Pajarito	21	Well suited		Well suited	
PCG:					
Altuda	20	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	1.00
		Slope	1.00	Restrictive layer	0.50
				Rock fragments	0.50
Pinery	32	Poorly suited		Well suited	
		Rock fragments	0.50		
Choza	27	Unsuited		Poorly suited	
		Restrictive layer	1.00	Restrictive layer	0.50
VLG:					
Victorio	51	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	1.00
		Slope	1.00	Restrictive layer	0.50
				Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Lozen	33	Unsuited		Poorly suited	
		Restrictive layer	1.00	Slope	0.50
		Slope	0.50	Rock fragments	0.50
				Restrictive layer	0.50
Rock outcrop	12	Not rated		Not rated	

Table 7.--Land Management--Mechanical Site Preparation and Mechanical Site Restoration--Continued

Map symbol and soil name	Pct. of map unit	Mechanical Site Preparation and Restoration (Deep)		Mechanical Site Preparation and Restoration (Surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
VLH:					
Victorio, 60 to 95 percent slopes	35	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Victorio, 40 to 60 percent slopes	20	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Stickiness; high plasticity index	0.50
				Rock fragments	0.50
Lozen	25	Unsuited		Poorly suited	
		Slope	1.00	Slope	1.00
		Restrictive layer	1.00	Rock fragments	0.50
		Rock fragments	0.50		
Rock outcrop	20	Not rated		Not rated	

Table 8.--Damage by Fire and Seedling Mortality on Forestland

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Low Texture/rock fragments	0.10	High Available water Soil reaction	1.00 0.50
Desario	28	Low Texture/slope/rock fragments	0.10	Moderate Carbonate content Soil reaction Available water	0.50 0.50 0.50
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Moderate Texture/slope/surface depth/rock fragments	0.50	Moderate Carbonate content	0.50
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	High Texture/slope/surface depth/rock fragments	1.00	High Available water	1.00
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Moderate Texture/rock fragments	0.50	Moderate Carbonate content	0.50
Tenneco	33	Moderate Texture/rock fragments	0.50	Moderate Carbonate content Soil reaction	0.50 0.50
CCD:					
Chilicotal	51	Moderate Texture/rock fragments	0.50	Moderate Carbonate content	0.50
Chispa	28	Moderate Texture/rock fragments	0.50	Moderate Carbonate content	0.50

Table 8.--Damage by Fire and Seedling Mortality on Forestland--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
COC:					
Copia	90	High		Moderate	
		Texture/surface depth/rock fragments	1.00	Soil reaction	0.50
CPB:					
Corvus	43	High		Low	
		Texture/surface depth/rock fragments	1.00		
Peligro	27	High		Low	
		Texture/surface depth/rock fragments	1.00		
LAD:					
Lazarus	80	Low		Low	
		Texture/rock fragments	0.10		
LPC:					
Lark	50	High		Moderate	
		Texture/rock fragments	1.00	Soil reaction	0.50
Peligro	40	High		Moderate	
		Texture/rock fragments	1.00	Soil reaction	0.50
LRH:					
Lostpeak	70	Low		High	
				Available water	1.00
				Soil reaction	0.50
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Moderate		High	
		Texture/rock fragments	0.50	Available water	1.00
				Wetness	1.00
				Carbonate content	0.50
McKittrick, frequently flooded-	20	Moderate		High	
		Texture/rock fragments	0.50	Available water	1.00
				Wetness	1.00
				Carbonate content	0.50
Riverwash	22	Not rated		Not rated	

Table 8.--Damage by Fire and Seedling Mortality on Forestland--Continued

Map symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MPB:					
Monahans	60	High Texture/surface depth/rock fragments	1.00	Low	
Pajarito	21	Moderate Texture/rock fragments	0.50	Moderate Soil reaction	0.50
PCG:					
Altuda	20	High Texture/slope/rock fragments	1.00	High Available water Carbonate content	1.00 0.50
Pinery	32	Moderate Texture/rock fragments	0.50	High Available water Soil reaction	1.00 0.50
Choza	27	High Texture/rock fragments	1.00	High Available water Soil reaction	1.00 0.50
VLG:					
Victorio	51	Low Texture/slope/rock fragments	0.10	Moderate Available water	0.50
Lozen	33	Moderate Texture/rock fragments	0.50	High Available water	1.00
Rock outcrop	12	Not rated		Not rated	
VLH:					
Victorio, 60 to 95 percent slopes	35	Moderate Texture/slope/surface depth/rock fragments	0.50	Low	
Victorio, 40 to 60 percent slopes	20	Moderate Texture/slope/surface depth/rock fragments	0.50	Low	
Lozen	25	Moderate Texture/rock fragments	0.50	High Available water	1.00
Rock outcrop	20	Not rated		Not rated	

Table 9.--Land Capability Classification

(Land capability is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time.)

Map symbol and soil name	Land Capability	
	N	I
BDG:		
Biduya	6s	---
Desario	7e	---
Rock outcrop	---	---
BRG:		
Bissett	7s	---
Rock outcrop	---	---
BSG:		
Bonespring	6c	---
Rock outcrop	---	---
CAD:		
Chispa	6s	---
Tenneco	6c	---
CCD:		
Chilicotal	7s	---
Chispa	6s	---
COC:		
Copia	7c	---
CPB:		
Corvus	7c	---
Peligro	7c	---
LAD:		
Lazarus	7e	2e
LPC:		
Lark	7c	---
Peligro	7c	---
LRH:		
Lostpeak	7s	---
MCB:		
McKittrick, occasionally flooded	6e	---
McKittrick, frequently flooded	6w	---
Riverwash	---	---
MPB:		
Monahans	7e	2e
Pajarito	7e	3e
PCG:		
Altuda	7s	---
Pinery	6e	---
Choza	6s	---

Table 9.--Land Capability Classification--Continued

Map symbol and soil name	Land Capability	
	N	I
VLG:		
Victorio	7s	---
Lozen	7s	---
VLH:		
Victorio, 60 to 95 percent slopes	7s	---
Victorio, 40 to 60 percent slopes	7s	---
Lozen	7s	---
Rock outcrop	---	---

Table 10.--Ecological Site--Soil Correlation

(Only soils and miscellaneous land types with correlated ecological sites are shown)

Map unit symbol soil percent (%) and soil name	Ecological site name	Ecological site type	Ecological site ID
BDG:			
42%-Biduya	Shallow Limestone	Rangeland	R070CY102NM
28%-Desario	Shallow Limestone	Rangeland	R070CY102NM
BRG:			
45%-Bissett	Limestone Hill and Mountain (Desert Grassland)	Rangeland	R042XC249TX
BSG:			
63%-Bonespring	Sandstone Hill	Rangeland	R070DY749TX
CAD:			
50%-Chispa	Gravelly (Desert Grassland)	Rangeland	R042XC244TX
33%-Tenneco	Loamy	Rangeland	R042XC007NM
CCD:			
51%-Chilicotal	Gravelly (Desert Grassland)	Rangeland	R042XC244TX
28%-Chispa	Gravelly (Desert Grassland)	Rangeland	R042XC244TX
COC:			
90%-Copia	Deep Sand	Rangeland	R042XB011NM
CPB:			
43%-Corvus	Gyp outcrop	Rangeland	R042XB007NM
27%-Peligro	Gyp Upland	Rangeland	R042XB006NM
LAD:			
80%-Lazarus	Loamy	Rangeland	R070CY109NM
LPC:			
50%-Lark	Vegetated Gypsum Dunes	Rangeland	R042XB003NM
40%-Peligro	Gyp Upland	Rangeland	R042XB006NM
LRH:			
70%-Lostpeak	Breaks	Rangeland	R070CY115NM
MCB:			
31%-McKittrick, occasionally flooded	Limestone Canyon	Rangeland	R070CY745TX
20%-McKittrick, frequently flooded	Gravelly	Rangeland	R070DY156NM
MPB:			
60%-Monahans	Sandy	Rangeland	R042XB012NM
21%-Pajarito	Sandy	Rangeland	R042XB012NM
PCG:			
32%-Pinery	Gravelly	Rangeland	R070DY156NM
27%-Choza	Shallow	Rangeland	R070DY152NM
20%-Altuda	Limestone Hills	Rangeland	R070DY151NM

Table 10.--Ecological Site--Soil Correlation--Continued

Map unit symbol soil percent (%) and soil name	Ecological site name	Ecological site type	Ecological site ID
VLG:			
51%-Victorio	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora	Forestland	F070CY020TX
33%-Lozen	Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia	Forestland	F070CY021TX
VLH:			
35%-Victorio, 60 to 95 percent slopes	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora	Forestland	F070CY020TX
25%-Lozen	Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia	Forestland	F070CY021TX
20%-Victorio, 40 to 60 percent slopes	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora	Forestland	F070CY020TX
20%-Victorio, 40 to 60 percent slopes	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora	Forestland	F070CY020TX

Table 11.--Mean Annual Precipitation (MAP), Landscape, Parent Material, and Ecological Site Identification

(Miscellaneous non-soil components are not displayed in this report. Component percents may not add up to 100 percent)

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Meters	mm				
BDG:								
Biduya	42	10-25	1,832-2,441	330-381	Mountains	Hill	Residuum weathered from limestone and sandstone gravelly colluvium derived from limestone and sandstone	Shallow Limestone, R070CY102NM
Desario	28	20-50	1,832-2,441	330-381	Mountains	Hill	Residuum weathered from limestone and sandstone gravelly colluvium derived from limestone and sandstone	Shallow Limestone, R070CY102NM
BRG:								
Bissett	45	15-60	1,192-2,111	254-381	Hills	Hillslope	Gravelly residuum weathered from limestone	Limestone Hill & Mountain (Desert Grassland), R042XC249TX
BSG:								
Bonespring	63	10-60	1,346-2,461	287-523	Mountains	Ridge	Slope alluvium and/or residuum weathered from limestone and sandstone	Sandstone Hill, R070DY749TX
CAD:								
Chispa	50	2-9	1,121-1,377	254-381	Hills	Fan	Loamy alluvium derived from limestone and dolomite	Gravelly (Desert Grassland), R042XC244TX
Tenneco	33	2-5	1,121-1,377	254-381	Hills	Alluvial fan	Loamy alluvium derived from limestone and dolomite	Loamy, R042XC007NM

Table 11.--Mean Annual Precipitation (MAP), Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Meters	mm				
CCD:								
Chilicotal	51	3-13	1,142-1,724	254-381	Piedmont	Fan remnant	Gravelly alluvium derived from limestone and dolomite	Gravelly (Desert Grassland), R042XC244TX
Chispa	28	3-13	1,142-1,724	254-381	Piedmont	Fan remnant	Gravelly alluvium derived from limestone and dolomite	Gravelly (Desert Grassland), R042XC244TX
COC:								
Copia	90	2-7	1,108-1,181	150-319	Basin floor	Dune	Eolian sands	Deep Sand, R042XB011NM
CPB:								
Corvus	43	1-5	1,104-1,123	150-319	Basin	Relict stabilized gypsum dune on basin floor	Gypsiferous loamy eolian deposits	Gyp outcrop, R042XB007NM
Peligro	27	1-5	1,104-1,123	150-319	Basin	Relict playa dune on basin floor	Gypsiferous eolian deposits	Gyp Upland, R042XB006NM
LAD:								
Lazarus	80	2-9	1,834-2,104	508-660	Mountains	Valley floor on canyon Valley side on canyon	Alluvium derived from limestone and dolomite	Loamy, R070CY109NM
LPC:								
Lark	50	5-8	1,106-1,130	150-319	Basin	Dune field	Gypseous eolian sands	Vegetated Gypsum Dunes, R042XB003NM
Peligro	40	1-8	1,106-1,130	150-319	Basin	Interdune	Gypsiferous eolian deposits	Gyp Upland, R042XB006NM
LRH:								
Lostpeak	70	40-95	1,426-2,647	330-381	Mountains	Escarpment	Residuum weathered from limestone	Breaks, R070CY115NM

Table 11.--Mean Annual Precipitation (MAP), Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Meters	mm				
MCB:								
McKittrick, occasionally flooded	31	0-3	1,511-1,960	508-660	Canyonlands	Flood-plain step on valley floor	Gravelly alluvium derived from limestone and dolomite	Limestone Canyon, R070CY745TX
McKittrick, frequently flooded	20	0-3	1,511-1,960	508-660	Canyonlands	Flood-plain step on valley floor	Gravelly alluvium derived from limestone and dolomite	Limestone Canyon, R070CY745TX
MPB:								
Monahans	60	0-5	1,108-1,237	150-319	Piedmont	Alluvial fan	Calcareous and gypsiferous coarse-loamy alluvium	Sandy, R042XB012NM
Pajarito	21	0-5	1,108-1,237	150-319	Piedmont	Alluvial fan	Eolian sands and/or alluvium derived from limestone and sandstone	Sandy, R042XB012NM
PCG:								
Pinery	32	5-20	1,370-1,995	287-523	Piedmont	Alluvial fan	Gravelly alluvium derived from limestone and dolomite	Gravelly, R070DY156NM
Choza	27	5-20	1,370-1,995	287-523	Piedmont	Fan remnant	Gravelly alluvium derived from limestone and dolomite	Shallow, R070DY152NM
Altuda	20	10-60	1,370-1,995	287-523	Hills	Hillslope	Residuum weathered from limestone	Limestone Hills, R070DY151NM

Table 11.--Mean Annual Precipitation (MAP), Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Meters	mm				
VLG:								
Victorio----------	51	25-60	1,911-2,632	508-660	Mountains	Mountain slope	Colluvium and residuum weathered from limestone and dolomite	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora, F070CY020TX
						Ridge		
Lozen----------	33	10-45	1,911-2,632	508-660	Mountains	Mountain slope	Colluvium and residuum weathered from limestone and dolomite	Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia, F070CY021TX
						Ridge		
VLH:								
Victorio, 60 to 95 percent slopes----	35	60-95	1,548-2,664	508-660	Mountains	Mountain slope	Colluvium and residuum weathered from limestone and dolomite	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora, F070CY020TX
						Ridge		
Lozen----------	25	40-95	1,548-2,664	508-660	Mountains	Mountain slope	Colluvium and residuum weathered from limestone and dolomite	Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia, F070CY021TX
						Ridge		

Table 11.--Mean Annual Precipitation (MAP), Landscape, Parent Material, and Ecological Site Identification--Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Meters	mm				
VLH:								
Victorio, 40 to 60 percent slopes----	20	40-60	1,548-2,664	508-660	Mountains	Mountain slope	Colluvium and residuum weathered from limestone and dolomite	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora, F070CY020TX
						Ridge		

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities

(Absence of a composition percent indicates trace amounts of that species)

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
BDG:						
Biduya----------	Shallow Limestone (R070CY102NM)	Favorable	1,450	New Mexico muhly		15
		Normal	1,000	pine muhly		15
		Unfavorable	650	New Mexico Feathergrass		10
				curlyleaf muhly		10
				green spangletop		5
				plains lovegrass		5
				true mountain mahogany		5
				sacahuista		5
				wavyleaf oak		5
				pinyon pine		3
				oneseed juniper		2
				other perennial grasses		10
				other shrubs		5
				other forbs		5
Desario---------	Shallow Limestone (R070CY102NM)	Favorable	1,450	New Mexico muhly		15
		Normal	1,000	Metcalfe's muhly		15
		Unfavorable	650	New Mexico Feathergrass		10
				curlyleaf muhly		10
				green spangletop		5
				plains lovegrass		5
				true mountain mahogany		5
				sacahuista		5
				wavyleaf oak		5
				pinyon pine		3
				oneseed juniper		2
				other perennial grasses		10
				other shrubs		5
				other forbs		5
Rock outcrop----	---	Favorable	---			
		Normal	---			
		Unfavorable	---			

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
BRG:						
Bissett---------	Limestone Hill and Mountain (Desert Grassland) (R042XC249TX)	Favorable	740	black grama		25
		Normal	635	sideoats grama		15
		Unfavorable	555	Arizona cottontop		10
				Aristida		5
				slim tridens		5
				Hall panicum		5
				mariola		2
				ocotillo		2
				lechuguilla		2
				green sotol		2
				range ratany		2
				rough menodora		1
				other perennial grasses		10
				other shrubs		5
				other forbs		9
Rock outcrop----	---	Favorable	---			
		Normal	---			
		Unfavorable	---			
BSG:						
Bonespring------	Sandstone Hill (R070DY749TX)	Favorable	1,200	black grama		20
		Normal	900	sideoats grama		10
		Unfavorable	600	Warnock's grama		10
				blue grama		10
				hairy grama		5
				New Mexico Feathergrass		5
				sand dropseed		5
				skeletonleaf goldeneye		2
				winterfat		2
				true mountain mahogany		2
				desert ceanothus		2
				feather dalea		1
				cholla		1
				other perennial grasses		10
				other annual forbs		10
				other shrubs		5
Rock outcrop----	---	Favorable	---			
		Normal	---			
		Unfavorable	---			

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
CAD:						
Chispa----------	Gravelly (Desert Grassland) (R042XC244TX)	Favorable	880	black grama		15
		Normal	660	bush muhly		12
		Unfavorable	440	sideoats grama		10
				Arizona cottontop		8
				slim tridens		5
				sand dropseed		5
				creosotebush		10
				littleleaf ratany		2
				mariola		2
				rough menodora		2
				other perennial grasses		10
				other shrubs		11
				other forbs		8
Tenneco---------	Loamy (R042XC007NM)	Favorable	1,200	tobosa		30
		Normal	925	blue grama		20
		Unfavorable	650	black grama		10
				burrograss		10
				sideoats grama		5
				bristlegrass		5
				tarbush		1
				western honey mesquite		1
				globemallow		1
				other perennial grasses		10
				other shrubs		2
				other forbs		5
CCD:						
Chilicotal------	Gravelly (Desert Grassland) (R042XC244TX)	Favorable	880	black grama		15
		Normal	660	bush muhly		12
		Unfavorable	440	sideoats grama		10
				Arizona cottontop		8
				slim tridens		5
				sand dropseed		5
				creosotebush		10
				littleleaf ratany		2
				mariola		2
				rough menodora		2
				other perennial grasses		10
				other shrubs		11
				other forbs		8

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
Chispa----------	Gravelly (Desert Grassland) (R042XC244TX)	Favorable	880	black grama		15
		Normal	660	bush muhly		12
		Unfavorable	440	sideoats grama		10
				Arizona cottontop		8
				slim tridens		5
				sand dropseed		5
				creosotebush		10
				littleleaf ratany		2
				mariola		2
				rough menodora		2
				other perennial grasses		10
				other shrubs		11
				other forbs		8
COC:						
Copia----------	Deep Sand (R042XB011NM)	Favorable	600	giant dropseed		30
		Normal	388	mesa dropseed		15
		Unfavorable	175	sand dropseed		5
				spike dropseed		5
				other annual forbs		5
				perennial forbs		8
				sand sagebrush		5
				broom dalea		5
				soaptree yucca		3
				longleaf jointfir		3
CPB:						
Corvus----------	Gyp outcrop (R042XB007NM)	Favorable	300	gyp grama		25
		Normal	200	gyp dropseed		15
		Unfavorable	100	rough coldenia		25
				fourwing saltbush		5
				Torrey's jointfir		3
				gyp moonpod		2
				other perennial grasses		5
				other shrubs		7
				other forbs		13

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
Peligro---------	Gyp Upland (R042XB006NM)	Favorable	800	alkali sacaton		35
		Normal	588	gyp dropseed		10
		Unfavorable	375	gyp grama		10
				bristlegrass		5
				sand dropseed		5
				fourwing saltbush		10
				Torrey's jointfir		1
				rough coldenia		1
				other perennial grasses		10
				other shrubs		3
				other forbs		10
LAD:						
Lazarus---------	Loamy (R070CY109NM)	Favorable	1,800	western wheatgrass		15
		Normal	1,300	blue grama		15
		Unfavorable	800	sideoats grama		10
				Texas needlegrass		10
				little bluestem		10
				New Mexico Feathergrass		5
				wolftail		3
				vine mesquite		2
				bottlebrush squirreltail		2
				agarito		2
				cholla		1
				oneseed juniper		1
				other perennial grasses		8
				other shrubs		6
				other forbs		10
LPC:						
Lark----------	Vegetated Gypsum Dunes (R042XB003NM)	Favorable	465	gyp grama		25
		Normal	315	Indian ricegrass		5
		Unfavorable	155	rosemary mint		20
				soaptree yucca		12
				fourwing saltbush		12
				Torrey's jointfir		5
				rough coldenia		5
				other perennial grasses		2
				other forbs		10
				other shrubs		4

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
Peligro---------	Gyp Upland (R042XB006NM)	Favorable	800	alkali sacaton		35
		Normal	588	gyp dropseed		10
		Unfavorable	375	gyp grama		10
				bristlegrass		5
				sand dropseed		5
				fourwing saltbush		10
				Torrey's jointfir		1
				rough coldenia		1
				other perennial grasses		10
				other shrubs		3
				other forbs		10
LRH:						
Lostpeak--------	Breaks (R070CY115NM)	Favorable	1,400	New Mexico muhly		10
		Normal	900	plains lovegrass		5
		Unfavorable	400	cane bluestem		5
				New Mexico Feathergrass		5
				bullgrass		5
				wavyleaf oak		20
				green sotol		10
				true mountain mahogany		5
				desert ceanothus		5
				evergreen sumac		5
				Damianita		2
				skeletonleaf goldeneye		2
				other shrubs		6
				other perennial grasses		5
				other forbs		5
Rock outcrop----	---	Favorable	---			
		Normal	---			
		Unfavorable	---			

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
MCB:						
McKittrick------	Limestone Canyon (R070CY745TX)	Favorable	2,500	little bluestem		5
		Normal	2,100	big bluestem		5
		Unfavorable	1,700	yellow Indiangrass		5
				pine muhly		5
				bullgrass		5
				sideoats grama	0	5
				pinyon ricegrass	0	2
				apache plume		3
				bigtooth maple		10
				little walnut		5
				ponderosa pine		5
				chinquapin oak		5
				madrone		5
				other perennial grasses		12
				green sotol		2
				other shrubs		10
				other trees		10
				other forbs		5
McKittrick------	Gravelly (R070DY156NM)	Favorable	1,400	sideoats grama		20
		Normal	---	black grama		15
		Unfavorable	400	juniper		10
				little bluestem		10
				mountain muhly		10
				New Mexico Feathergrass		10
				other shrubs		10
				other perennial forbs		5
				other perennial grasses		5
				twoneedle pinyon		5
Riverwash-------	---	Favorable	---			
		Normal	---			
		Unfavorable	---			

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
MPB:						
Monahans--------	Sandy (R042XB012NM)	Favorable	650	black grama		25
		Normal	438	sand dropseed		6
		Unfavorable	225	spike dropseed		6
				mesa dropseed		6
				bush muhly		10
				Arizona cottontop		5
				soaptree yucca		4
				longleaf jointfir		4
				broom dalea		2
				croton		2
				other perennial grasses		18
				other shrubs		2
				other forbs		10
Pajarito--------	Sandy (R042XB012NM)	Favorable	650	black grama		25
		Normal	438	sand dropseed		6
		Unfavorable	225	spike dropseed		6
				mesa dropseed		6
				bush muhly		10
				Arizona cottontop		5
				soaptree yucca		4
				longleaf jointfir		4
				broom dalea		2
				croton		2
				other perennial grasses		18
				other shrubs		2
				other forbs		10
PCG:						
Altuda----------	Limestone Hills (R070DY151NM)	Favorable	1,000	sideoats grama		10
		Normal	800	curlyleaf muhly		10
		Unfavorable	500	blue grama		10
				black grama		5
				hairy grama		5
				New Mexico Feathergrass		5
				wavyleaf oak		5
				redberry juniper		5
				desert ceanothus		3
				true mountain mahogany		3
				pinyon pine		5
				other shrubs		5
				other perennial grasses		15
				other forbs		10

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
Pinery----------	Gravelly (R070DY156NM)	Favorable	1,200	sideoats grama		20
		Normal	900	cane bluestem		15
		Unfavorable	700	blue grama		10
				little bluestem		10
				New Mexico Feathergrass		10
				redberry juniper		5
				skunkbush sumac		3
				pinyon pine		3
				gray oak		2
				other perennial grasses		5
				other shrubs		7
				other forbs		10
Choza----------	Shallow (R070DY152NM)	Favorable	900	curlyleaf muhly		15
		Normal	700	blue grama		10
		Unfavorable	400	black grama		10
				sideoats grama		10
				hairy grama		5
				slim tridens		5
				wavyleaf oak		5
				redberry juniper		5
				feathery dalea		1
				sacahuista		2
				pricklypear		2
				pinyon pine		2
				other perennial grasses		10
				other shrubs		10
				other forbs		8
VLG:						
Victorio--------	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora (F070CY020TX)	Favorable	0			
		Normal	0			
		Unfavorable	0			

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
Lozen----------	Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia (F070CY021TX)	Favorable	3,000	little bluestem	0	10
		Normal	2,500	yellow Indiangrass	0	10
		Unfavorable	2,000	mountain muhly	0	10
				pine muhly		10
				Arizona fescue		5
				pinyon ricegrass		2
				New Mexico muhly	0	3
				ponderosa pine	0	15
				alligator juniper	0	10
				pinyon pine	0	2
				oneseed juniper	0	2
				desert rose		1
				wavyleaf oak	0	2
				cliff fendlerbush	0	1
				other trees		1
				other perennial grasses		12
				other shrubs		1
				other perennial forbs		3
Rock outcrop----	---	Favorable	---			
		Normal	---			
		Unfavorable	---			

Table 12.--Rangeland and Forest Understory Productivity with Existing Plant Communities--Continued

Map symbol and soil name	Ecological site (number)	Total production		Existing vegetation	Composition	
		Kind of year	Dry weight		Forest	Range
			Lb/acre		Pct	Pct
VLH:						
Victorio	Pseudotsuga menziesii var. glauca-Quercus gambelii/Amelanchier utahensis-Fendlera rupicola/Muhlenbergia pauciflora (F070CY020TX)	Favorable	0			
		Normal	0			
		Unfavorable	0			
Lozen	Pinus ponderosa var. scopulorum-Pinus edulis/Quercus undulata-Cercocarpus montanus/Muhlenbergia dubia (F070CY021TX)	Favorable	0	little bluestem	0	10
		Normal	0	yellow Indiangrass	0	10
		Unfavorable	0	mountain muhly	0	10
				pine muhly		10
				Arizona fescue		5
				pinyon ricegrass		2
				New Mexico muhly	0	3
				ponderosa pine	0	15
				alligator juniper	0	10
				pinyon pine	0	2
				oneseed juniper	0	2
				desert rose		1
				wavyleaf oak	0	2
				cliff fendlerbush	0	1
				other trees		1
				other perennial grasses		12
				other shrubs		1
				other perennial forbs		3
Rock outcrop	---	Favorable	---			
		Normal	---			
		Unfavorable	---			

Table 13.--Forestland Productivity

(Only map units with information are provided in this table)

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			cu ft/ac	
BSG:				
Bonespring	---	---	---	juniper, pinyon
Rock outcrop	---	---	---	---
VLG:				
Victorio	Douglas fir	---	---	---
	ponderosa pine	65	51	
Lozen	ponderosa pine	60	46	---
Rock outcrop	---	---	---	---
VLH:				
Victorio, 60 to 95 percent slopes	---	---	---	---
Victorio, 40 to 60 percent slope	Douglas fir	---	---	---
	ponderosa pine	65	51	
Lozen	ponderosa pine	60	46	---
Rock outcrop	---	---	---	---

Table 14.--Common Name and Scientific Nomenclature of Plants within Guadalupe Mountains National Park

Common Name	Scientific Name
alkali sacaton	*Sporobolus airodes*
alligator juniper	*Juniperus deppeana*
apache plume	*Fallugia paradoxa*
Arizona fescue	*Festuca arizonica*
big bluestem	*Andropogon gerardii* var. chrysocomus
bigtooth maple	*Acer grandidentatum*
black grama	*Bouteloua eriopoda*
blue grama	*Bouteloua gracilis*
broom dalea	*Psorothamnus scoparius*
bull muhly	*Muhlenbergia emersleyi*
burrograss	*Scleropogon brevifolous*
bush muhly	*Muhlenbergia porteri*
cane bluestem	*Bothriochloa barbinodis*
catclaw mimosa	*Mimosa aculeaticarpa*
chinkapin oak	*Quercus muehlenbergii*
cholla	*Cylindropuntia imbricata*
cliff fendlerbush	*Fendlera rupicola*
creosote bush	*Larrea tridentata*
croton	*Croton* spp.
curlyleaf muhly	*Muhlenbergia setifolia*
desert ceanothus	*Ceanothus greggiii*
finestem needlegrass	*Nassella tenuis*
fourwing saltbush	*Atriplex canescens*
fragrant sumac	*Rhus aromatica*
frosted mint	*Poliomintha incana*
Gambel oak	*Quercus gambelii*
giant dropseed	*Sporobolus giganteus*
Gregg's coldenia	*Tiquilia greggii*
gyp coldenia	*Tiquilia hispidissima*
gyp dropseed	*Sporobolus nealleyi*
gyp grama	*Bouteloua breviseta*
gyp moonpod	*Selinocarpus lanceolatus*
hairy grama	*Bouteloua hirsuta*
hoptree	*Ptelea trifoliata*
Indian ricegrass	*Achnatherum hymenoides*
mesa dropseed	*Sporobolus flexuosus*
mountain mahogany	*Cercocarpus montanus*
New Mexico agave	*Agave parryi* ssp. *neomexicana*
New Mexico feathergrass	*Hesperostipa neomexicana*
New Mexico muhly	*Muhlenbergia pauciflora*
nodding brome	*Bromus anomalus*
oaks	*Quercus* spp.
ocotillo	*Fouquieria splendens*
oneseed juniper	*Juniperus monosperma*
pine muhly	*Muhlenbergia dubia*
pinyon pine	*Pinus edulis*
pinyon ricegrass	*Piptochaetium fimbriatum*
plains bristlegrass	*Seteria leucopila*
plains lovegrass	*Eragrostis intermedia*
ponderosa pine	*Pinus ponderosa var. scopulorum*
pricklypear	*Opuntia* spp.
range rantany	*Krameria erecta*
redberry juniper	*Juniperus pinchotii*
rough ephedra	*Ephedra aspera*
sacahuista	*Nolina texana*
sedges	*Carex* spp.
sideoats grama	*Bouteloua curtipendula*
skeletonleaf goldeneye	*Viguiera stenoloba*
slim tridens	*Tridens muticus*
soaptree yucca	*Yuccal elata*
sotol	*Dasylirion leiophyllum*
southwestern white pine	*Pinus strobiformis*
spike dropseed	*Sporobolus contractus*
tasajillo	*Cylindropuntia leptocaulis*
threeawns	*Aristida* spp.
tobosa	*Pleuraphis mutica*
Utah serviceberry	*Amelanchier utahensis*
velvet ash	*Fraxinus velutina*
Warnock's grama	*Bouteloua warnockii*
wavyleaf oak	*Quercus pungens*

Table 14.--Common Name and Scientific Nomenclature of Plants within Guadalupe Mountains National Park--Continued

Common Name	Scientific Name	Common Name	Scientific Name
Knowlton hophornbeam	*Ostrya knowltonii*	western honey mesquite	*Prosopis glandulosa* var. torreyana
lechuguilla	*Agave lechuguilla*	western wheatgrass	*Pascopyrum smithii*
little bluestem	*Schizachyrium scoparium*	winterfat	*Krascheninnikovia lanata*
madrone	*Arbutus xalapensis*	wolftail	*Lycurus phleoides*
mariola	*Parthenium incanum*	yellow Indiangrass	*Sorghastrum nutans*

Table 15.--Camp and Picnic Areas

(The information in this table indicates the dominant soil condition but does Not eliminate the need for onsite investigation. The numbers in the value Columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Large stones	0.16	Large stones	0.16
		content		content	
		Dusty	0.50	Dusty	0.50
Desario	28	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Tenneco	33	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
CCD:					
Chilicotal	51	Somewhat limited		Somewhat limited	
		Slope	0.04	Slope	0.04
		Dusty	0.50	Dusty	0.50
Chispa	28	Somewhat limited		Somewhat limited	
		Slope	0.04	Slope	0.04
		Dusty	0.50	Dusty	0.50
COC:					
Copia	90	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00

Table 15.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
CPB:					
Corvus	43	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Dusty	0.50	Dusty	0.50
Peligro	27	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
LAD:					
Lazarus	80	Not limited		Not limited	
LPC:					
Lark	50	Not limited		Not limited	
Peligro	40	Somewhat limited		Somewhat limited	
		Too sandy	0.68	Too sandy	0.68
LRH:					
Lostpeak	70	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Very limited		Not limited	
		Flooding	1.00		
McKittrick, frequently flooded	20	Very limited		Somewhat limited	
		Flooding	1.00	Flooding	0.40
Riverwash	22	Not rated		Not rated	
MPB:					
Monahans	60	Not limited		Not limited	
Pajarito	21	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
PCG:					
Altuda	20	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.06	Gravel	0.06
		Dusty	0.50	Dusty	0.50
Pinery	32	Somewhat limited		Somewhat limited	
		Slope	0.96	Slope	0.96
		Gravel	0.09	Gravel	0.09
		Dusty	0.50	Dusty	0.50

Table 15.--Camp and Picnic Areas--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Choza	27	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Slope	0.96	Slope	0.96
		Gravel	0.34	Gravel	0.34
		Dusty	0.50	Dusty	0.50
VLG:					
Victorio	51	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
Lozen	33	Very limited		Very limited	
		Gravel	1.00	Gravel	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00
Rock outcrop	12	Not rated		Not rated	
VLH:					
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.39	Gravel	0.39
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Gravel	0.39	Gravel	0.39
Lozen	25	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Large stones content	0.96	Large stones content	0.96
Rock outcrop	20	Not rated		Not rated	

Table 16.--Trail Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Somewhat limited		Somewhat limited	
		Large stones content	0.16	Large stones content	0.16
		Dusty	0.50	Dusty	0.50
Desario	28	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.78
		Dusty	0.50	Dusty	0.50
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
		Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Tenneco	33	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
CCD:					
Chilicotal	51	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Chispa	28	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
		Dusty	0.50	Dusty	0.50
COC:					
Copia	90	Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00
CPB:					
Corvus	43	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Peligro	27	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50

Table 16.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
LAD:					
Lazarus	80	Not limited		Not limited	
LPC:					
Lark	50	Not limited		Not limited	
Peligro	40	Somewhat limited		Somewhat limited	
		Too sandy	0.68	Too sandy	0.68
LRH:					
Lostpeak	70	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Not limited		Not limited	
McKittrick, frequently flooded	20	Somewhat limited		Somewhat limited	
		Flooding	0.40	Flooding	0.40
Riverwash	22	Not rated		Not rated	
MPB:					
Monahans	60	Not limited		Not limited	
Pajarito	21	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
PCG:					
Altuda	20	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Dusty	0.50	Dusty	0.50
Pinery	32	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
Choza	27	Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50
VLG:					
Victorio	51	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Lozen	33	Very limited		Not limited	
		Slope	1.00		
Rock outcrop	12	Not rated		Not rated	

Table 16.--Trail Management--Continued

Map symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
VLH:					
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited	
		Slope	1.00	Slope	1.00
Lozen	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Large stones content	0.96	Large stones content	0.96
Rock outcrop	20	Not rated		Not rated	

Table 17.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines

(The information in this table indicates the dominant soil condition but does not eliminate the need For onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants		Upland Desertic Shrubs and Trees		Upland Shrubs and Vines	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Biduya	42	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.07	Too gravelly, cobbly, or stony	0.07	Too gravelly, cobbly, or stony	0.07
		Droughty	0.50	Droughty	0.50	Droughty	0.50
Desario	28	Somewhat limited		Somewhat limited		Somewhat limited	
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.11
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Bissett	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.14
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.11	Too gravelly, cobbly, or stony	0.11	Too gravelly, cobbly, or stony	0.11
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.08
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Not limited		Not limited		Not limited	
Tenneco	33	Not limited		Not limited		Not limited	
CCD:							
Chilicotal	51	Not limited		Not limited		Not limited	
Chispa	28	Not limited		Not limited		Not limited	
COC:							
Copia	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Sandy surface	0.60	Sandy surface	0.60	Sandy surface	0.60
CPB:							
Corvus	43	Not limited		Not limited		Somewhat limited	
						Cemented pan	0.62
Peligro	27	Not limited		Not limited		Not limited	
LAD:							
Lazarus	80	Not limited		Not limited		Not limited	

Table 17.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants		Upland Desertic Shrubs and Trees		Upland Shrubs and Vines	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LPC:							
Lark	50	Somewhat limited Sandy surface	 0.40	Somewhat limited Sandy surface	 0.40	Somewhat limited Sandy surface	 0.40
Peligro	40	Somewhat limited Sandy surface	 0.60	Somewhat limited Sandy surface	 0.60	Somewhat limited Sandy surface	 0.60
LRH:							
Lostpeak	70	Somewhat limited Droughty Too gravelly, cobbly, or stony	 0.50 0.02	Somewhat limited Droughty Too gravelly, cobbly, or stony	 0.50 0.02	Somewhat limited Droughty Too gravelly, cobbly, or stony Bedrock	 0.50 0.02 0.02
Rock outcrop	25	Not rated		Not rated		Not rated	
MCB:							
McKittrick, occasionally flooded	31	Not limited		Not limited		Not limited	
McKittrick, frequently flooded	20	Not limited		Not limited		Not limited	
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Not limited		Not limited		Not limited	
Pajarito	21	Not limited		Not limited		Not limited	
PCG:							
Altuda	20	Somewhat limited Droughty	 0.50	Somewhat limited Droughty	 0.50	Somewhat limited Droughty Bedrock	 0.50 0.08
Pinery	32	Not limited		Not limited		Not limited	
Choza	27	Somewhat limited Droughty	 0.50	Somewhat limited Droughty	 0.50	Somewhat limited Cemented pan Droughty	 0.94 0.50
VLG:							
Victorio	51	Somewhat limited Droughty	 0.50	Somewhat limited Droughty	 0.50	Somewhat limited Droughty Bedrock	 0.50 0.07
Lozen	33	Somewhat limited Droughty Too gravelly, cobbly, or stony	 0.50 0.02	Somewhat limited Droughty Too gravelly, cobbly, or stony	 0.50 0.02	Somewhat limited Droughty Too gravelly, cobbly, or stony	 0.50 0.02
Rock outcrop	12	Not rated		Not rated		Not rated	

Table 17.--Upland Native Herbaceous Plants, Upland Desertic Shrubs and Trees, and Upland Shrubs and Vines--Continued

Map symbol and soil name	Pct. of map unit	Upland Native Herbaceous Plants		Upland Desertic Shrubs and Trees		Upland Shrubs and Vines	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
VLH:							
Victorio, 60 to 95 percent slope	35	Not limited		Not limited		Somewhat limited	
						Bedrock	0.25
Victorio, 40 to 60 percent slope	20	Not limited		Not limited		Somewhat limited	
						Bedrock	0.25
Lozen	25	Somewhat limited		Somewhat limited		Somewhat limited	
		Too gravelly, cobbly, or stony	0.26	Too gravelly, cobbly, or stony	0.26	Too gravelly, cobbly, or stony	0.26
		Droughty	0.50	Droughty	0.50	Droughty	0.50
						Bedrock	0.27
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 18.--Upland Deciduous Trees and Upland Coniferous Trees

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees		Upland Coniferous Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Too arid	0.50
Desario	28	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	0.50		
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	1.00		
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	1.00		
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Very limited		Not limited	
		Too arid	1.00		
Tenneco	33	Very limited		Not limited	
		Too arid	1.00		
CCD:					
Chilicotal	51	Very limited		Somewhat limited	
		Too arid	1.00	Droughty	0.05
		Droughty	0.05		
Chispa	28	Very limited		Not limited	
		Too arid	1.00		
COC:					
Copia	90	Somewhat limited		Somewhat limited	
		Droughty	0.92	Droughty	0.92

Table 18.--Upland Deciduous Trees and Upland Coniferous Trees--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees		Upland Coniferous Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
CPB:					
Corvus	43	Very limited		Very limited	
		Cemented pan	1.00	Cemented pan	1.00
		Droughty	0.81	Droughty	0.81
Peligro	27	Not limited		Not limited	
LAD:					
Lazarus	80	Somewhat limited		Not limited	
		Too arid	0.50		
LPC:					
Lark	50	Somewhat limited		Somewhat limited	
		Droughty	0.92	Droughty	0.92
Peligro	40	Not limited		Not limited	
LRH:					
Lostpeak	70	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	1.00	Too arid	0.50
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Too arid	0.50		
McKittrick, frequently flooded-	20	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Too arid	0.50		
Riverwash	22	Not rated		Not rated	
MPB:					
Monahans	60	Not limited		Not limited	
Pajarito	21	Not limited		Not limited	
PCG:					
Altuda	20	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	0.50		
Pinery	32	Very limited		Somewhat limited	
		Too arid	1.00	Too arid	0.50

Table 18.--Upland Deciduous Trees and Upland Coniferous Trees--Continued

Map symbol and soil name	Pct. of map unit	Upland Deciduous Trees		Upland Coniferous Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Choza	27	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Cemented pan	1.00	Cemented pan	1.00
		Too arid	0.50		
VLG:					
Victorio	51	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	0.50		
Lozen	33	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	0.50		
Rock outcrop	12	Not rated		Not rated	
VLH:					
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00
		Droughty	0.88	Droughty	0.88
		Too arid	0.50		
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited	
		Bedrock	1.00	Bedrock	1.00
		Droughty	0.88	Droughty	0.88
		Too arid	0.50		
Lozen	25	Very limited		Very limited	
		Droughty	1.00	Droughty	1.00
		Bedrock	1.00	Bedrock	1.00
		Too arid	0.50		
Rock outcrop	20	Not rated		Not rated	

Table 19.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants		Riparian Shrubs, Vines, and Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.27		
Desario	28	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.42		
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
Tenneco	33	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
CCD:					
Chilicotal	51	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.05

Table 19.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants		Riparian Shrubs, Vines, and Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Chispa	28	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
COC:					
Copia	90	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.92
		Too sandy	0.50		
CPB:					
Corvus	43	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.81
Peligro	27	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
LAD:					
Lazarus	80	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
LPC:					
Lark	50	Very limited		Very limited	
		Too sandy	1.00	Too dry	1.00
		Too dry	1.00	Droughty	0.92
		Infrequent flooding	1.00		
Peligro	40	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
		Too sandy	0.50		
LRH:					
Lostpeak	70	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.08		
Rock outcrop	25	Not rated		Not rated	

Table 19.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants		Riparian Shrubs, Vines, and Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MCB:					
McKittrick, occasionally flooded	31	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	1.00
McKittrick, frequently flooded-	20	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
				Droughty	1.00
Riverwash	22	Not rated		Not rated	
MPB:					
Monahans	60	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
Pajarito	21	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
PCG:					
Altuda	20	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Pinery	32	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00		
Choza	27	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.01		
VLG:					
Victorio	51	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
Lozen	33	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.08		

Table 19.--Riparian Herbaceous Plants and Riparian Shrubs, Vines, and Trees--Continued

Map symbol and soil name	Pct. of map unit	Riparian Herbaceous Plants		Riparian Shrubs, Vines, and Trees	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Rock outcrop--------	12	Not rated		Not rated	
VLH:					
Victorio, 60 to 95 percent slopes-----	35	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.88
Victorio, 40 to 60 percent slopes-----	20	Very limited		Very limited	
		Too dry	1.00	Too dry	1.00
		Infrequent flooding	1.00	Droughty	0.88
Lozen---------------	25	Very limited		Very limited	
		Too dry	1.00	Droughty	1.00
		Infrequent flooding	1.00	Too dry	1.00
		Too gravelly, cobbly, or stony	0.84		
Rock outcrop--------	20	Not rated		Not rated	

Table 20.--Dwellings and Small Commercial Buildings

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Dwellings without Basements		Dwellings with Basements		Small Commercial Buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Lazarus	4	Not rated		Not rated		Not rated	
Biduya	42	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
		Large stones	0.61	Large stones	0.61	Large stones	0.61
Desario	28	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Chispa	8	Not rated		Not rated		Not rated	
Bissett	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Not limited		Not limited		Somewhat limited	
						Slope	0.50
Tenneco	33	Not limited		Not limited		Somewhat limited	
						Slope	0.50
CCD:							
Chilicotal	51	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.04	Slope	0.04	Slope	1.00
Chispa	28	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.04	Slope	0.04	Slope	1.00

Table 20.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements		Dwellings with Basements		Small Commercial Buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
COC:							
Copia	90	Not limited		Not limited		Somewhat limited	
						Slope	0.12
CPB:							
Corvus	43	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00
				Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00
Peligro	27	Not limited		Not limited		Not limited	
LAD:							
Lazarus	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
LPC:							
Lark	50	Not limited		Not limited		Somewhat limited	
						Slope	0.12
Peligro	40	Not limited		Not limited		Somewhat limited	
						Slope	0.12
LRH:							
Lostpeak	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Rock outcrop	25	Not rated		Not rated		Not rated	
MCB:							
McKittrick, occasionally flooded	31	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Large stones	0.43	Large stones	0.43	Large stones	0.43
McKittrick, frequently flooded	20	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Large stones	0.43	Large stones	0.43	Large stones	0.43
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Not limited		Not limited		Not limited	
Pajarito	21	Not limited		Not limited		Not limited	

Table 20.--Dwellings and Small Commercial Buildings--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without Basements		Dwellings with Basements		Small Commercial Buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PCG:							
Altuda	20	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
Pinery	32	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.96	Slope	0.96	Slope	1.00
		Large stones	0.41	Large stones	0.41	Large stones	0.41
Choza	27	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00
		Slope	0.96	Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00
				Slope	0.96	Slope	1.00
VLG:							
Victorio	51	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	0.11	Large stones	0.11	Large stones	0.11
Lozen	33	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Too steep	1.00	Too steep	1.00	Depth to hard bedrock	1.00
Rock outcrop	12	Not rated		Not rated		Not rated	
VLH:							
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
Lozen	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Large stones	1.00	Large stones	1.00	Large stones	1.00
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 21.--Roads and Streets, Shallow Excavations, and Landscaping

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Biduya	42	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Large stones	1.00
		Large stones	0.61	Large stones	0.61	Droughty	1.00
		Frost action	0.50	Unstable excavation walls	0.50	Too steep	1.00
Desario	28	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Shrink-swell	0.50	Unstable excavation walls	0.10	Droughty	1.00
		Frost action	0.50			Large stones	0.03
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Bissett	45	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
				Unstable excavation walls	0.10	Droughty	1.00
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
				Unstable excavation walls	0.10	Too steep	1.00
						Gravel	1.00
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Somewhat limited		Somewhat limited		Very limited	
		Low strength	0.22	Unstable excavation walls	0.10	Too dense	1.00
						Large stones	0.01
Tenneco	33	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Unstable excavation walls	0.10		

Table 21.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CCD:							
Chilicotal	51	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.04	Unstable excavation walls	1.00	Droughty	0.06
				Slope	0.04	Slope	0.04
Chispa	28	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.04	Slope	0.04	Slope	0.04
				Unstable excavation walls	0.10		
COC:							
Copia	90	Not limited		Very limited		Somewhat limited	
				Unstable excavation walls	1.00	Droughty	0.92
CPB:							
Corvus	43	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to cemented pan	1.00
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Droughty	0.81
				Dense layer	0.50		
				Unstable excavation walls	0.10		
Peligro	27	Not limited		Somewhat limited		Not limited	
				Unstable excavation walls	0.10		
LAD:							
Lazarus	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Unstable excavation walls	0.10		
		Shrink-swell	0.50				
		Frost action	0.50				
LPC:							
Lark	50	Not limited		Very limited		Somewhat limited	
				Unstable excavation walls	1.00	Droughty	0.92
Peligro	40	Not limited		Somewhat limited		Not limited	
				Unstable excavation walls	0.10		
LRH:							
Lostpeak	70	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	0.50	Gravel	1.00
						Droughty	1.00
Rock outcrop	25	Not rated		Not rated		Not rated	

Table 21.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
MCB:							
McKittrick, occasionally flooded	31	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Large stones	0.43	Droughty	1.00
		Large stones	0.43	Flooding	0.60	Large stones	0.38
		Frost action	0.50	Unstable excavation walls	0.10	Flooding	0.60
McKittrick, frequently flooded	20	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Large stones	0.43	Flooding	1.00
		Large stones	0.43	Flooding	0.80	Droughty	1.00
		Frost action	0.50	Unstable excavation walls	0.10	Large stones	0.38
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Not limited		Somewhat limited		Not limited	
				Unstable excavation walls	0.10		
Pajarito	21	Not limited		Somewhat limited		Not limited	
				Unstable excavation walls	0.10		
PCG:							
Altuda	20	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Droughty	1.00
				Unstable excavation walls	0.10	Too steep	1.00
						Large stones	0.74
						Gravel	0.06
Pinery	32	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.96	Slope	0.96	Slope	0.96
		Large stones	0.41	Large stones	0.41	Large stones	0.54
				Unstable excavation walls	0.10	Gravel	0.09
Choza	27	Very limited		Very limited		Very limited	
		Depth to thick cemented pan	1.00	Depth to thick cemented pan	1.00	Depth to cemented pan	1.00
		Depth to thin cemented pan	1.00	Depth to thin cemented pan	1.00	Droughty	1.00
		Slope	0.96	Slope	0.96	Slope	0.96
				Unstable excavation walls	0.10	Gravel	0.34
						Large stones	0.38

Table 21.--Roads and Streets, Shallow Excavations, and Landscaping--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
VLG:							
Victorio	51	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Shrink-swell	1.00	Large stones	0.11	Droughty	1.00
		Low strength	0.78	Unstable excavation walls	0.10	Large stones	0.61
		Large stones	0.11				
Lozen	33	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Gravel	1.00
		Frost action	0.50	Unstable excavation walls	0.50	Droughty	1.00
						Too steep	1.00
Rock outcrop	12	Not rated		Not rated		Not rated	
VLH:							
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Shrink-swell	1.00	Unstable excavation walls	0.10	Gravel	0.39
		Low strength	0.78			Large stones	0.26
						Droughty	0.89
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Shrink-swell	1.00	Unstable excavation walls	0.10	Gravel	0.39
		Low strength	0.78			Large stones	0.26
						Droughty	0.89
Lozen	25	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Large stones	1.00	Large stones	1.00	Large stones	1.00
		Low strength	1.00	Unstable excavation walls	0.10	Droughty	1.00
		Frost action	0.50				
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 22.--Sewage Disposal

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields		Sewage Lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	0.61	Large stones	1.00
				Seepage	0.18
Desario	28	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.50
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.50
				Large stones	0.04
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.27
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Tenneco	33	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.92
				Seepage	0.50
CCD:					
Chilicotal	51	Somewhat limited		Very limited	
		Slow water movement	0.46	Slope	1.00
		Slope	0.04	Seepage	0.53
Chispa	28	Somewhat limited		Very limited	
		Slow water movement	0.50	Slope	1.00
		Slope	0.04	Seepage	0.50

Table 22.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields		Sewage Lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
COC:					
Copia	90	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.68
CPB:					
Corvus	43	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
				Seepage	0.50
Peligro	27	Not limited		Very limited	
				Seepage	1.00
LAD:					
Lazarus	80	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.32
LPC:					
Lark	50	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.68
Peligro	40	Not limited		Very limited	
				Seepage	1.00
				Slope	0.68
LRH:					
Lostpeak	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.27
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
		Large stones	0.43	Large stones	0.16
McKittrick, frequently flooded	20	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
		Large stones	0.43	Large stones	0.16
Riverwash	22	Not rated		Not rated	

Table 22.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields		Sewage Lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MPB:					
Monahans	60	Not limited		Very limited	
				Seepage	1.00
				Slope	0.08
Pajarito	21	Not limited		Very limited	
				Seepage	1.00
				Slope	0.08
PCG:					
Altuda	20	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.21
Pinery	32	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
		Large stones	0.41	Large stones	0.11
Choza	27	Very limited		Very limited	
		Depth to cemented pan	1.00	Depth to cemented pan	1.00
		Slope	0.96	Slope	1.00
VLG:					
Victorio	51	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Large stones	0.11	Large stones	0.97
Lozen	33	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
				Seepage	0.27
Rock outcrop	12	Not rated		Not rated	

Table 22.--Sewage Disposal--Continued

Map symbol and soil name	Pct. of map unit	Septic Tank Absorption Fields		Sewage Lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
VLH:					
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
Lozen	25	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Large stones	1.00	Large stones	1.00
				Seepage	0.50
Rock outcrop	20	Not rated		Not rated	

Table 23.--Source of Gravel and Sand

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Gravel Source		Sand Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:					
Biduya	42	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Desario	28	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Rock outcrop	18	Not rated		Not rated	
BRG:					
Bissett	45	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.15	Thickest layer	0.00
Rock outcrop	43	Not rated		Not rated	
BSG:					
Bonespring	63	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.72	Thickest layer	0.00
Rock outcrop	20	Not rated		Not rated	
CAD:					
Chispa	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Tenneco	33	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
CCD:					
Chilicotal	51	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Chispa	28	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
COC:					
Copia	90	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.90
		Thickest layer	0.00	Thickest layer	0.90

Table 23.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source		Sand Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
CPB:					
Corvus	43	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.02
Peligro	27	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LAD:					
Lazarus	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LPC:					
Lark	50	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.36
		Thickest layer	0.00	Bottom layer	0.43
Peligro	40	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LRH:					
Lostpeak	70	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.12	Thickest layer	0.00
Rock outcrop	25	Not rated		Not rated	
MCB:					
McKittrick, occasionally flooded	31	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
McKittrick, frequently flooded	20	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Riverwash	22	Not rated		Not rated	
MPB:					
Monahans	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Pajarito	21	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 23.--Source of Gravel and Sand--Continued

Map symbol and soil name	Pct. of map unit	Gravel Source		Sand Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
PCG:					
Altuda	20	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Pinery	32	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Choza	27	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
VLG:					
Victorio	51	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Lozen	33	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.12	Thickest layer	0.00
Rock outcrop	12	Not rated		Not rated	
VLH:					
Victorio, 60 to 95 percent slopes	35	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Victorio, 40 to 60 percent slopes	20	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Lozen	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	20	Not rated		Not rated	

Table 24.--Source of Reclamation Material, Roadfill, and Topsoil

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Reclamation Source		Roadfill Source		Topsoil Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Biduya	42	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Cobble content	0.00	Depth to bedrock	0.00
		Cobble content	0.39			Slope	0.00
Desario	28	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Slope	0.00
		Organic matter content low	0.68	Shrink-swell	0.87	Rock fragments	0.00
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Bissett	45	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
		Carbonate content	0.03	Cobble content	0.75	Slope	0.00
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
						Slope	0.00
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Fair		Fair		Fair	
		Water erosion	0.90	Low strength	0.78	Carbonate content	0.84
		Carbonate content	0.68			Hard to reclaim (rock fragments)	0.98
		Organic matter content low	0.88			Rock fragments	0.98
Tenneco	33	Fair		Poor		Fair	
		Water erosion	0.68	Low strength	0.00	Carbonate content	0.97
		Organic matter content low	0.50				
		Carbonate content	0.95				

Table 24.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source		Roadfill Source		Topsoil Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CCD:							
Chilicotal	51	Fair		Fair		Poor	
		Organic matter content low	0.18	Cobble content	0.99	Rock fragments	0.00
		Carbonate content	0.08			Hard to reclaim (rock fragments)	0.08
		Droughty	0.94			Carbonate content	0.21
Chispa	28	Fair		Good		Fair	
		Water erosion	0.99			Rock fragments	0.68
		Organic matter content low	0.88			Slope	0.96
		Carbonate content	0.99			Carbonate content	0.99
COC:							
Copia	90	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.50				
CPB:							
Corvus	43	Poor		Poor		Poor	
		Droughty	0.00	Depth to cemented pan	0.00	Depth to cemented pan	0.00
		Depth to cemented pan	0.00			Too sandy	0.96
		Water erosion	0.37				
Peligro	27	Fair		Good		Fair	
		Organic matter content low	0.18			Too sandy	0.99
		Water erosion	0.90				
		Too sandy	0.99				
LAD:							
Lazarus	80	Fair		Poor		Good	
		Water erosion	0.99	Low strength	0.00		
				Shrink-swell	0.90		
LPC:							
Lark	50	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.18				
Peligro	40	Poor		Good		Fair	
		Wind erosion	0.00			Too sandy	0.99
		Organic matter content low	0.18				
		Water erosion	0.68				

Table 24.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source		Roadfill Source		Topsoil Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LRH:							
Lostpeak	70	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
						Slope	0.00
Rock outcrop	25	Not rated		Not rated		Not rated	
MCB:							
McKittrick, occasionally flooded	31	Poor		Poor		Poor	
		Droughty	0.00	Cobble content	0.00	Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.18			Rock fragments	0.00
		Cobble content	0.27			Carbonate content	0.70
McKittrick, frequently flooded	20	Poor		Poor		Poor	
		Droughty	0.00	Cobble content	0.00	Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.18			Rock fragments	0.00
		Cobble content	0.27			Carbonate content	0.70
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Fair		Good		Good	
		Organic matter content low	0.32				
		Water erosion	0.99				
Pajarito	21	Fair		Good		Good	
		Organic matter content low	0.08				
		Water erosion	0.90				
PCG:							
Altuda	20	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Rock fragments	0.00
		Carbonate content	0.92	Cobble content	0.88	Slope	0.00
Pinery	32	Fair		Poor		Poor	
		Organic matter content low	0.18	Cobble content	0.00	Hard to reclaim (rock fragments)	0.00
		Cobble content	0.28			Rock fragments	0.00
						Slope	0.04
Choza	27	Poor		Poor		Poor	
		Droughty	0.00	Depth to cemented pan	0.00	Depth to cemented pan	0.00
		Depth to cemented pan	0.00			Rock fragments	0.00
						Slope	0.04

Table 24.--Source of Reclamation Material, Roadfill, and Topsoil--Continued

Map symbol and soil name	Pct. of map unit	Reclamation Source		Roadfill Source		Topsoil Source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
VLG:							
Victorio	51	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Slope	0.00
		Too clayey	0.00	Shrink-swell	0.06	Too clayey	0.00
Lozen	33	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Rock fragments	0.00
		Depth to bedrock	0.00	Slope	0.00	Depth to bedrock	0.00
						Slope	0.00
Rock outcrop	12	Not rated		Not rated		Not rated	
VLH:							
Victorio, 60 to 95 percent slopes	35	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Slope	0.00
		Too clayey	0.00	Shrink-swell	0.06	Rock fragments	0.00
Victorio, 40 to 60 percent slopes	20	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00	Slope	0.00	Slope	0.00
		Too clayey	0.00	Shrink-swell	0.06	Rock fragments	0.00
Lozen	25	Poor		Poor		Poor	
		Stone content	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Droughty	0.00	Slope	0.00	Slope	0.00
		Depth to bedrock	0.00	Stones	0.00	Rock fragments	0.00
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 25.--Ponds and Embankments

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
BDG:							
Biduya	42	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.61		
Desario	28	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
Rock outcrop	18	Not rated		Not rated		Not rated	
BRG:							
Bissett	45	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Seepage	0.40		
Rock outcrop	43	Not rated		Not rated		Not rated	
BSG:							
Bonespring	63	Very limited		Very limited		Very limited	
		Slope	1.00	Seepage	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Thin layer	1.00		
		Seepage	0.53				
Rock outcrop	20	Not rated		Not rated		Not rated	
CAD:							
Chispa	50	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.70	Depth to water	1.00
		Slope	0.68				
Tenneco	33	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.30	Depth to water	1.00
		Slope	0.68				
CCD:							
Chilicotal	51	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.72				
Chispa	28	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Piping	0.95	Depth to water	1.00
		Seepage	0.70				
COC:							
Copia	90	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.32				

Table 25.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
CPB:							
Corvus	43	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Seepage	1.00	Depth to water	1.00
		Gypsum content	1.00	Piping	1.00		
				Thin layer	1.00		
Peligro	27	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00
		Gypsum content	1.00				
LAD:							
Lazarus	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.08	Piping	0.03	Depth to water	1.00
		Seepage	0.03				
LPC:							
Lark	50	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Gypsum content	1.00	Piping	1.00		
		Slope	0.32				
Peligro	40	Very limited		Very limited		Very limited	
		Seepage	1.00	Piping	1.00	Depth to water	1.00
		Gypsum content	1.00	Seepage	0.49		
		Slope	0.32				
LRH:							
Lostpeak	70	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
Rock outcrop	25	Not rated		Not rated		Not rated	
MCB:							
McKittrick, occasionally flooded	31	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Seepage	1.00	Depth to water	1.00
				Large stones	0.43		
McKittrick, frequently flooded	20	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Seepage	1.00	Depth to water	1.00
				Large stones	0.43		
Riverwash	22	Not rated		Not rated		Not rated	
MPB:							
Monahans	60	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Piping	0.12	Depth to water	1.00
Pajarito	21	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00

Table 25.--Ponds and Embankments--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
PCG:							
Altuda	20	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
		Seepage	0.45				
Pinery	32	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Large stones	0.41	Depth to water	1.00
		Seepage	0.70				
Choza	27	Very limited		Very limited		Very limited	
		Depth to cemented pan	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00				
VLG:							
Victorio	51	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	0.11		
		Seepage	0.46	Hard to pack	0.40		
Lozen	33	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00				
Rock outcrop	12	Not rated		Not rated		Not rated	
VLH:							
Victorio, 60 to 95 percent slopes	35	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Hard to pack	0.35		
		Seepage	0.46				
Victorio, 40 to 60 percent slopes	20	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Hard to pack	0.35		
		Seepage	0.46				
Lozen	25	Very limited		Very limited		Very limited	
		Slope	1.00	Thin layer	1.00	Depth to water	1.00
		Depth to bedrock	1.00	Large stones	1.00		
		Seepage	0.53	Piping	0.50		
Rock outcrop	20	Not rated		Not rated		Not rated	

Table 26.--Engineering Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
BDG:												
Biduya	0-13	Very cobbly loam	CL, GC	A-2-6, A-6	0	29-53	49-79	49-79	44-79	33-61	30-40	11-19
	13-38	Bedrock			---	---	---	---	---	---	---	---
Desario	0-12	Gravelly loam	CL, SC	A-2-6, A-6	0	0-14	65-83	65-83	53-75	38-56	29-40	12-18
	12-31	Very gravelly loam, very gravelly clay loam	CL, GC	A-2-6, A-7-6	0	7-24	36-75	36-75	30-71	21-53	32-44	13-23
	31-56	Bedrock			---	---	---	---	---	---	---	---
Rock outcrop	---	---	---	---	---	---	---	---	---	---	---	---
BRG:												
Bissett	0-4	Loam	ML, CL-ML	A-4, A-6	0	0	84-100	83-100	71-91	53-72	25-39	6-12
	4-34	Very gravelly loam	GC, GM	A-6, A-2-4	0	14-61	30-72	27-70	23-63	16-47	24-35	8-14
	34-59	Bedrock			---	---	---	---	---	---	---	---
Rock outcrop	---	---	---	---	---	---	---	---	---	---	---	---
BSG:												
Bonespring	0-9	Very channery sandy loam	GP-GC, GC	A-6, A-2-4	0	0-16	19-73	16-72	14-68	7-38	24-34	7-13
	9-28	Extremely gravelly sandy loam	GP-GC, GW, GC	A-2-4, A-1-a, A-2-6	0	0-15	11-56	7-54	7-53	3-28	22-32	6-12
	28-53	Bedrock			---	---	---	---	---	---	---	---
Rock outcrop	---	---	---	---	---	---	---	---	---	---	---	---
CAD:												
Chispa	0-15	Loam	SC, CL	A-4, A-6	0	0-29	75-100	73-100	67-100	46-76	26-40	9-19
	15-203	Loam, sandy loam, gravelly sandy clay loam	CL, SC, SM	A-6, A-4	0	0-26	68-100	67-100	60-100	42-74	26-39	9-19
Tenneco	0-13	Very fine sandy loam	ML, ML-CL	A-4, A-2-4	0	0	100	100	96-100	58-70	24-39	9-17
	13-72	Loam, very fine sandy loam	CL	A-6	0	0	100	100	95-100	71-81	26-39	11-19
	72-203	Loam, clay loam	CL	A-6	0	0	83-100	83-100	77-100	50-73	26-39	13-23

Table 26.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
CCD:												
Chilicotal	0-21	Gravelly loam	SC, CL, GC	A-4, A-6	0	0	64-84	63-84	53-78	37-57	26-39	9-17
	21-157	Very gravelly sandy loam, very cobbly loam, extremely gravelly sandy loam	GC, GM	A-2-6, A-6	0	15-26	48-68	46-67	40-64	25-43	27-38	12-19
Chispa	0-19	Fine sandy loam	SC-SM, SM	A-4	0	0	89-100	88-100	74-94	47-63	20-32	4-12
	19-157	Loam, sandy loam	SC, CL	A-6, A-4	0	0	76-100	75-100	70-95	47-65	28-33	12-13
COC:												
Copia	0-4	Loamy fine sand	SP-SM	A-2-4, A-3	0	0	100	100	93-98	6-11	0-22	NP-3
	4-203	Fine sand	SP-SM, SP	A-2-4, A-3	0	0	100	100	92-97	5-10	0-20	NP-3
CPB:												
Corvus	0-6	Gypsiferous very fine sandy loam	CL-ML, CL	A-6, A-4	0	0	100	100	96-100	64-71	21-30	6-11
	6-49	Gypsiferous fine sandy loam, Gypsiferous loamy fine sand	SC, SC-SM	A-4	0	0	100	100	84-91	36-43	19-27	4-10
	49-74	Cemented material	---	---	---	---	---	---	---	---	---	---
Peligro	0-5	Very fine sandy loam	ML, ML-CL	A-4	0	0	100	100	91-100	58-68	19-30	3-11
	5-112	Gypsiferous fine sandy loam	SM, SM-SC	A-4	0	0	100	100	90-100	41-51	16-26	2-9
	112-203	Gypsiferous very fine sandy loam	SM, SM-SC	A-4	0	0	100	100	86-94	36-44	17-26	2-8
LAD:												
Lazarus	0-19	Loam	SC, CL	A-6, A-4	0	0	100	100	93-100	69-84	26-39	9-17
	19-203	Clay loam, loam, silty clay loam	CL, SC, ML	A-6, A-7-6	0	0	100	100	91-100	68-83	32-50	13-25
LPC:												
Lark	0-27	Gypsiferous fine sand	SP-SM	A-3, A-2-4	0	0	100	100	81-87	9-15	0-21	NP-4
	27-203	Gypsiferous fine sand	SP-SM	A-3, A-2-4	0	0	100	100	85-91	10-16	0-20	NP-4
Peligro	0-18	Loamy fine sand	SC, SM, SC-SM	A-2-4	0	0	100	100	91-99	26-34	19-29	3-10
	18-43	Gypsiferous sandy loam	CL-ML, ML	A-4	0	0	100	100	94-99	61-66	16-22	2-6
	43-203	Gypsiferous fine sandy loam	SM, SC-SM	A-4	0	0	100	100	94-98	45-49	17-22	2-5

Table 26.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
LRH:												
Lostpeak--------	0-19	Very gravelly clay loam	GC	A-7-6, A-2-6, A-2-7	0	0	35-50	35-50	32-50	27-44	35-49	16-24
	19-44	Bedrock	---	---	---	---	---	---	---	---	---	---
Rock outcrop----	---	---	---	---	---	---	---	---	---	---	---	---
MCB:												
McKittrick, occasionally flooded--------	0-12	Gravelly sandy loam	GC-GM, CL, SC	A-6, A-1-b	0	9-28	53-90	51-89	42-88	25-58	24-40	6-18
	12-41	Very gravelly sandy loam	GP-GC, GM	A-6, A-1-a, A-2-6	0	15-37	17-66	14-65	11-61	7-40	22-36	6-17
	41-157	Extremely cobbly coarse sandy loam	GM, GP-GM, GP-GC	A-2-6, A-2-4, A-1-a	0	43-60	19-47	16-45	10-34	5-20	18-33	3-15
McKittrick, frequently flooded--------	0-12	Gravelly sandy loam	GC-GM, CL, SC	A-6, A-1-b	0	9-28	53-90	51-89	42-88	25-58	24-40	6-18
	12-41	Very gravelly sandy loam	GP-GC, GM	A-6, A-1-a, A-2-6	0	15-37	17-66	14-65	11-61	7-40	22-36	6-17
	41-157	Extremely cobbly coarse sandy loam	GC, GP-GM, GP-GC	A-2-6, A-2-4, A-1-a	0	43-60	19-47	16-45	10-34	5-20	18-33	3-15
Riverwash-------	---	---	---	---	---	---	---	---	---	---	---	---
MPB:												
Monahans--------	0-10	Very fine sandy loam	ML, CL, SM	A-4	0	0	100	100	95-100	50-61	18-30	3-12
	10-33	Fine sandy loam, loam	SC-SM, SM	A-4, A-2-4	0	0	100	100	91-100	48-57	21-30	6-12
	33-203	Fine sandy loam, loam	SM, SC-SM, CL	A-2-4, A-4	0	0	100	100	92-100	42-56	15-30	1-12
Pajarito--------	0-28	Very fine sandy loam	ML, SM, SM-SC	A-2-4, A-4	0	0	100	100	89-93	48-52	26-32	9-13
	28-98	Very fine sandy loam, fine sandy loam, sandy loam	ML, SM, SM-SC	A-4, A-2-6, A-2-4	0	0	100	100	89-95	46-52	25-32	9-13
	98-203	Very fine sandy loam, loam, fine sandy loam, sandy loam	ML, SM, SM-SC	A-2-4, A-4	0	0	100	100	89-95	46-50	25-32	9-16

Table 26.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
PCG:												
Altuda----------	0-12	Very gravelly loam	CL, GM	A-2-6, A-6	0	16-31	46-90	44-90	39-86	28-64	29-39	13-19
	12-28	Very gravelly loam, extremely cobbly loam	CL, GM	A-2-6, A-6	0	15-24	39-83	36-82	32-81	23-60	29-39	12-19
	28-53	Bedrock	---	---	---	---	---	---	---	---	---	---
Pinery----------	0-48	Gravelly loam	CL, GM	A-6, A-4	0	8-35	31-91	28-90	26-90	20-71	25-39	13-19
	48-157	Extremely cobbly loam, very gravelly loam	GC, GP-GC	A-2-6, A-6	0	29-68	18-80	15-79	14-78	10-60	29-38	13-19
Choza----------	0-26	Very gravelly loam	GM, GC	A-4, A-6	0	8-25	50-83	48-82	43-81	30-59	25-39	12-19
	26-51	Cemented material	---	---	---	---	---	---	---	---	---	---
VLG:												
Victorio--------	0-17	Gravelly loam	GM, CL, GW-GC	A-2-6	0-10	8-31	12-91	8-90	7-90	6-75	25-39	9-17
	17-47	Very cobbly clay, very gravelly silty clay loam, very gravelly clay loam	GC, CH, GP-GC	A-7-6, A-2-7	0-10	15-52	16-82	12-81	11-81	9-76	47-70	25-40
	47-72	Bedrock			---	---	---	---	---	---	---	---
Lozen----------	0-12	Very gravelly loam	GM, GC	A-2-7, A-2-6	0	0	35-50	35-50	31-49	23-38	25-39	11-19
	12-37	Bedrock	---	---	---	---	---	---	---	---	---	---
Rock outcrop----	---	---	---	---	---	---	---	---	---	---	---	---
VLH:												
Victorio, 60 to 95 percent slopes---------	0-10	Very gravelly clay loam	GC, GW-GC	A-2-6, A-7-6	0	14-31	12-82	8-81	7-80	6-71	38-53	17-25
	10-42	Very cobbly clay, very gravelly silty clay loam, very gravelly clay loam	GC	A-7-6, A-2-7	0	15-43	25-74	21-73	20-73	17-70	47-66	25-36
	42-67	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 26.--Engineering Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
Victorio, 40 to 60 percent slopes	0-10	Very gravelly clay loam	GC, GW-GC	A-2-6, A-7-6	0	14-31	12-82	8-81	7-80	6-71	38-53	17-25
	10-42	Very cobbly clay, very gravelly silty clay loam, very gravelly clay loam	GC	A-7-6, A-2-7	0	15-43	25-74	21-73	20-73	17-70	47-66	25-36
	42-67	Bedrock	---	---	---	---	---	---	---	---	---	---
Lozen	0-43	Very cobbly loam	GM, GC	A-4, A-6	15-37	15-53	100	100	85-94	62-71	25-39	11-18
	43-68	Bedrock	---	---	---	---	---	---	---	---	---	---
Rock outcrop	---	---	---	---	---	---	---	---	---	---	---	---

Table 27.--Physical Soil Properties

(Sand, silt and clay values show ranges where populated, otherwise a representative value (rv) is shown. Absence of an entry, either blank or marked with --- indicates that data were not estimated. Soil properties are measured or inferred from direct observations in the field or laboratory.)

Map symbol and soil name	Depth	Particle size			Moist bulk density	Permeability (K-sat)	Available water capacity	Shrink-swell potential	Organic matter
		Sand	Silt	Clay					
	Cm	Pct	Pct	Pct	g/cc	µm/sec	Cm/cm	Pct	Pct
BDG:									
Biduya	0-13	41	36	18-28	1.30-1.55	4.0-14.0	0.08-0.10	0.0-2.9	1.5-2.5
	13-38				---	0.4-14.0	---	---	---
Desario	0-12	44	33	18-27	1.30-1.55	4.0-14.0	0.06-0.08	0.0-2.9	1.0-3.0
	12-31	42	33	20-32	1.40-1.65	4.0-14.0	0.05-0.07	3.0-5.9	0.5-0.7
	31-56				---	0.0-0.4	---	---	---
BRG:									
Bissett	0-4	40-51	36-45	11-19	1.30-1.55	4.0-14.0	0.15-0.20	1.0-2.9	1.4-4.2
	4-34	38-53	34-43	13-21	1.30-1.55	4.0-14.0	0.09-0.13	1.0-2.9	0.5-1.5
	34-59				---	---	---	---	---
BSG:									
Bonespring	0-9	67	17	12-20	1.30-1.55	14.0-42.0	0.06-0.08	1.0-3.0	0.5-1.5
	9-28	70	17	10-18	1.30-1.55	14.0-42.0	0.04-0.06	1.0-3.0	0.5-1.5
	28-53				---	1.4-14.0	0.00-0.00	---	---
CAD:									
Chispa	0-15	23-52	28-50	15-27	1.60-1.70	4.0-14.0	0.12-0.18	0.0-2.9	0.5-1.5
	15-203	23-52	28-50	15-27	1.60-1.70	4.0-14.0	0.08-0.15	0.0-2.9	0.5-1.0
Tenneco	0-13	58	23	13-25	1.30-1.55	4.0-14.0	0.16-0.18	0.0-2.9	0.0-2.0
	13-72	41	37	17-27	1.30-1.55	4.0-14.0	0.16-0.18	0.0-2.9	0.0-1.0
	72-203	38	36	20-32	1.30-1.55	1.4-4.0	0.17-0.21	3.0-5.9	0.0-0.0
CCD:									
Chilicotal	0-21	44	35	15-25	1.40-1.60	4.0-14.0	0.08-0.12	0.0-2.9	0.8-2.0
	21-157	47	31	18-27	1.40-1.65	4.0-14.0	0.05-0.12	0.0-2.9	0.1-0.5
Chispa	0-19	56	29	8-18	1.30-1.55	4.0-14.0	0.12-0.18	0.0-2.9	0.5-1.5
	19-157	52	29	18-20	1.40-1.65	4.0-14.0	0.08-0.15	0.0-2.9	0.5-1.0
COC:									
Copia	0-4	95	2	1-6	1.50-1.70	42.0-141.0	0.05-0.08	1.0-2.9	0.5-1.5
	4-203	96	1	1-6	1.50-1.70	42.0-141.0	0.05-0.08	1.0-2.9	0.3-0.8

Table 27.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Particle size			Moist bulk density	Permeability (K-sat)	Available water capacity	Shrink-swell potential	Organic matter
		Sand	Silt	Clay					
	Cm	Pct	Pct	Pct	g/cc	µm/sec	Cm/cm	Pct	Pct
CPB:									
Corvus	0-6	57	29	10-17	1.25-1.40	4.0-14.0	0.13-0.20	0.0-2.9	0.5-1.0
	6-49	72	18	8-15	1.25-1.40	4.0-14.0	0.11-0.15	0.0-2.9	0.1-0.5
	49-74				1.80-1.95	0.0-1.4	---	---	---
Peligro	0-5	56	29	7-17	1.35-1.50	42.0-141.0	0.13-0.20	1.0-3.0	0.4-1.1
	5-112	71	18	5-15	1.45-1.60	14.0-42.0	0.11-0.15	0.0-1.0	0.2-0.5
	112-203	76	12	5-13	1.45-1.60	14.0-42.0	0.13-0.20	1.0-3.0	0.2-0.5
LAD:									
Lazarus	0-19	41	34	20-35	1.30-1.60	1.4-4.0	0.19-0.21	3.0-6.0	2.0-3.0
	19-203	39	33	20-35	1.45-1.70	1.4-4.0	0.19-0.21	3.0-6.0	0.8-2.3
LPC:									
Lark	0-27	96	0	2-8	1.45-1.60	42.0-141.0	0.05-0.07	0.0-1.0	0.5-1.0
	27-203	94	2	2-8	1.45-1.60	42.0-141.0	0.05-0.07	0.0-1.0	0.1-0.5
Peligro	0-18	82	9	7-15	1.35-1.50	42.0-141.0	0.09-0.11	1.0-3.0	0.4-1.1
	18-43	48	46	5-10	1.45-1.60	14.0-42.0	0.11-0.13	0.0-1.0	0.2-0.5
	43-203	71	22	5-9	1.45-1.60	14.0-42.0	0.13-0.15	1.0-3.0	0.2-0.5
LRH:									
Lostpeak	0-19	28	43	24-35	1.30-1.60	4.0-14.0	0.08-0.10	0.0-2.9	1.5-3.0
	19-44				---	1.4-14.0	---	---	---
MCB:									
McKittrick occasionally flooded	0-12	56	27	10-26	1.20-1.30	4.0-14.0	0.10-0.12	2.0-5.0	1.0-2.0
	12-41	56	27	10-24	1.30-1.45	4.0-14.0	0.06-0.08	2.0-4.0	0.5-0.7
	41-157	74	14	7-22	1.30-1.40	4.0-14.0	0.02-0.04	0.0-2.0	0.1-0.5
McKittrick frequently flooded	0-12	56	27	10-26	1.20-1.30	4.0-14.0	0.10-0.12	2.0-5.0	1.0-2.0
	12-41	56	27	10-24	1.30-1.45	4.0-14.0	0.06-0.08	2.0-4.0	0.5-0.7
	41-157	74	14	7-22	1.30-1.40	4.0-14.0	0.02-0.04	0.0-2.0	0.1-0.5

Table 27.--Physical Soil Properties--Continued

Map symbol and soil name	Depth	Particle size			Moist bulk density	Permeability (K-sat)	Available water capacity	Shrink-swell potential	Organic matter
		Sand	Silt	Clay					
	Cm	Pct	Pct	Pct	g/cc	µm/sec	Cm/cm	Pct	Pct
MPB:									
Monahans -------	0-10	63	27	5-16	1.40-1.70	14.0-42.0	0.09-0.15	0.0-2.9	0.4-1.1
	10-33	63	23	10-19	1.40-1.70	14.0-42.0	0.10-0.16	0.0-2.9	0.3-0.8
	33-203	66	23	4-18	1.40-1.70	14.0-42.0	0.07-0.14	0.0-2.9	0.2-0.6
Pajarito -------	0-28	68	24	6-10	1.45-1.55	14.0-42.0	0.13-0.15	0.0-2.9	0.5-0.8
	28-98	68	22	6-12	1.45-1.55	14.0-42.0	0.13-0.15	0.0-2.9	0.2-0.5
	98-203	71	18	9-13	1.35-1.45	14.0-42.0	0.13-0.15	0.0-2.9	0.1-0.3
PCG:									
Altuda ---------	0-12	47	30	20-27	1.30-1.50	4.0-14.0	0.09-0.13	0.0-3.0	1.0-2.0
	12-28	48	32	18-27	1.40-1.65	4.0-14.0	0.08-0.11	0.0-3.0	1.0-2.0
	28-53				---	0.4-14.0	---	---	---
Pinery ---------	0-48	41	36	20-27	1.25-1.45	4.0-14.0	0.09-0.13	0.0-2.9	1.0-2.0
	48-157	41	35	20-27	1.25-1.50	4.0-14.0	0.09-0.13	0.0-2.9	0.1-0.5
Choza ----------	0-26	46	29	18-27	1.35-1.55	4.0-14.0	0.09-0.13	0.0-2.9	1.0-2.0
	26-51				---	---	---	---	---
VLG:									
Victorio -------	0-17	30	38	25-38	1.35-1.60	14.0-42.0	0.13-0.15	3.0-6.0	1.3-3.8
	17-47	24	31	35-55	1.35-1.60	14.0-42.0	0.14-0.16	6.0-9.0	1.0-3.0
	47-72				---	0.4-14.0	---	---	---
Lozen ----------	0-12	35	41	18-28	1.30-1.60	4.0-14.0	0.08-0.10	0.0-2.9	2.0-4.0
	12-37				---	1.4-14.0	---	---	---
VLH:									
Victorio 60 to 95 percent slopes-	0-10	21	46	25-35	1.35-1.60	14.0-42.0	0.13-0.15	3.0-6.0	1.3-3.8
	10-42	20	39	35-50	1.35-1.60	14.0-42.0	0.14-0.16	6.0-9.0	1.0-3.0
	42-67				---	0.4-14.0	---	---	---
Victorio 40 to 60 percent slopes-	0-10	21	46	25-35	1.35-1.60	14.0-42.0	0.13-0.15	3.0-6.0	1.3-3.8
	10-42	20	39	35-50	1.35-1.60	14.0-42.0	0.14-0.16	6.0-9.0	1.0-3.0
	42-67				---	0.4-14.0	---	---	---
Lozen ----------	0-43	40	38	18-27	1.30-1.60	4.0-14.0	0.08-0.10	0.0-2.9	2.0-4.0
	43-68				---	1.4-14.0	---	---	---

Table 28.--Erosion Properties of Soils

(Entries under "Erosion factors" apply to the entire profile. Entries under "Wind erodibility group" and "wind erodibility index" apply only to the surface layer)

Map symbol and soil name	Depth	Erosion factors			Wind erodibility group	Wind erodibility index
	inches	Kw	Kf	T		
BDG:						
Biduya	0-5	.15	.37	1	8	0
	5-15	---	---			
Desario	0-5	.24	.37	1	5	56
	5-12	.15	.37			
	12-22	---	---			
Rock outcrop	---	---	---	-	---	---
BRG:						
Bissett	0-2	.37	.37	1	4L	86
	2-13	.10	.43			
	13-23	---	---			
Rock outcrop	---	---	---	-	---	---
BSG:						
Bonespring	0-4	.10	.28	1	6	48
	4-11	.05	.28			
	11-21	---	---			
Rock outcrop	---	---	---	-	---	---
CAD:						
Chispa	0-6	.37	.37	5	4L	86
	6-80	.43	.43			
Tenneco	0-5	.37	.37	5	3	86
	5-43	.49	.49			
	43-80	.32	.32			
CCD:						
Chilicotal	0-8	.20	.28	5	5	56
	8-62	.10	.32			
Chispa	0-7	.37	.37	5	3	86
	7-62	.37	.37			
COC:						
Copia	0-2	.05	.05	5	1	250
	2-80	.02	.02			
CPB:						
Corvus	0-2	.55	.55	2	3	86
	2-19	.37	.37			
	19-29	---	---			
Peligro	0-2	.43	.43	2	3	86
	2-44	.32	.32			
	44-80	.37	.37			
LAD:						
Lazarus	0-24	.37	.37	5	6	48
	24-80	.37	.37			

Table 28.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth centimeters	Erosion factors			Wind erodibility group	Wind erodibility index
		Kw	Kf	T		
LPC:						
Lark	0-11	.02	.02	5	1	250
	11-80	.02	.02			
Peligro	0-7	.15	.15	2	2	134
	7-17	.49	.49			
	17-80	.43	.43			
LRH:						
Lostpeak	0-7	.10	.28	1	6	48
	7-17	---	---			
Rock outcrop	---	---	---	-	---	---
MCB:						
McKittrick, occasionally flooded	0-5	.17	.32	5	5	56
	5-16	.10	.37			
	16-62	.02	.17			
McKittrick, frequently flooded	0-5	.17	.32			
	5-16	.10	.37			
	16-62	.02	.17			
Riverwash	---	---	---	-	---	---
MPB:						
Monahans	0-4	.37	.37	5	3	86
	4-13	.32	.32			
	13-80	.32	.32			
Pajarito	0-11	.37	.37	5	3	86
	11-39	.43	.43			
	39-80	.43	.43			
PCG:						
Altuda	0-5	.15	.37	1	6	48
	5-11	.10	.32			
	11-21	---	---			
Pinery	0-19	.17	.37	2	5	56
	19-62	.10	.43			
Choza	0-10	.15	.37	1	6	48
	10-20	---	---			
VLG:						
Victorio	0-7	.15	.28	1	7	38
	7-19	.05	.20			
	19-28	---	---			
Lozen	0-5	.10	.24	1	8	0
	5-15	---	---			
Rock outcrop	---	---	---	-	---	---

Table 28.--Erosion Properties of Soils--Continued

Map symbol and soil name	Depth centimeters	Erosion factors			Wind erodibility group	Wind erodibility index
		Kw	Kf	T		
VLH:						
Victorio, 60 to 95 % slope	0-4	.10	.24	1	8	0
	4-17	.10	.24			
	17-26	---	---			
Victorio, 40 to 60 % slope	0-4	.10	.24			
	4-17	.10	.24			
	17-26	---	---			
Lozen	0-17	.05	.24	1	8	0
	17-27	---	---			
Rock outcrop	---	---	---	-	---	---

Table 29.--Chemical Soil Properties

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	Cm	meq/100 g	pH	Pct	Pct	dS/m	
BDG:							
Biduya	0-13	15-23	7.6-8.3	0-4	0	0.0-1.0	0
	13-38	---	---	---	---	---	---
Desario	0-12	15-23	7.9-8.4	10-30	0	0.0-0.5	0
	12-31	16-25	7.9-8.4	15-40	0	0.0-0.8	0
	31-56	---	---	---	---	---	---
BRG:							
Bissett	0-4	9.1-15	7.6-8.3	17-32	---	0.3-0.6	---
	4-34	9.7-16	7.6-8.2	30-40	---	0.3-1.4	---
	34-59	---	---	---	---	---	---
BSG:							
Bonespring	0-9	8.6-15	7.4-7.9	0-10	0	0	0
	9-28	7.4-13	7.6-8.4	0-15	0	0	0
	28-53	---	---	---	---	---	---
CAD:							
Chispa	0-15	13-22	7.6-8.4	5-25	0	0.0-1.0	0
	15-203	13-22	7.6-8.4	15-30	0	0.0-7.0	0
Tenneco	0-13	9.6-21	7.6-8.4	5-15	0	0.0-1.0	---
	13-72	12-22	7.6-8.4	10-25	0	0.0-6.0	---
	72-203	14-22	7.6-8.4	10-25	0	0.0-8.0	---
CCD:							
Chilicotal	0-21	13-21	7.6-8.2	10-30	0	0.0-2.0	---
	21-157	14-21	7.6-8.6	20-50	0-5	0.0-2.0	---
Chispa	0-19	7.1-15	7.6-8.4	5-25	0	0.0-1.0	0
	19-157	15-17	7.6-8.4	5-25	0	0.0-4.0	0
COC:							
Copia	0-4	1.0-5.1	8.0-8.4	0	0	0.0-0.5	0
	4-203	0.9-4.9	8.0-8.4	0	0	0.0-0.3	0
CPB:							
Corvus	0-6	1.2-3.5	7.6-8.2	1-6	70-95	1.0-4.0	0-2
	6-49	0.7-2.6	7.6-8.6	1-6	80-100	2.0-6.0	0-2
	49-74	---	7.6-8.6	1-6	80-100	2.0-6.0	0-2
Peligro	0-5	4.4-13	7.6-8.4	0-8	3-10	1.0-4.0	0-2
	5-112	3.5-6.3	7.9-8.4	0-2	40-70	2.0-5.0	0-2
	112-203	3.5-6.3	7.6-8.4	0-2	40-70	2.0-6.0	0-2
LAD:							
Lazarus	0-19	17-29	6.6-7.3	0	0	0.0-0.4	0
	19-203	16-28	6.1-6.5	0	0	0.0-0.5	0
LPC:							
Lark	0-27	0.0-10	7.9-8.4	0	40-60	---	---
	27-203	0.0-10	7.9-8.4	0	50-90	---	---
Peligro	0-18	9.4-13	7.9-8.4	0-2	3-10	2.0-4.0	0-2
	18-43	3.5-6.3	7.9-8.4	0-2	40-70	2.0-4.0	0-2
	43-203	3.5-6.3	7.9-8.4	0-2	40-70	2.0-4.0	0-2

Table 29.--Chemical Soil Properties--Continued

Map symbol and soil name	Depth	Cation exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	Cm	meq/100 g	pH	Pct	Pct	dS/m	
LRH:							
Lostpeak	0-19	20-29	8.0-8.4	0-15	0	0.0-1.0	0
	19-44	---	---	---	---	---	---
MCB:							
McKittrick, occasionally flooded	0-12	8.9-22	6.6-7.3	0-15	0	0.0-1.0	---
	12-41	8.6-19	7.4-7.8	15-25	0	0.0-1.0	---
	41-157	5.9-18	7.4-7.8	25-40	0	0.0-1.0	---
McKittrick, frequently flooded	0-12	8.9-22	6.6-7.3	0-15	0	0.0-1.0	---
	12-41	8.6-19	7.4-7.8	15-25	0	0.0-1.0	---
	41-157	5.9-18	7.4-7.8	25-40	0	0.0-1.0	---
MPB:							
Monahans	0-10	4.5-12	7.4-8.0	5-10	0-3	0.0-1.0	0-4
	10-33	5.1-10	7.9-8.4	10-15	5-10	0.0-1.0	0-4
	33-203	1.9-9.4	7.9-8.4	10-15	10-15	2.0-4.0	0-4
Pajarito	0-28	11-15	7.4-8.4	0-5	0	0.0-2.0	0-2
	28-98	11-14	7.9-8.4	0-5	0	0.0-2.0	0-2
	98-203	11-16	7.9-8.4	0-5	0	0.0-2.0	0-2
PCG:							
Altuda	0-12	17-22	7.4-8.2	5-25	0	0.0-1.0	0
	12-28	15-22	7.6-8.4	10-30	0	0.0-1.0	0
	28-53	---	---	---	---	---	---
Pinery	0-48	17-22	7.9-8.4	10-15	0	0.0-0.5	---
	48-157	15-21	7.9-8.4	10-25	0	0.0-0.5	---
Choza	0-26	15-22	7.6-8.2	8-15	0	0.0-0.5	---
	26-51	---	---	---	---	---	---
VLG:							
Victorio	0-17	21-31	6.6-7.4	0	0	---	---
	17-47	28-43	6.6-7.4	0	0	---	---
	47-72	---	---	---	---	---	---
Lozen	0-12	16-24	6.6-7.3	0	0	---	---
	12-37	---	---	---	---	---	---
VLH:							
Victorio, 60 to 95 percent slopes	0-10	21-29	7.4-8.0	0	0	---	---
	10-42	28-40	7.4-8.0	0	0	---	---
	42-67	---	---	---	---	---	---
Victorio, 40 to 60 percent slopes	0-10	21-29	7.4-8.0	0	0	---	---
	10-42	28-40	7.4-8.0	0	0	---	---
	42-67	---	---	---	---	---	---
Lozen	0-43	16-23	6.6-7.3	0	0	---	---
	43-68	---	---	---	---	---	---

Table 30.--Total Soil Carbon

(This report displays soil organic carbon (SOC) and soil inorganic carbon (SIC) in kilograms per square meter to a 2 meter depth or to representative top depth of any bedrock kind or any cemented soil horizon. Only major components of a map unit are displayed in this report.)

Map unit symbol and component name	SOC	SIC
	kg/m2	kg/m2
BDG:		
Biduya	1	0
Desario	3	9
Rock outcrop	0	0
BRG:		
Bissett	2	10
Rock outcrop	0	0
BSG:		
Bonespring	1	1
Rock outcrop	0	0
CAD:		
Chispa	13	89
Tenneco	5	59
CCD:		
Chilicotal	4	56
Chispa	10	42
COC:		
Copia	9	0
CPB:		
Corvus	1	5
Peligro	5	4
LAD:		
Lazarus	32	0
LPC:		
Lark	6	0
Peligro	6	4
LRH:		
Lostpeak	2	2
Rock outcrop	0	0
MCB:		
McKittrick, occasionally flooded	2	18
McKittrick, frequently flooded	2	18
Riverwash	0	0
MPB:		
Monahans	8	43
Pajarito	5	10

Table 30.--Total Soil Carbon--Continued

Map unit symbol and component name	SOC	SIC
	kg/m2	kg/m2
PCG:		
Altuda	2	5
Pinery	5	17
Choza	2	3
VLG:		
Victorio	3	0
Lozen	2	0
Rock outcrop	0	0
VLH:		
Victorio, 60 to 95 percent slopes	5	0
Victorio, 40 to 60 percent slopes	5	0
Lozen	5	0
Rock outcrop	0	0

Table 31.--Water Features

(Depths of layers are in centimeters. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Cm	Cm	Cm				
BDG:									
Biduya	D	Jan-Dec	---	---	---	---	None	---	None
Desario	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---								
		---	---	---	---	---	---	---	---
BRG:									
Bissett	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	---	---	---	---	---	---	---	---
BSG:									
Bonespring	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	---	---	---	---	---	---	---	---
CAD:									
Chispa	B	Jan-Dec	---	---	---	---	None	---	None
Tenneco	B	Jan-Dec	---	---	---	---	None	---	None
CCD:									
Chilicotal	B	Jan-Dec	---	---	---	---	None	---	None
Chispa	B	Jan-Dec	---	---	---	---	None	---	None
COC:									
Copia	A	Jan-Dec	---	---	---	---	None	---	None
CPB:									
Corvus	D	Jan-Dec	---	---	---	---	None	---	None
Peligro	A	Jan-Dec	---	---	---	---	None	---	None
LAD:									
Lazarus	C	Jan-Dec	---	---	---	---	None	---	None
LPC:									
Lark	A	Jan-Dec	---	---	---	---	None	---	None
Peligro	A	Jan-Dec	---	---	---	---	None	---	None

Table 31.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Cm	Cm	Cm				
LRH:									
Lostpeak	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	---	---	---	---	---	---	---	---
MCB:									
McKittrick, occasionally flooded	B	Jun-Sep	---	---	---	---	None	Extremely brief	Occasional
McKittrick, frequently flooded	B	Jun-Sep	---	---	---	---	None	Very brief	Frequent
Riverwash	---	Jun-Sep	---	---	---	---	None	Brief	Frequent
MPB:									
Monahans	A	Jan-Dec	---	---	---	---	None	---	None
Pajarito	A	Jan-Dec	---	---	---	---	None	---	None
PCG:									
Altuda	D	Jan-Dec	---	---	---	---	None	---	None
Pinery	B	Jan-Dec	---	---	---	---	None	---	None
Choza	D	Jan-Dec	---	---	---	---	None	---	None
VLG:									
Victorio	D	Jan-Dec	---	---	---	---	None	---	None
Lozen	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---	---	---	---	---	---	---	---	---
VLH:									
Victorio, 60 to 95 percent slope	D	Jan-Dec	---	---	---	---	None	---	None
Victorio, 40 to 60 percent slope	D	Jan-Dec	---	---	---	---	None	---	None
Lozen	D	Jan-Dec	---	---	---	---	None	---	None
Rock outcrop	---								

Table 32.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that data were not populated. Components with no data in all columns will not display. Depths are in metric)

Map symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		cm	cm				
BDG:							
Biduya	Lithic bedrock	10-43	---	Very strongly cemented	Moderate	Moderate	Low
Desario	Lithic bedrock	29-52	---	Very strongly cemented	Moderate	Moderate	Low
Rock outcrop	Lithic bedrock	0	---	Indurated	---	---	---
BRG:							
Bissett	Lithic bedrock	18-49	---	Very strongly cemented	None	Moderate	Low
Rock outcrop	Lithic bedrock	0	---	Indurated	---	---	---
BSG:							
Bonespring	Lithic bedrock	8-47	---	Very strongly cemented	None	Moderate	Low
Rock outcrop	Lithic bedrock	0	---	Indurated	---	---	---
CAD:							
Chispa	No restriction	---	---	---	None	Moderate	Moderate
Tenneco	No restriction	---	---	---	None	High	Moderate
CCD:							
Chilicotal	No restriction	---	---	---	None	Moderate	Low
Chispa	No restriction	---	---	---	None	Moderate	Low
COC:							
Copia	No restriction	---	---	---	None	Low	Low
CPB:							
Corvus	Petrogypsic	31-52	---	Moderately cemented	None	Moderate	High
Peligro	No restriction	---	---	---	None	Moderate	High

Table 32.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		cm	cm				
LAD:							
Lazarus	No restriction	---	---	---	Moderate	Low	Low
LPC:							
Lark	No restriction	---	---	---	None	Moderate	High
Peligro	No restriction	---	---	---	None	Moderate	High
LRH:							
Lostpeak	Lithic bedrock	11-46	---	Very strongly cemented	Moderate	Moderate	Low
Rock outcrop	Lithic bedrock	0	---	Indurated	None	---	Low
MCB:							
McKittrick, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	Low
McKittrick, frequently flooded	No restriction	---	---	---	Moderate	Moderate	Low
Riverwash	No restriction	---	---	---	---	---	---
MPB:							
Monahans	No restriction	---	---	---	None	Moderate	High
Pajarito	No restriction	---	---	---	None	Moderate	Low
PCG:							
Altuda	Lithic bedrock	18-52	---	Very strongly cemented	None	Moderate	Low
Pinery	No restriction	---	---	---	None	Moderate	Low
Choza	Petrocalcic	13-49	---	Very strongly cemented	None	Moderate	Low
VLG:							
Victorio	Lithic bedrock	18-49	---	Very strongly cemented	Low	High	Low
Lozen	Lithic bedrock	11-44	---	Very strongly cemented	Moderate	Moderate	Low
Rock outcrop	Lithic bedrock	0	---	Indurated	---	---	---

Table 32.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		cm	cm				
VLH:							
Victorio, 60 to 95 percent slopes	Lithic bedrock	40-52	---	Very strongly cemented	Low	High	Low
Victorio, 40 to 60 percent slopes	Lithic bedrock	40-52	---	Very strongly cemented	Low	High	Low
Lozen	Lithic bedrock	40-45	---	Very strongly cemented	Moderate	Moderate	Low
Rock outcrop	Lithic bedrock	0	---	Indurated	---	---	---

Table 33.--Taxonomic Classification of the Soils

(See text for a description of the characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
*Altuda	Loamy-skeletal, mixed, superactive, thermic Lithic Calciustolls
Biduya	Loamy-skeletal, mixed, superactive, mesic Aridic Lithic Haplustolls
*Bissett	Loamy-skeletal, mixed, superactive, thermic Lithic Ustic Haplocalcids
Bonespring	Loamy-skeletal, mixed, superactive, calcareous, thermic Aridic Lithic Ustorthents
Chilicotal	Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
Chispa	Fine-loamy, mixed, superactive, thermic Ustic Haplocalcids
Choza	Loamy-skeletal, mixed, superactive, thermic, shallow Petrocalcic Calciustolls
Copia	Mixed, thermic Typic Torripsamments
Corvus	Loamy, hypergypsic, thermic, shallow Typic Petrogypsids
Desario	Loamy-skeletal, mixed, superactive, mesic Lithic Calciustolls
Lark	Gypsic, thermic Typic Torripsamments
Lazarus	Fine-silty, mixed, superactive, mesic Pachic Argiustolls
Lostpeak	Loamy-skeletal, mixed, superactive, mesic Aridic Lithic Haplustolls
Lozen	Loamy-skeletal, mixed, superactive, mesic Lithic Haplustolls
McKittrick	Loamy-skeletal, carbonatic, superactive, mesic Fluventic Haplustolls
Monahans	Coarse-loamy, mixed, superactive, thermic Typic Calcigypsids
**Murray	Fine-loamy, mixed, superactive, thermic Aridic Calciustolls
**Nasa	Coarse-loamy, gypsic, thermic Typic Petrogypsids
Pajarito	Coarse-loamy, mixed, superactive, thermic Typic Haplocambids
Peligro	Coarse-gypseous, hypergypsic, thermic Leptic Haplogypsids
**Penasco	Loamy-skeletal, carbonatic, mesic, shallow Petrocalcic Calciustolls
Pinery	Loamy-skeletal, mixed, superactive, thermic Aridic Calciustolls
Tenneco	Fine-loamy, mixed, superactive, thermic Ustic Haplocambids
Victorio	Clayey-skeletal, mixed, superactive, mesic Lithic Argiustolls

* Indicates a taxadjunct to the series
** Minor components listed in Detailed Soil Map Unit section

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