

SOIL SURVEY OF ANGELES NATIONAL FOREST AREA, CALIFORNIA



United States Department of Agriculture
Forest Service and Soil Conservation Service
in cooperation with
The Regents of the University of California
(Agricultural Experiment Station)



How To Use This Soil Survey

General Soil Map

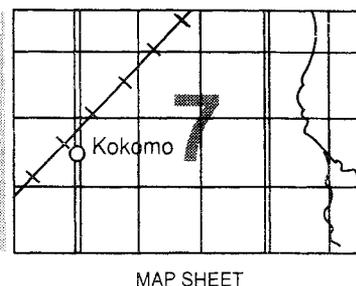
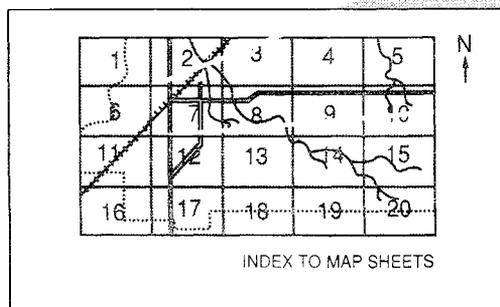
The general soil map, which is the small scale map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

Detailed Soil Maps

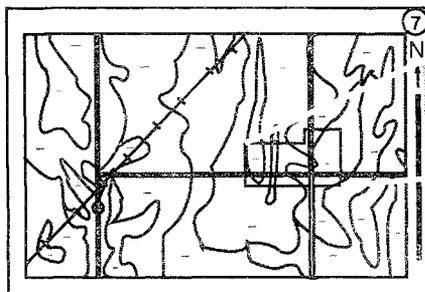
The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

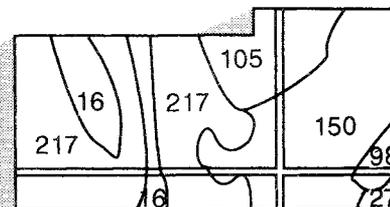


MAP SHEET

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



MAP SHEET



AREA OF INTEREST

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

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

Angeles National Forest Area, California

This is a publication of the United States Department of Agriculture, Forest Service, Pacific Southwest Region and is a joint effort and the University of California (Agricultural Experiment Station) and the Soil Conservation Service. As a part of the National Cooperative Soil Survey, the fieldwork and technical quality control for this survey were the responsibility of the Forest Service. The correlation of the soils was done by the Soil Conservation Service in consultation with the Forest Service. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was performed in the period 1975-80. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Forest Service and the Soil Conservation Service. The soil survey area consists of these parts of the Angeles National Forest in Los Angeles and San Bernardino Counties.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: View eastward along Angeles Crest Highway and parallel to San Gabriel fault zone, to Red Box Station in saddle.

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Foreword

The Soil Survey of Angeles National Forest, California, in Los Angeles and San Bernardino Counties, was designed to facilitate forestwide resource management planning and to increase the knowledge of our environment. It contains predictions of soil behavior for selected land uses. It also points out inherent limitations or hazards to land uses.

This soil survey has been prepared primarily for forest resource planners and managers. It is useful for preliminary project planning, for identifying general soil management considerations, and for evaluation of more intensive soil survey needs. The survey could be used for detailed resource management and project level planning with field verification.

Major differences in soil properties can occur even within short distances. Some soils are shallow to bedrock and have low available water capacity. These conditions inhibit plant growth. Some soils are seasonally wet and have a high water table or are subject to flooding.

Soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each soil map unit is shown on detailed soil maps. Each kind of soil in the survey area is described, and information is given about each soil for specific uses.

This soil survey can be useful in the conservation, improvement, and productive use of soil, water, and other resources.



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Location of the Angeles National Forest Area, California

Soil Survey of Angeles National Forest Area, California

By Thomas M. Ryan, Forest Service

Soils surveyed by Thomas M. Ryan and David R. Giger, Forest Service,
Esmaili and Associates, Inc., and Soil and Land Use Technology, Inc.

The ANGELES NATIONAL FOREST survey area is 680,324 acres in size. This acreage includes 41,000 acres of private land, the 36,118-acre San Gabriel Wilderness, and the 17,000-acre San Dimas Experimental Forest. Most of the survey area is in Los Angeles County; 9,700 acres are in San Bernardino County. The survey area does not include all of the forest.

The Angeles National Forest is uniquely situated because of its nearness to the Los Angeles metropolitan area, one of the most heavily populated areas in the world. The Forest Service is responsible for protecting the Los Angeles area from the hazards of fire and flood. It also provides outdoor recreational facilities and a continuous supply of water to the six million people who live just south of the forest. The Mojave Desert borders the forest on the north. Los Padres National Forest is to the west and northwest. San Bernardino National Forest is to the east and southeast. Cleveland National Forest lies to the south and southwest.

General Nature of the Survey Area

This section provides general information about the survey area. It discusses history and development, natural vegetation, geomorphology, geology, relief, drainage, water supply and climate.

History and Development

The Angeles National Forest was established on December 20, 1892, as the San Gabriel Timberland Reserve. The reserve was established to promote watershed protection. The reserve took in most of the San Gabriel Mountains and consisted of the southern part of the present-day Angeles National Forest and parts of the San Bernardino National Forest. In 1905, all reserves were transferred from the Department of the Interior to the Department of Agriculture. In 1907, the San Gabriel Timberland Reserve was renamed as the San Gabriel National Forest; in 1908, it was renamed again

as the Angeles National Forest. In 1926, the eastern area was divided and the San Bernardino National Forest was established. At that time, the Saugus District was detached from the Santa Barbara National Forest and joined with the Angeles National Forest.

Use of these mountainous areas by people dates back to prehistoric times. Evidence of this prehistoric use exists today in the form of campsites, bedrock mortars, petroglyphs, rock shelters, and flake scatters. When Europeans first came to the area, many different Indian groups were using the forest. They included the Gabrielino, the Fernandeno, the Tataviam (*Alliklik*), the Ventureno Chumash, the Kitanemuk, the Serrano, and quite possibly the Vanyume and the Kawaiisu. The first European contact in the area occurred when Spanish explorers, such as Portola in 1769, Fages in 1772, and Garces in 1776, traveled near the forest. The explorers were concerned with blazing trails between outposts, looking for mission sites and looking for deserters or Indian neophytes. The San Gabriel Mission was founded in 1771 and the San Fernando Mission in 1797. The Spanish missions used the area of the forest as a source of labor, water, and raw materials. The forest was never part of the land-grant system under the Spanish or the Mexican government. In 1842, gold was discovered adjacent to the northern boundary of the main body of the forest. The main passes through and adjacent to the forest had long since become major travel corridors. American explorers were using these corridors as early as 1826 when Jedediah Smith visited Los Angeles. The mountains witnessed placer mining in the 1850's and hard rock mining in the 1890's.

Homesteading occurred between the 1850's and 1938. Recreational resorts also appeared during the same period. The use of the forest for recreation began in earnest in the 1880's and coincided with the real estate boom in the Cowlands causing a major influx of people. At present the Angeles National Forest is the most highly utilized forest for recreation in the country.

Vegetation

The vegetative cover (5) is predominantly chaparral communities with pockets of oak woodland and conifer types in drainages and riparian zones. Isolated stands of oak are mixed with conifers and a variety of shrub species. Most of the conifer stands are at elevations above 5,000 feet along the ridges and canyons of the easterly end of the forest, and mainly on north aspects.

The natural vegetative groups and their proportionate extent in the survey area are as follows:

| | |
|--|------------|
| Chamise Chaparral | 50 percent |
| Mixed Chaparral and Semi-desert (shrubs) | 25 percent |
| Oak Woodland and Forest | 3 percent |
| Conifer Woodland and Forest | 17 percent |
| Pinyon-Juniper | 5 percent |

An estimated 2 percent of the forest survey area is in riparian vegetation.

The chaparral community includes shrubs and small trees well adapted to withstand long periods of drought and heat. The root systems are capable of penetrating deeply into the bedrock - whether it is soft and weathered or hard but highly fractured - that underlies the thin soil mantles. The ability of the roots to obtain moisture from the substratum is crucial to the survival of many of these shrub species.

Some of the common chaparral plant species are chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos spp.*), sugar sumac (*Rhus ovata*), sagebrush (*Artemisia californica*), wild buckwheat (*Eriogonum fasciculatum*), California lilac (*Ceanothus spp.*), black sage (*Salvia mellifera*), yucca (*Yucca whipplei*), and big sagebrush (*Artemisia tridentata*).

Chaparral occurs extensively below 5,000 feet, particularly on south-facing aspects, and canyon live oak or bigcone Douglas-fir are found more on north aspects.

The conifers generally occur in mixed stands at higher elevations where the average annual precipitation is more than 30 inches. They include Jeffrey pine (*Pinus jeffreyi*), ponderosa pine (*P. ponderosa*), lodgepole pine (*P. contorta*), limber pine (*P. flexilis*), sugar pine (*P. lambertiana*), white fir (*Abies concolor*), and incense-cedar (*Calocedrus decurrens*). Pinyon pine (*P. monophylla*) is found on the desert-facing slopes.

The oak types are found along drainage bottoms and frequently at middle elevation zones on northerly exposures. They include scrub oak (*Quercus dumosa*), canyon live oak (*Quercus chrysolepis*), interior live oak

(*Quercus wislizenii*), California live oak (*Quercus agrifolia*), and California black oak (*Quercus californica*) at higher elevations.

Geomorphology

The mountain area of the Angeles National Forest Survey Area is one of the most intensively faulted and fractured regions in the world. Earthquake faulting through uplifting has formed the San Gabriel Mountains. Extreme compression has caused the mountains to rise to their present height and is continuing to build. Also, extensive thrusting and shearing have caused significant horizontal displacement along the fault zones.

Three major fault systems trend essentially east-west through the forest. The San Andreas Fault is the most extensive fault zone in California. It runs parallel to the forest on the north side. Uplifting on the Sierra Madre Fault has produced the steep faces along the south side of the mountains. The San Gabriel Fault has caused the straight east-west alignment of the two forks of the San Gabriel River.

The faults have had a tremendous influence on landform development. Many landslides, falls, and unstable areas originate at the fault zones. Steep rock faces frequently are the exposed sides of faults. Many streams follow fault lines.

There are many natural barriers to the underground flow of water in the mountains. The barriers may force percolating water to the surface to form seeps and springs. When underground water encounters a wide fault-crushed zone, it generally flows within and parallel to the fault zone. Many fault zones carry large volumes of water from several drainages for long distances. This is especially true in the San Andreas Fault zone which has many seeps, springs, and small natural ponds.

The main mass of the mountain area is made up of crystalline metamorphic and granitic rocks (4). The San Gabriel Mountains represent a mature stage of topographic relief in which the drainage pattern has been developed to almost the maximum. The mountains have been highly dissected by streams, and the topography consists of deep V-shaped canyons and sharp narrow ridges. Mountainsides typically have 60 to 100 percent slopes.

The percentage of forest acreage by slope groupings is as follows:

| | |
|-----------------------------|------|
| 0 to 20 percent slopes | 3.5 |
| 21 to 40 percent slopes | 3.5 |
| 41 to 60 percent slopes | 25.0 |
| More than 60 percent slopes | 68.0 |

The crest of the mountains, on the average, is at 4,000 to 5,000 feet, rising higher in the east to a maximum of 10,064 feet at San Antonio Peak (Old Baldy).

The topography has a pronounced influence on precipitation and rainfall distribution patterns. Crystalline metamorphic and granitic rocks generally are considered to be nonwaterbearing and nearly impervious, but the rocks of these mountains have a considerable capacity for temporary storage of water because of the tremendous number of fractures. Exceptionally deep and rapid weathering is characteristic of these rocks because of the extensive fractures. The capacity of the rocks to receive and store water is very important in any consideration of water relations. If the soils of the forest provided the only place that water could be temporarily stored, the watershed would soon become saturated because the soils are typically shallow (less than 20 inches deep) and have relatively little storage capacity (9).

Streamflows within the watershed fluctuate significantly. They vary from high-volume, rapidly peaking flows of relatively short duration to very minimal flows. Many of the streams of the watershed are intermittent, drying up for many months and in drought years. During high-runoff periods, streams frequently carry heavy loads of mineral soil, rock, and organic debris. The differences in streamflow are related to the geology, the highly variable amounts of precipitation, and the occurrence of high-intensity rainfall. Streamflow is also indirectly related to the removal of vegetation from mountainsides primarily by fire.

Groundwater recharge from precipitation is an important process. Most recharge occurs in the upper elevations where precipitation is greatest. Areas that are most favorable to recharge are talus slopes and coarse-textured alluvial channel bottoms. Major underground basins lie south of the mountains. The basins consist of adjacent irregularly shaped cells filled with coarse sand, gravel, and boulders deposited by the streams emanating from the mountains. A large amount of the water used in southern California is obtained from wells drilled into these underground basins. Replenishment of the basins occurs through the percolation of rainwater falling on the surface, percolation from the surface streams, and deep percolation into the rock mass.

Water-spreading grounds are used to conserve local water supplies. The process involves diverting water from streams and running it through a series of ditches and shallow basins on the alluvial fans at the mouth of

the canyons. Water percolates through these pervious alluvial fans to replenish the underground supply. Water spreading helps to trap and store the winter surface streamflow.

Climate

The climate in the survey area is Mediterranean, consisting of dry, hot summers and cool, moist winters. The mountain climate is strongly influenced by topography and can vary widely over relatively short distances. Extensive urban areas occur at the base of the survey area boundary along the frontal or south-facing slopes of the San Gabriel Mountains. The maritime influence predominates in the southwestern part of the survey area.

In general, the coolest temperatures occur at the highest elevations. Mean maximum temperatures near 80 degrees F. occur in midsummer and in the middle 40's in midwinter. In the higher regions in January, minimum temperatures are usually in the upper 20's, but extreme lows of -9 degrees F. have been recorded. Along the frontal parts of the forest, maximum summer temperatures frequently surpass 100 degrees and winter minimum temperatures seldom drop below 25 degrees. In winter, snowfall usually occurs at elevations above 4,000 feet. More than 80 inches of snow normally falls at the higher elevations. The growing season is 150 to 200 days.

Most precipitation originates from cyclonic storms that develop over the north Pacific Ocean and move inland on westerly to northwesterly prevailing winds. Moisture-laden marine air is forced to climb over the east-west trending ranges, causing large amounts of rainfall to drop on south and west slopes. Rainfall diminishes rapidly over the desert, producing a marked rain shadow. Most of the precipitation occurs from November through April. Except for the Saugus Ranger District, the survey area is subject to high-intensity storms (more than 5.5 inches within 24 hours). Such high-intensity storms are expected at a frequency interval of every two years. Mean annual precipitation along the frontal slopes ranges from 20 to 24 inches (2). In the interior regions, annual rainfall ranges from 25 to 33 inches. On the desert slopes, it ranges from 12 to 15 inches.

From fall until April, Santa Ana winds may occur. These are strong, gusty, northeasterly winds that flow over mountain peaks and passes and drop down along the lower valleys to the sea. The warm temperatures and low humidities that normally accompany these winds create severe fire risk conditions. Santa Ana winds in September, October, and early November are the most hazardous.

How This Survey Was Made

This is an Order 3 soil survey. It has followed the directives and guidelines in the Forest Service Manual and Handbooks and the concepts, procedures, and guidelines of the National Cooperative Soil Survey as specified in the Soil Survey Manual (6), the National Soils Handbook (1,8), and the soil classification system as stated in Soil Taxonomy (7).

Soil scientists began the inventory by collecting, studying, and correlating soil genesis and morphology data, including lithological, geomorphological, topographical, climatic, and vegetative data, for the survey area and for adjoining areas.

The data and information were assimilated and transferred to a single base map of suitable scale and accuracy, forming the beginning soil map unit delineations, or a schematic map. With the schematic map and aerial photo field sheets (stereo-pair coverage) in hand, a reconnaissance study of the survey area was made. The delineations on the schematic map were checked for accuracy of content and location. The aerial photos were studied stereoscopically and the photo images were compared to the conditions found on the ground to ensure that later recognition by photo interpretation would be credible. Lithologic, geomorphic, soil, and vegetative characteristics were recorded in field notes, on the schematic map, and on the aerial photo field sheets.

Using the augmented and corrected schematic map, field notes, and an understanding of how the photo images relate to actual conditions on the ground, the soil scientists delineated map units on the aerial photographs. The map units correspond to segments of the landscape having similar landform, vegetative cover, and soils as determined by a knowledge of ground conditions and by stereoscopic aerial photo interpretation. The aerial photos with the delineated map units and delineation symbols became the exploratory or preliminary soil map.

With the aerial photographs (exploratory soil maps) and a field stereoscope, the soil scientists examined on the ground as many delineations of each map unit as possible, considering limited access in places and the time allowed to complete the survey. Map units were examined, studied, and described by aerial photo interpretations and on-the-ground investigation.

Because the survey is Order 3 in intensity (3), and because of the time allotted for its completion, not every delineation of each map unit was visited and examined on the ground. Few of the delineations with no easy access were visited, but they were scrutinized by aerial photo interpretation. Possibly one-third to one-half of the delineations on the field sheets and maps were not examined on the ground. Consequently, the data in this report are not suitable for project planning without field verification.

At each site that was visited and examined, the individual soils were studied, named, described, and classified, and enough data were collected to make interpretations and predictions concerning the use and management of each soil. However, the exact location of each soil was not delineated. The map units in most places consist of a group of soils on a particular landscape that has been delineated on the aerial photo field sheets. Depending on the location and extent of the individual soils that are components of the delineated map unit, a map unit is called an association or a complex. The soil scientists made a field study and aerial photo examination to estimate the percentage of each soil component in each map unit. The map units do not necessarily consist of similar soils. They consist of geographically associated soils that may be, and in places are, quite different in their characteristics and their suitability for use and management. For this reason also, the data in this report are not suitable for project planning without field verification.

The interpretations and predictions concerning use and management in this report are based on the soil scientists' knowledge and understanding of the conditions recognized and measured in the field. In classifying the soils, soil scientists can also, with acceptable reliability, bring information concerning use and management of a particular soil from other survey areas where the same soil occurs and has been recognized and studied. Some use and management interpretations and predictions should be considered as first or second approximations owing to the relative few examinations and measurements that were made. This is still another reason that limits the data in this survey for project planning without field verification.

Despite the cautions that have been given concerning the use of data in this survey for project planning, the survey is adequate and reliable for its intended and designed purpose: a base for a forestwide system of land management planning.

General Soil Map Units

The general soil map shows map units which consist of many individual soils. Each map unit consists of soils that have similar parent rock material and similar soil temperature regimes. A map unit typically is made up of one or more soils of major extent and several soils of minor extent. Map units are named for the major soils in the unit. The soils in one unit can occur in other units. The soils are classified at the family level or a higher taxonomic level.

The general soil map furnishes a broad perspective of the soils in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. General areas which are capable of timber production or spring-summer range can be identified on the map. Likewise, general areas of soils having properties that are distinctly unfavorable for certain land uses can be identified.

Because of the generalization of map units and the small scale of the map, the location of specific soils is not shown. The map and map unit information are not suitable for land management planning at the forestwide or project level. They give a very general overview of soil conditions and are suitable for state or regional planning. Groups of soils and the map units making up each group are described on the pages that follow.

Soils in the Thermic Soil Temperature Regime

In the thermic soil temperature regime, the mean annual soil temperature is 59 to 72 degrees F. The soils in this group are generally on south aspects at an elevation of 1,000 to 6,500 feet. They are on mountainsides, ridges, and alluvial fans. Slopes range from 5 to 100 percent. Annual precipitation is 9 to 30 inches.

The soils in this group are shallow to deep and are moderately well drained to excessively drained. The plant species on these soils are chamise, manzanita, sumac, yucca, and buckwheat. These soils are used mainly for watershed, wildlife habitat, and recreation.

1. Trigo, granitic substratum-Exchequer-Pismo families

The soils in this map unit formed in material that weathered from granitic rock. They are on mountainsides and ridges that have slopes of 50 to 100 percent. This unit makes up about 21 percent of the survey area.

Approximately 50 percent of the unit is Trigo family, granitic substratum soils, 25 percent is Exchequer family

soils, and 15 percent is Pismo family soils. The remaining 10 percent is minor components of Caperton family soils and Rock outcrop.

Trigo family, granitic substratum soils are shallow to very shallow, have a sandy loam surface layer, and are somewhat excessively drained. They are underlain by soft, weathered bedrock. Exchequer family soils are similar to Trigo family, granitic substratum soils but are underlain by hard fractured bedrock. Pismo family soils are shallow, have a loamy sand surface layer and are somewhat excessively drained and excessively drained.

2. Typic Xerorthents, warm-Rock outcrop

The soils in this map unit formed in material that weathered from granitic rock. They are on mountainsides and ridges on slopes of 50 to 100 percent. This unit makes up about 14 percent of the survey area.

Approximately 70 percent of the unit is Typic Xerorthents, warm, and 20 percent is Rock outcrop. The remaining 10 percent is Haploxerolls, warm.

Typic Xerorthents, warm, are shallow to deep and somewhat excessively drained. The soil profile is very gravelly sandy loam or very gravelly loamy sand and is 35 percent or more rock fragments. Rock outcrop is scattered throughout the unit.

3. Caperton-Trigo, granitic substratum-Lodo families

The soils in this map unit formed in material that weathered from a complex of granitic and metamorphic rock. They are on mountainsides and ridges that have slopes of 50 to 90 percent. This unit makes up about 10 percent of the survey area.

Approximately 45 percent of the unit is Caperton family soils, 25 percent is Trigo family, granitic substratum soils, and 15 percent is Lodo family soils. The remaining 15 percent is minor components of Rock outcrop, Chilao family soils, and Haploxerolls, warm.

Caperton family soils are shallow and well drained and have a loam or sandy loam surface layer. Trigo family, granitic substratum soils are shallow to very shallow, have a sandy loam surface horizon, and are somewhat excessively drained. Lodo family soils are shallow and well drained and have a loam surface layer.

4. Caperton-Vista-Modesto families

The soils in this map unit formed in material that weathered from a complex of granitic and metamorphic

rock. They are on mountainsides, ridges, toe slopes, and colluvial slopes. Slopes range from 25 to 65 percent. This unit makes up about 7 percent of the survey area.

Approximately 40 percent of the unit is Caperton family soils, 25 percent is Vista family soils, and 15 percent is Modesto soils. The remaining 20 percent is minor components of Capistrano family soils, Baywood family soils, San Andreas family soils, and Trigo family, granitic substratum soils.

Caperton family soils are shallow and well drained and have a loam or sandy loam surface layer. Vista and Modesto family soils are moderately deep and deep. Vista soils are well drained, and Modesto soils are moderately well drained.

5. Lodo-Modesto, moderately deep-Trigo families

The soils in this map unit formed in material that weathered from metamorphic or sedimentary rock. They are on mountainsides and broad ridge tops on slopes of 30 to 60 percent. This unit makes up about 10 percent of the survey area.

Approximately 35 percent of the unit is Lodo family soils, 35 percent is Modesto family, moderately deep soils, and 15 percent is Trigo family soils. The remaining 15 percent is minor components of Millsholm family soils, Osito family soils, and Stonyford family soils.

Lodo family soils are shallow and well drained and have a loam surface layer. Modesto family, moderately deep soils are moderately well drained and have a loam surface layer and a clay loam subsoil. Trigo family soils are shallow to very shallow, have a silt loam or sandy loam surface layer, and are somewhat excessively drained.

6. Trigo-Calleguas families-Calcixerollic Xerochrepts

The soils in this map unit formed in material that weathered from sedimentary rock. They are on uplifted, tilted, eroded beds of sedimentary strata on slopes of 30 to 80 percent. This unit makes up about 8 percent of the survey area.

Approximately 35 percent of the map unit is Trigo family soils, 35 percent is Calleguas family soils, and 15 percent is Calcixerollic Xerochrepts. The remaining 15 percent is minor components of Modesto family, moderately deep soils and sedimentary rock escarpments, which are very steep faces of stratified rock that has been uplifted.

Trigo family soils are shallow to very shallow, have a silt loam or sandy loam surface layer, and are somewhat excessively drained. Calleguas family soils are shallow and have a silt loam surface layer and a calcareous profile. Calcixerollic Xerochrepts are shallow to moderately deep and have a silt loam, silty clay loam, or clay loam profile that is calcareous.

7. Hanford family-Mollic Haploxeralfs-Haploxerolls, warm

The soils in this map unit formed in material that weathered from old to recent alluvium. They are on alluvial fans, terraces, and stream bottoms on slopes of 5 to 45 percent. This unit makes up about 2 percent of the survey area.

About 35 percent of the map unit is Hanford family soils, 35 percent is Mollic Haploxeralfs, and 15 percent is Haploxerolls, warm. The remaining 15 percent is minor components of Capistrano family soils, Tujunga family soils, Vista family soils, Typic Haploxeralfs, and Riverwash.

Hanford family soils are deep and well drained and are sandy loam throughout their profile. Mollic Haploxeralfs are moderately deep or deep and well drained and have a thin loam surface layer and a clay loam subsoil. Haploxerolls, warm, are well drained and have a gravelly sandy loam profile.

Soils in the Mesic Soil Temperature Regime

In the mesic soil temperature regime, the mean annual soil temperature is 47 to 59 degrees F. The soils in this group are generally on north aspects, or if on south aspects, they are at elevations above 5,500 feet. The elevation ranges from 1,800 to 10,064 feet. The soils are on mountainsides, ridges, and colluvial slopes. Slopes range from 10 to 100 percent. Annual precipitation is 14 to 40 inches.

The soils in this group are shallow to deep and are well drained to excessively drained. The plant species on these soils are canyon live oak, bigcone Douglas-fir, Coulter pine, ponderosa or Jeffrey pine, and other mixed conifers. The areas are used mainly for watershed, wildlife habitat, recreation, and fuelwood production.

8. Xerorthents-Green Bluff family

The soils in this map unit formed in material that weathered from granitic rock. They are on mountainsides on slopes of 15 to 60 percent. This unit makes up about 1 percent of the survey area.

Approximately 50 percent of the map unit is Xerorthents and 35 percent is Green Bluff family soils. The remaining 15 percent is minor components of Hohmann family soils, Pacifico family soils, and Rock outcrop.

Xerorthents are shallow and well drained to excessively drained soils that have a cobbly loam to very gravelly loamy sand surface layer. Green Bluff family soils are moderately deep or deep and are well drained, with gravelly sandy loam profile.

9. Rock outcrop-Lithic Xerorthents

The soils in this map unit formed in material that weathered from a complex of granitic and metamorphic rock. They are on mountainsides, ridges, and colluvial slopes. Slopes are of 60 to 100 percent. This unit makes up about 7 percent of the survey area.

Approximately 45 percent of the unit is Rock outcrop, and 35 percent is Lithic Xerorthents. The remaining 20 percent is minor components of Bakeoven family soils, Winthrop family soils, and Rubble land, which consists of deposits of rock fragments that accumulate on mountainsides.

Rock outcrop occurs in massive exposures. Lithic Xerorthents are shallow over hard bedrock and are somewhat excessively drained. The surface layer is very gravelly sandy loam or very gravelly loamy sand.

10. Olete, moderately deep-Sur, moderately deep-Bakeoven families

The soils in this map unit formed in material that weathered from a complex of granitic and metamorphic rocks. They are on mountainsides and ridges on slopes of 45 to 80 percent. This unit makes up about 3 percent of the survey area.

Approximately 30 percent of the unit is Olete family, moderately deep soils, 30 percent is Sur family, moderately deep soils, and 20 percent is Bakeoven family soils. The remaining 20 percent is minor components of Kilburn family soils; Mollic Haploxeralfs, moderately deep, cool; Lithic Xerorthents; Haploxerolls; Rock outcrop; and Riverwash deposits.

All three of the major soils are well drained and have more than 35 percent rock fragments in their profile. Olete family, moderately deep soils have a cobbly loam surface layer and a very cobbly loam or sandy loam subsoil. Sur family, moderately deep soils have a gravelly to very cobbly sandy loam profile. Bakeoven family soils are shallow over hard bedrock.

11. Knutsen-Tollhouse families-Mollic Haploxeralfs, cool

The soils in this map unit formed in material that weathered from a complex of granitic and metamorphic rock. They are on mountainsides and broad ridgetops on slopes of 10 to 50 percent. This unit makes up about 4 percent of the survey area.

Approximately 40 percent of the map unit is Knutsen family soils, 30 percent is Tollhouse family soils, and 15 percent is Mollic Haploxeralfs, cool. The remaining 15 percent is minor components of Balder family soils, Oak Glen family soils, Stukel family soils, and Supan family soils.

All the soils in this unit are well drained. Knutsen family soils are moderately deep or deep and have a sandy loam profile. Tollhouse family soils are shallow and have a gravelly sandy loam surface layer. Mollic Haploxeralfs, cool, are moderately deep and have a thin sandy loam or loam surface layer and gravelly sandy clay loam or cobbly clay loam subsoil.

12. Pacifico-Waterman-Springdale families

The soils in this map unit formed in material that weathered from granitic rock. They are on mountainsides and ridges on slopes of 15 to 70 percent. This unit makes up about 4 percent of the survey area.

Approximately 35 percent of the unit is Pacifico family soils, 35 percent is Waterman family soils, and 15 percent is Springdale family soils. The remaining 15 percent is minor components of Xerorthents, Preston family soils, and Rock outcrop.

Pacifico family and Waterman family soils are shallow. Pacifico family soils are somewhat excessively drained and formed over soft, weathered bedrock. Waterman family soils are excessively drained, formed over hard bedrock, and have more than 35 percent rock fragments in their profile. Springdale family soils are moderately deep and somewhat excessively drained and have more than 35 percent rock fragments in their profile.

13. Olete-Winthrop-Wrentham families

The soils in this map unit formed in colluvial material that weathered from mixed granitic and metamorphic rocks. They are on colluvial slopes of 15 to 90 percent. This unit makes up about 8 percent of the survey area.

Approximately 35 percent of the map unit is Olete family soils, 30 percent is Winthrop family soils, and 15 percent is Wrentham family soils. The remaining 20

percent is minor components of Sur family soils, Kilburn family soils, Stukel family soils, Etsel family soils, and Rock outcrop.

All the soils in this unit are deep and have more than 35 percent rock fragments. Olete family soils are well drained and have a cobbly or very gravelly loam surface layer and very gravelly or very cobbly sandy loam subsoil. Winthrop family soils are somewhat excessively drained and have a very gravelly sandy loam or loamy sand surface layer and a very gravelly or very cobbly loamy sand subsoil. Wrentham family soils are well drained and have a gravelly loam surface layer and a very gravelly or very cobbly loam or sandy loam subsoil.

Soils in the Frigid Soil Temperature Regime

In the frigid soil temperature regime, the mean annual soil temperature is 32 to 47 degrees F. The difference between mean winter and mean summer soil temperatures is more than 9 degrees F. The mean summer soil temperature is higher than 47 degrees F.

The soils in this group formed in material that weathered from granitic or metamorphic rocks. They are generally on north aspects above 5,400 feet or on south aspects above 7,500 feet. Some soils are at an elevation of 9,400 feet. The soils are on mountainsides, ridges, and

colluvial slopes of 5 to 85 percent. Annual precipitation is 25 to 44 inches.

The plant species on these soils are Jeffrey pine, limber pine, sugar pine, lodgepole pine, and white fir. The unit is used mainly for watershed, wildlife habitat, and recreation.

14. Typic Xerorthents, cold-Haploxerolls, cold-Typic Xerochrepts

This map unit makes up about 1 percent of the survey area. Approximately 45 percent of the unit is Typic Xerorthents, cold; 25 percent is Haploxerolls, cold; 20 percent is Typic Xerochrepts; and 10 percent is minor components of Xerorthents and Rock outcrop.

Typic Xerorthents, cold, are moderately deep to deep and are well drained or somewhat excessively drained. They have a profile that is very gravelly coarse sandy loam or extremely gravelly loamy coarse sand.

Haploxerolls, cold, are deep, well drained soils. They have a surface layer of very gravelly or very stony sandy loam and a subsoil of very gravelly or very cobbly sandy loam or very gravelly loamy sand. Typic Xerochrepts are shallow to deep and are well drained. The surface layer is gravelly loam or sandy loam, and the subsoil is very cobbly sandy loam or sandy clay loam.

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Detailed Soil Map Units

The map units on the soil maps at the back of this report show the kind of soils in the survey area. Table 2 gives the acreage and proportionate extent of each map unit. Each map unit on the soil maps represents an area on the landscape and consists of one or more soils for which the unit is named. The map unit descriptions, which are in tabular format, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They can also be used to plan the management needed for those uses.

In this survey, the individual soils (components of map units) were recognized and classified to families or phases of families or to the subgroup level (see "Classification of the Soils"). Soils that have profiles somewhat alike make up a soil family. Soil families are established within a subgroup primarily on the basis of physical and chemical properties that affect use and management. Soils of a family can also differ in slope, wetness, or degree of erosion, and because of such differences, a family is divided into soil phases.

Many map units are made up of two or more major soils. Table 4 lists for each soil, those map units in which the soil occurs as a major component. These map units are called soil complexes or soil associations. A soil complex consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. A soil association is made up of two or more geographically associated soils that are shown as one unit on the maps.

Because of present or anticipated uses, it was considered impractical to map the soils separately. In addition, some map units include miscellaneous areas as components. Rock outcrop is an example; it has little or no soil and supports little or no vegetation.

Definitions and Criteria

The following are explanations of entries used in detailed soil map unit descriptions.

Map unit symbol and name. A numerical symbol is used to designate areas of each map unit on the soil maps. The symbol corresponds to the symbol preceding the map unit name in the map unit descriptions. The map unit name consists of soil components or miscellaneous areas or both.

Soil map unit components consist mostly of soil families but may include subgroups or higher soil taxa and miscellaneous land types.

Approximate proportion is the approximate percentage of each soil component or miscellaneous land type making up the map unit.

Landscape position describes the type of landform or surface on which the components are found.

A typical vegetation series is listed for each soil component. A series is a natural vegetation unit that has a common dominant species or set of species. Vegetation series are part of a hierarchical stratification used in the Vegetation Classification system for southern California. (U.S. Forest Service and California Department of Fish and Game, April 1978.)

Soil profile description is an abridged version of the more detailed soil profile descriptions in the section "Taxonomic Unit Descriptions". Included are the following layers:

Surface layer. The uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils; ranging in depth from 3 to 10 inches. Frequently designated as the "A horizon."

Subsoil. The soil between the surface layer and the uppermost substratum. The subsoil consists of all parts of the B horizon above a depth of 2 meters and any part of the A or C horizon between the surface layer and a depth of 1 meter or a more shallow substratum.

Substratum. A layer below a depth of 1 meter, or beneath the solum if the lower part of the solum is between 1 and 2 meters deep. Any part of the solum below 2 meters is considered substratum. Bedrock, hardpan, and unconsolidated geologic materials that are in contrasting particle-size classes relative to the surface soil or solum are substratum regardless of depth, even within 1 meter of the ground surface.

Included areas comprise the other kinds of soils in the map unit that are not named as a component part because they constitute too small a percentage of the unit.

Effective rooting depth is the range of depth that the main body of plant roots extend to, generally to shallow bedrock or to a maximum depth of 60 inches. Other limiting layers include hardpans, claypans, or weathered bedrock.

Available water capacity is the capacity of the soil to store water for use by most plants. It is commonly

defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is expressed as total inches of water within the effective rooting depth or to a depth of 60 inches. The following four classes of AWC are used in this survey:

| | |
|----------|--------------------|
| Very low | 0 to 2 inches |
| Low | 2 to 4 inches |
| Moderate | 4 to 8 inches |
| High | more than 8 inches |

Water retention class is based on the available water capacity for plants of a typical soil profile to a depth of 20 inches or to bedrock, whichever is less. This moisture content is used in evaluating soils for revegetation according to the probability of survival of seedlings.

There are three water retention classes. The soils in class 1 have an available water capacity of more than 2.4 inches. Plantings on these soils have a high probability of survival. The soils in class 2 have an available water capacity of 1.2 to 2.4 inches. Some problems will be encountered in establishing plantings. The soils in class 3 have an available water capacity of less 1.2 inches. Plantings on these soils have little chance of success unless intensive management or mitigation measures are applied.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. The soils are grouped according to the intake of water when they are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are.

Group A. Low runoff potential. Soils having high rates of infiltration and water transmission when wet. They are mostly deep, well drained to excessively drained sands and gravels.

Group B. Moderately low runoff potential. Soils having moderate rates of infiltration and water transmission when wet. They are mostly moderately deep and deep, moderately well drained and well drained soils, moderately fine to moderately coarse textured and have moderately slow to moderately rapid permeability.

Group C. Moderately high runoff potential. Soils having slow rates of infiltration and water transmission when wet. They belong mostly to one of two general categories. Those in the first category are mostly well drained and moderately well drained soils that have a slowly or very slowly permeable layer (such as a claypan or hardpan

or massive bedrock) at moderate depth (20-40 inches). Those soils in the second category generally have moderately fine or fine textures or a moderately high water table and may be somewhat poorly drained. This group also includes shallow soils over hard but highly fractured bedrock that allows moderate water transmission.

Group D. High runoff potential. Soils having very slow rates of infiltration and water transmission when wet. They are mostly fine-textured soils that have high shrink-swell potential, soils that have a permanently high water table, soils that have a claypan or a clay layer near the surface, or shallow soils over impervious material.

Some of the soil subgroups (for example, C-B for Calcixerollic Xerochrepts) were given two ratings because of their wide range of characteristics.

Permeability is the quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are: Very slow (less than 0.06 inch), slow (0.06 to 0.20 inches), moderately slow (0.2 to 0.6 inches), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Maximum Erosion Hazard

Many land use activities have the potential to cause erosion rates to exceed natural soil erosion or soil formation rates. Potential consequences of accelerated erosion include reductions in the productive capacity of the soil and adverse effects on water quality. Many interrelated factors are evaluated in an EHR system (10) to determine whether land use activities would cause accelerated erosion, and to what degree accelerated erosion would cause adverse effects. It is designed to appraise the relative risk of accelerated sheet and rill erosion. The system does not rate gully erosion, dry ravel, wind erosion, or mass wasting.

The adjective erosion hazard ratings are described below in terms of the likelihood and consequences of accelerated erosion. As the risk of accelerated erosion increases, so does the likelihood that accelerated erosion will exceed soil formation rates. The risk and consequence becomes especially critical for shallow and moderately deep soils over consolidated materials.

The maximum EHR are based on little or no vegetative cover present and on the long-term average occurrence of 2-year, 6-hour storm events. Erosion hazard risks are greater when storm frequency, intensity and/or duration

exceed long-term average occurrence, and risks are less when occurrence is below "average". The risks and consequences for adjective erosion hazard ratings are described below.

Low EHR. Accelerated erosion is not likely to occur, except in the upper part of the Low EHR numerical range, or during periods of above average storm occurrence. If accelerated erosion does occur, adverse effects on soil productivity and to nearby water quality are not expected. Erosion control measures are usually not needed for these areas.

Moderate EHR. Accelerated erosion is likely to occur in most years. Adverse effects on soil productivity (especially to shallow and moderately deep soils) and to nearby water quality may occur for the upper part of the Moderate EHR numerical range, or during periods of above average storm occurrence. The need for erosion control should be evaluated for these areas. A wide selection of measures and application methods are available.

High EHR. Accelerated erosion will occur in most years. Adverse effects on soil productivity (especially to shallow and moderately deep soils) and to nearby water quality are likely to occur, especially during periods of above average storm occurrence. Erosion control is necessary for these areas to prevent accelerated erosion. The selection of measures and methods of application are somewhat limited.

Very high EHR. Accelerated erosion will occur in most years. Adverse effects on soil productivity and to nearby water quality are very likely to occur, even during periods of below average storm occurrence. Erosion control is essential for these areas to prevent accelerated erosion. The selection of measures and methods of application are limited.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in the survey area range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Drainage class refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels

or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized.

Excessively drained. Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained. Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained. Water is removed from the soil readily but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained. Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. The soils commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained. Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained. Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, or nearly continuous rainfall, or a combination of these.

Very poorly drained. Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Soil manageability. Certain features of the land affect the relative ease of management with mechanized

equipment. Soil manageability classification rates soils and their topography on the basis of features that reduce the ease of equipment operation and features that increase the need for soil protection measures.

Soil manageability classes are ratings that are applied to the individual components of a soil map unit. Manageability classes are useful for providing specific information about individual soils. Because map units may contain soils with contrasting class ratings, soil manageability groups are used to provide general ratings that apply to an entire map unit. Manageability groups are useful for providing general information for large areas.

Soil manageability classes are represented by the numerals 1 to 4. Class 1 is the easiest to manage and class 4 is the most difficult. Letter symbols are added to classes 2, 3, and 4 to identify specific soil problems affecting management. Soil manageability classes are described as follows:

Class 1 - Easy to manage. Soils in this class are on stable slopes with gradients ranging up to about 30 percent. They are moderately deep or deep and do not have more than slight management

problems. No management option modifiers apply to this class.

Class 2 - Readily manageable. Soils in this class are mostly on slopes of less than 30 percent and have one or more moderate management limitations, such as a moderate erosion hazard.

Class 3 - Moderately difficult to manage. Soils in this class are on steep slopes that are mostly between 30 and 60 percent, or they have a major management limitation, or both.

Class 4 - Very difficult to manage. Soils in this class are on very steep slopes (more than 60 percent), or they have two or more other major management limitations.

Letter symbols are used to express the severity of potential problems in soil management. Major management option modifiers are identified by capital letters and moderate management modifiers are indicated by lowercase letters. The criteria and symbols for management option modifiers for each soil characteristic or topographic feature are listed in table 1.

TABLE 1. - Soil Features Affecting Management

| Soil features | Major modifiers | Moderate modifiers |
|----------------------------------|------------------------------------|-------------------------------------|
| Slope gradient | G..Mostly more than 60 percent | g..Mostly between 30 and 60 percent |
| Slope stability | S..Low | s..Moderate |
| Maximum erosion hazard | E..High or very high | e..Moderate |
| Soil depth | D..Less than 10 inches | d..10 to 20 inches |
| AWC, upper 20 inches | P..Less than 1.2 inches | p..1.2 to 2.4 inches |
| Wetness | W..Poorly drained | w..Somewhat poorly drained |
| Rock outcrop or surface boulders | X..More than 15 percent of surface | x..3 to 15 percent of surface area |

Management option modifiers are chosen in the order in which they are listed. One symbol can be chosen from each of the following groups: (1) symbols G, S, and E (and their lowercase forms); (2) symbols D and P; and (3) symbols W and X. Within each group, symbols for major management limitations take precedence over moderate limitations.

Soil manageability groups are defined by the mix of soil manageability classes that occurs in a soil map unit. They are designated by Roman numerals to distinguish them from soil manageability classes. Only one group applies to a soil map unit, whereas as many classes may apply as there are major components in the map unit. The soil manageability groups in the survey area are defined as follows:

Group I - Map unit is predominantly class 1. Less than 20 percent of the unit is class 3 or class 4. The unit may be no more than 50 percent class 2, or combinations of classes 2, 3, and 4.

Group II - Map unit is predominantly class 2. Less than 20 percent of the unit is class 4. Less than 50 percent of the unit is class 3 or a combination of classes 3 and 4.

Group III - Map unit is predominantly class 3. Less than 40 percent of the unit is class 4.

Group IV - Map unit is at least 40 percent class 4.

A soil map unit is placed in the group with the lowest numeral if group definitions allow the unit to be placed in more than one soil manageability group.

Soil productivity signifies the assessed ability of soils to supply essential nutrients for plant growth. Current knowledge of critical or threshold nutrient levels for

native or chaparral species is incomplete. The soil criteria used to make these ratings are: soil depth, presence or absence of a mollic epipedon, particle-size class, mineralogy, and reaction classes. The ratings are: very low, low, moderate, and high.

Production for annual forage is an estimate of the total annual production of forage grasses in pounds per acre (air-dry weight). The estimates generally are based on professional judgment because little if any field data or yield studies were available. These estimates can be verified through project monitoring activities and ecosystem classification.

Forest survey site class - the timber productivity of the soil components is expressed by the Forest Survey Site Class (FSSC). The FSSC estimated for each soil component is an average over the map unit. Site index values were obtained by using available site index data and appropriate guides for converting into FSSC. On a specific site in the map unit, FSSC might be more or less than what is given in the report FSSC is an expression of the volume of bole wood produced on an acre in one year in a normal even-aged stand at culmination mean annual increment. Below are the seven FSSC's and their corresponding volume in cubic feet per acre:

| | |
|---|------------------|
| 1 | greater than 225 |
| 2 | 165 to 225 |
| 3 | 120 to 165 |
| 4 | 85 to 120 |
| 5 | 50 to 85 |
| 6 | 20 to 50 |
| 7 | less than 20 |

The term NC means not capable of growing commercial conifer species.

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**1 Exchequer family,
30 to 60 percent slopes.**

Elevation: 1,800 to 3,700 feet Annual Precipitation: 12 to 17 inches

| | |
|---------------------------|--------------------------|
| Soil Map Unit Components | Exchequer family |
| Approximate Proportion | 80 percent |
| Landscape Position | Mountainsides and ridges |
| Slope | 30 to 60 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | 0 to 8 inches; pale brown sandy loam; weak granular structure; soft; pH 7.3 |
| Subsoil | |
| Substratum | 8 inches; hard, highly fractured micaceous schist, granitic or gneissic rock |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 5 to 18 |
| Available Water Capacity | Very low |
| Water Retention Class | 3 |
| Hydrologic Soil Group | C |
| Permeability | Moderate |
| Maximum Erosion Hazard | High |
| Erosion Factor K | .24 |
| Drainage Class | Somewhat excessively drained |
| Soil Manageability Group | III |
| Class | 3EP |
| Soil Productivity | Very low |
| Annual Forage Production (lbs/ac) | 1,000 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Modesto family, moderately deep soils and metasedimentary Rock outcrop. Included areas make up about 20 percent of the map unit. |

6 Typic Haploxeralfs, 3 to 50 percent slopes.

Elevation: 2,400 to 3,400 feet Annual Precipitation: 11 to 16 inches

Soil Map Unit **Typic Haploxeralfs**

| | |
|---------------------------|--|
| Components | |
| Approximate Proportion | 90 Percent |
| Landscape Position | Alluvial fans and terraces and dissected terrace side slopes |
| Slope | 3 to 50 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | These soils are 15 to 50 inches deep, well drained, underlain by partly consolidated sediments. They are brown sandy loam in the surface layer and reddish brown gravelly sandy clay loam of clay loam in the subsoil and are 0 to 65 percent rock fragments in the profile. |
| Subsoil | |
| Substratum | Reaction is neutral to moderately alkaline (pH 6.6 to 8.4). |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 15 to 50 |
| Available Water Capacity | Low to moderate |
| Water Retention Class | 2 |
| Hydrologic Soil Group | |
| Permeability | Moderately slow |
| Maximum Erosion Hazard | Moderate to high |
| Erosion Factor K | |
| Drainage Class | Well drained, moderately well drained |
| Soil Manageability Group Class | II 2ep |
| Soil Productivity | Moderate |
| Annual Forage Production (lbs/ac) | 1,200 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Mollic Haploxeralfs and soils similar to Haploxerolls, warm. Included areas make up about 10 percent of the map unit area. This unit is not extensive. It is located mainly in the Rowher Flats area of the Saugus and the Arrastre Canyon area of the Tujung District. In the Rowher Flats area it is used heavily by off-road vehicles. Clay is mined in the Arrastre Canyon area. |

**7 Hanford family,
3 to 25 percent slopes.**

Elevation: 2,700 to 4,400 feet Annual Precipitation: 11 to 15 inches

| | |
|---------------------------|----------------------------------|
| Soil Map Unit Components | Hanford family |
| Approximate Proportion | 75 percent |
| Landscape Position | Young alluvial fans and terraces |
| Slope | 3 to 25 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|---|
| Surface Layer | 0 to 13 inches; brown sandy loam; weak granular structure; soft; pH 7.0 |
| Subsoil | 13 to 36 inches; brown sandy loam; massive; slightly hard; pH 7.0 |
| Substratum | 36 to 60 inches; brown sandy loam; massive; slightly hard; pH 7.0 |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 60 |
| Available Water Capacity | Moderate |
| Water Retention Class | 2 |
| Hydrologic Soil Group | B |
| Permeability | Moderately rapid |
| Maximum Erosion Hazard | Moderate |
| Erosion Factor K | .20 |
| Drainage Class | Well drained |
| Soil Manageability Group | II |
| Class | 2ep |
| Soil Productivity | Moderate |
| Annual Forage Production (lbs/ac) | 1,500 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Typic Haploxeralfs, Vista family soils, Trigo family soils, Riverwash deposits and Hanford family soils. Included areas make up about 25 percent of the map unit area. |

**8 Lodo - Modesto families complex,
30 to 70 percent slopes.**

Elevation: 3,700 to 5,000 feet Annual Precipitation: 12 to 16 inches

| | | |
|---------------------------|--------------------------|--------------------------|
| Soil Map Unit Components | Lodo family | Modesto family |
| Approximate Proportion | 60 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|--|---|
| Surface Layer | 0 to 17 inches; brown gravelly loam; strong granular structure; soft; 20 percent rock fragments; pH 7.0. | 0 to 8 inches; brown loam; moderate granular structure; soft; pH 7.0 |
| Subsoil | | 8 to 46 inches; yellowish red clay loam; moderate subangular blocky structure; hard; pH 7.0 |
| Substratum | 17 inches; hard fractured schist | 46 inches; hard fractured schist |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------|
| Effective Rooting Depth (inches) | 6 to 20 | 40 to 60 |
| Available Water Capacity | Very low to low | Moderate to high |
| Water Retention Class | 2 | 1 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderate | Moderately slow |
| Maximum Erosion Hazard | High | Moderate to high |
| Erosion Factor K | .28 | .37 |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group | III | III |
| Class | 3Ed | 3g |
| Soil Productivity | Low | High |
| Annual Forage Production (lbs/ac) | 1,500 | 1,500 to 2,000 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Lodo family soils, Modesto family soils, Stonyford family soils, Millsholm family soils, and Rock outcrop. Included areas make up about 20 percent of the map unit area. | |

**12 Mollic Haploxeralfs,
2 to 50 percent slopes.**

Elevation: 1,400 to 3,200 feet Annual Precipitation: 13 to 27 inches

| | |
|---------------------------|----------------------------|
| Soil Map Unit Components | Mollic Haploxeralfs |
| Approximate Proportion | 75 percent |
| Landscape Position | Alluvial fans, terraces |
| Slope | 2 to 50 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|---|
| Surface Layer | These soils are 20 to 40 inches deep and formed in material weathered from gneiss, conglomerate, and old alluvium. They are brown loam or sandy loam in the surface layer and reddish brown or brown sandy clay loam or cobbly clay loam in the subsoil and are 0 to 55 percent rock fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8). |
| Subsoil | |
| Substratum | |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 20 to 40 inches |
| Available Water Capacity | Very low to moderate |
| Water Retention Class | 2 |
| Hydrologic Soil Group | C |
| Permeability | Moderately slow |
| Maximum Erosion Hazard | Moderate to high |
| Erosion Factor K | |
| Drainage Class | Well drained |
| Soil Manageability Group Class | II 2ep |
| Soil Productivity | Moderate |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Vista family soils, Modesto family soils, and Typic Haploxeralfs soils. Included areas make up about 25 percent of the map unit area. This unit occurs along the forest boundary adjacent to urban developments. |

**15 Calcixerollic Xerochrepts - Calleguas family - Modesto family, moderately deep complex,
30 to 60 percent slopes**

| | | | |
|---------------------------|----------------------------------|--------------------------|--|
| | Elevation: 1,500 to 2,200 feet | | Annual Precipitation: 12 to 14 inches |
| Soil Map Unit Components | Calcixerollic Xerochrepts | Calleguas family | Modesto family, moderately deep |
| Approximate Proportion | 45 percent | 20 percent | 15 percent |
| Landscape Position | Mountainsides ridges | Mountainsides and ridges | Remnants of old terrace deposits |
| Slope | 30 to 60 percent | 30 to 60 percent | 30 to 60 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|---|---|---|
| Surface Layer | These soils are 15 to 42 inches deep and formed in materials weathered from calcareous shale and sandstone. They are brown or pale brown silt loam, clay loam or silty clay loam with 2 to 30 percent rock fragments. The lower profile is moderately alkaline (pH 7.9 to 8.4) and contains soft powdery lime and lime filaments. | 0 to 4 inches; pale brown silty clay loam; moderate granular structure; slightly hard; pH 7.8 | 0 to 3 inches; dark brown loam; moderate subangular blocky structure; slightly hard; pH 7.0 |
| Subsoil | | 4 to 10 inches; very pale brown silty clay loam; massive; hard; pH 7.8 | 3 to 25 inches; brown gravelly clay loam; moderate prismatic structure; hard; 15 percent rock fragments; pH 7.0 |
| Substratum | | 10 inches; highly weathered fine-grained sandstone | 25 inches; partly consolidated sandstone conglomerate. |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|-----------------|------------------|
| Effective Rooting Depth (inches) | 15 to 42 | 6 to 19 | 20 to 40 |
| Available Water Capacity | Very low to moderate | Very low to low | Moderate |
| Water Retention Class | 1 | 2 | 1 |
| Hydrologic Soil Group | C to B | C | C |
| Permeability | Moderately slow | Moderate | Moderately slow |
| Maximum Erosion Hazard | High | High | Moderate to high |
| Erosion Factor K | | .32 | .37 |
| Drainage Class | Well drained | Well drained | Well drained |
| Soil Manageability Group Class | III 3E | III 3Ed | III 3e |
| Soil Productivity | Moderate | Very low | Moderate |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 | 300 to 7600 | 1,500 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Modesto family soils, Hanford family soils, Osito family soils, Vista family soils, and sedimentary Rock outcrop and escarpments. Included areas make up about 20 percent of the map unit area. | | |

**19 Trigo family - Calcixerollic Xerochrepts - Vista family complex,
30 to 70 percent slopes.**

Elevation: 1,400 to 2,200 feet Annual Precipitation: 14 to 20 inches

| Soil Map Unit Components | Trigo family | Calcixerollic Xerochrepts | Vista family |
|---------------------------|--------------------------|--|--------------------------|
| Approximate Proportion | 35 percent | 30 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges on calcareous sediments | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent | 30 to 60 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | 0 to 8 inches; pale brown silt loam; weak granular structure; slightly hard; pH 7.0 | These soils are 15 to 42 inches deep and formed in material weathered from calcareous shale and sandstone. They are brown or pale brown silt loam, clay loam or silty clay loam with 2 to 30 percent rock fragments. The lower profiles is moderately alkaline (pH 7.9 to 8.4) and contains soft powdery lime and lime filaments. | 0 to 9 inches; brown sandy loam; weak granular structure; slightly hard; pH 7.0 |
| Subsoil | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 | | 9 to 50 inches; pale brown sandy loam; weak subangular blocky structure; hard; pH 6.7 |
| Substratum | 16 inches; highly weathered sandstone | | 50 to 60 inches; very pale brown gravelly coarse sandy loam; massive; slightly hard; 15 percent rock fragments; pH 6.5 |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|----------------------|----------------------|------------------|
| Effective Rooting Depth (inches) | 3-19 | 15-42 | 22-60 |
| Available Water Capacity | Very low to low | Very Low to Moderate | Low to Moderate |
| Water Retention Class | 2 | 1 | 2 |
| Hydrologic Soil Group | C | C-B | C |
| Permeability | Moderately rapid | Moderately slow | Moderately rapid |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .32 | * | .28 |
| Drainage Class | Somewhat excessively | Well | Well |
| Soil Manageability Group Class | III 3Ed | 3Ed | 3Ep |
| Soil Productivity | Very Low | Moderate | High |
| Annual Forage Production (lbs/ac) | 800-1,500 | 1,000-1,500 | 1,500-2,000 |
| Forest Survey Site Class | NC | NC | NC |

Included Areas and Remarks: Milsholm family soils, Modesto family soils, Vista family soils, sedimentary Rock outcrop and escarpments, and soils similar to Trigo family soils except that they have a silty clay loam texture. Included areas make up about 15 percent of the map unit area. Under wildfire conditions Trigo and Vista soils have a high potential for forming water-repellent layers. Trigo family soils on steep slopes also have a high potential for dry ravel if protective cover is removed.

**21 Riverwash,
2 to 10 percent slopes.**

Elevation: 1,800 to 4,800 feet Annual Precipitation: 14 to 30 inches

Soil Map Unit **Riverwash**

Components

Approximate 75 percent
Proportion

Landscape Position Stream channels

Slope 2 to 10 percent

Typical Vegetation Barren
Series

Soil Profile Description

Surface Layer Riverwash consists of recent
deposits of sand, gravel,
cobble, and stony material.
The areas are subject to
flooding and are reworked by
water so frequently that they
support little or no vegetation.

Subsoil

Substratum

Soil Properties & Management Interpretations

Effective Rooting 40 to 60
Depth (inches)

Available Water
Capacity

Water Retention Class

Hydrologic Soil Group A

Permeability Very rapid

Maximum Erosion
Hazard

Erosion Factor K

Drainage Class Excessively drained

Soil Manageability
Group
Class

Soil Productivity

Annual Forage
Production (lbs/ac)

Forest Survey Site
Class NC

Included Areas and
Remarks: Small areas of Hanford family soils, Tujunga family soils, Capistrano family soils, and Vista family
soils. Included areas make up about 25 percent of the map unit area.

**24 Modesto, moderately deep - Trigo families complex,
25 to 75 percent slopes.**

Elevation: 1,800 to 2,400 feet Annual Precipitation: 12 to 19 inches

| | | |
|---------------------------|--|--------------------------|
| Soil Map Unit Components | Modesto family, moderately deep | Trigo family |
| Approximate Proportion | 60 percent | 15 percent |
| Landscape Position | Mountainsides and broad ridges | Mountainsides and ridges |
| Slope | 25 to 75 percent | 25 to 75 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | 0 to 3 inches; dark brown loam; moderate subangular blocky structure; slightly hard; pH 7.0 | 0 to 8 inches; pale brown silt loam; weak granular structure; slightly hard; pH 7.0 |
| Subsoil | 3 to 25 inches; brown gravelly clay loam; moderate prismatic structure; hard; 15 percent rock fragments; pH 7.0 | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 |
| Substratum | 25 inches; partly consolidated sandstone conglomerate | 16 inches; highly weathered sandstone |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------|------------------------------|
| Effective Rooting Depth (inches) | 20 to 40 | 3 to 19 |
| Available Water Capacity | Moderate | Very low |
| Water Retention Class | 1 | 2 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately slow | Moderately rapid |
| Maximum Erosion Hazard | Moderate to high | High |
| Erosion Factor K | .37 | .32 |
| Drainage Class | Well drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3e | III 3Ed |
| Soil Productivity | Moderate | Very low |
| Annual Forage Production (lbs/ac) | 1,500 | 800 to 1,500 |
| Forest Survey Site Class | NC | NC |

Included Areas and Remarks: Small areas of Millsholm family soils, Stonyford family soils, Lodo family soils, Vista family soils, Typic Haploxeralfs and sandstone Rock outcrop. Included areas make up about 25 percent of the map unit area.

**26 Stonyford - Millsholm families complex,
30 to 70 percent slopes.**

Elevation: 1,800 to 3,700 feet Annual Precipitation: 16 to 20 inches

| Soil Map Unit Components | Stonyford family | Millsholm family |
|---------------------------|--------------------------|--------------------------|
| Approximate Proportion | 50 percent | 30 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | 0 to 5 inches; dark grayish brown gravelly clay loam; moderate subangular blocky structure; slightly hard; 15 percent rock fragments; pH 7.0. | 0 to 5 inches; pale brown clay loam; moderate subangular blocky structure; slightly hard; pH 7.0. |
| Subsoil | 5 to 19 inches; brown gravelly clay loam; moderate subangular blocky structure; hard; 20 percent rock fragments; pH 7.0. | 5 to 17 inches; brown clay loam; moderate subangular blocky structure; hard; pH 7.0. |
| Substratum | 19 inches; hard, highly fractured fine-grained sandstone. | 17 inches; hard fractured sandstone. |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|-----------------|
| Effective Rooting Depth (inches) | 10 to 20 | 12 to 19 |
| Available Water Capacity | Very low to low | Very low to low |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately slow | Moderately slow |
| Maximum Erosion Hazard | High | High |
| Erosion Factor K | .32 | .37 |
| Drainage Class | Well drained | Well drained |
| Soil Manageability Group Class | III 3Ed | III 3Ed |
| Soil Productivity | Low | Low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,200 | 1,000 to 1,200 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Lodo family soils, Exchequer family soils, Typic Haploxeralfs, Modesto family soils, Millsholm family soils and sandstone Rock outcrop. Included areas make up about 20 percent of the map unit area. | |

**29 Lodo family - Mollic Haploxeralfs association,
15 to 50 percent slopes.**

Elevation: 2,800 to 3,400 feet Annual Precipitation: 15 to 21 inches

| Soil Map Unit Components | Lodo family | Mollic Haploxeralfs |
|---------------------------|-----------------------------------|----------------------------|
| Approximate Proportion | 75 percent | 25 percent |
| Landscape Position | Mountainsides, ridges, and basins | Mountainsides and ridges |
| Slope | 15 to 50 percent | 15 to 50 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | 0 to 17 inches; brown gravelly loam; strong granular structure; soft; 20 percent rock fragments; pH 7.0 | These soils are 20 to 40 inches deep and formed in material weathered from gneiss, conglomerate, and old alluvium. They are brown loam or sandy loam in the surface layer and reddish brown or brown sandy clay loam or cobbly clay loam in the subsoil and are 0 to 55 percent rock fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8). |
| Subsoil | | |
| Substratum | 17 inches; hard fractured schist | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|----------------------|
| Effective Rooting Depth (inches) | 6 to 20 | 20 to 60 |
| Available Water Capacity | Very low to low | Very low to moderate |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderate | Moderately slow |
| Maximum Erosion Hazard | High | Moderate to high |
| Erosion Factor K | .28 | |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | III 3Ed | III 3ep |
| Soil Productivity | Low | Moderate |
| Annual Forage Production (lbs/ac) | 1,500 | 1,000 to 1,500 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | This unit is not extensive; it is in the Necktie Basin area on Warm Springs Mountain in the Saugus Ranger District. | |

**33 Caperton - Capistrano families complex,
35 to 80 percent slopes**

Elevation: 2,200 to 5,600 feet Annual Precipitation: 15 to 21 inches

| Soil Map Unit Components | Caperton family | Capistrano family |
|---------------------------|--|---|
| Approximate Proportion | 60 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and colluvial slopes |
| Slope | 35 to 80 percent | 35 to 80 percent |
| Typical Vegetation Series | Chamise on south aspects. Interior live oak on north aspects. | Chamise on south aspects Interior live oak on north aspects. |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | 0 to 17 inches; dark grayish brown gravelly loam; moderate granular structure; soft; 15 percent rock fragments; pH 6.6 | 0 to 17 inches; brown gravelly sandy loam; moderate granulate structure; soft; 15 percent rock fragments; pH 6.7 |
| Subsoil | | 17 to 42 inches; yellowish brown gravelly sandy loam; massive; soft; 30 percent rock fragments; pH 7.0 |
| Substratum | 17 inches; highly weathered gneissic rock | 42 to 60 inches; yellowish brown gravelly sandy loam; massive; soft; 30 percent rock fragment; pH 7.0 |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|------------------|
| Effective Rooting Depth (inches) | 4 to 20 | 40 to 60 |
| Available Water Capacity | Very low to low | Moderate |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | B |
| Permeability | Moderate | Moderately rapid |
| Maximum Erosion Hazard | High | High |
| Erosion Factor K | .20 | .20 |
| Drainage Class | Well drained | Well drained |
| Soil Manageability Group Class | III 3Ed | III 3Ep |
| Soil Productivity | Low | High |
| Annual Forage Production (lbs/ac) | 1,000 to 1,300 | 1,500 to 1,800 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Trigo family soils, Lodo family soils, and other moderately deep, moderately fine textured soils. Included areas make up about 20 percent of the map unit area. On north aspects, this unit borders on the mesic soil temperature regime. | |

**35 Trigo, granitic substratum - Exchequer families - Rock outcrop complex,
30 to 60 percent slopes**

| Soil Map Unit Components | Elevation: 1,800 to 5,500 feet | | Annual Precipitation: 14 to 25 inches |
|---------------------------|--|--------------------------|---------------------------------------|
| | Trigo family, granitic substratum | Exchequer family | Rock outcrop |
| Approximate Proportion | 40 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Canyonside |
| Slope | 30 to 60 percent | 30 to 60 percent | 30 to 60 percent |
| Typical Vegetation Series | Chamise | Chamise | Barren |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | 0 to 3 inches; dark grayish brown loam; weak granular structure; soft; pH 6.7 | 0 to 8 inches; pale brown sandy loam; weak granular structure; soft; pH 7.3 | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soil material capable of supporting plants |
| Subsoil | 3 to 17 inches; pale brown gravelly sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | | |
| Substratum | 17 inches; highly weathered granitic rock | 8 inches; highly fractured micaceous schist or granitic or gneissic rock | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------------------|------------------------------|
| Effective Rooting Depth (inches) | 3 to 19 | 5 to 18 |
| Available Water Capacity | Very low | Very low |
| Water Retention Class | 3 | 3 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid | Moderate |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .24 | .24 |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3EP | III 3EPx |
| Soil Productivity | Very low | Very low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,000 |
| Forest Survey Site Class | NC | NC |

Included Areas and Remarks: Small areas of Chilao family soils, Pismo family soils, Shortcut family soils, Caperton family soils, Lodo family soils, Modjeska family soils, Osito family soils, and Typic Xerorthents, warm. Included areas make up about 15 percent of the map unit area. These soils have high potential for dry ravel on slopes of more than 50 percent if their protective cover is removed.

**36 Trigo, granitic substratum - Exchequer families - Rock outcrop complex,
60 to 100 percent slopes.**

| | | | |
|---------------------------|--|--------------------------|---------------------------------------|
| | Elevation: 1,800 to 5,500 feet | | Annual Precipitation: 14 to 25 inches |
| Soil Map Unit Components | Trigo family, granitic substratum | Exchequer family | Rock outcrop |
| Approximate Proportion | 40 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Canyonsides |
| Slope | 60 to 100 percent | 60 to 100 percent | 60 to 85 percent |
| Typical Vegetation Series | Chamise | Chamise | Barren |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | 0 to 3 inches; dark gravelly grayish brown sandy loam; weak granular structure; soft; pH 6.7 | 0 to 8 inches; pale brown sandy loam; weak granular structure; soft; pH 7.3 | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusion of soil material capable of supporting plants. |
| Subsoil | 3 to 17 inches; pale brown gravelly sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | | |
| Substratum | 17 inches; highly weathered rock | 8 inches; highly fractured micaceous schist or granitic or gneissic rock | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------------------|
| Effective Rooting Depth (inches) | 3 to 19 | 5 to 18 |
| Available Water Capacity | Very Low | Very Low |
| Water Retention Class | 2 | 3 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid | moderate |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .24 | .24 |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4Edx | IV 4EPx |
| Soil Productivity | Very low | Very low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,000 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Chilao family soils, Pismo family soils, Shortcut family soils, Caperton family soils, Lodo family soils, Modjeska family soils, and Typic Xerorthents, warm. Included areas make up about 15 percent of the map unit area. These soils have a high potential for dry ravel if cover is removed. | |

**37 Lodo - Tujunga families association,
2 to 50 percent slopes.**

| | | |
|---------------------------|-------------------------------|---------------------------------------|
| | Elevation 3,000 to 3,400 feet | Annual Precipitation: 14 to 17 inches |
| Soil Map Unit Components | Lodo family | Tujunga family |
| Approximate Proportion | 45 percent | 45 percent |
| Landscape Position | Mountainsides and ridges | Alluvial fans |
| Slope | 15 to 50 percent | 2 to 50 percent |
| Typical Vegetation Series | Chamise | Chamise and annual grasses |

Soil Profile Description

| | | |
|---------------|---|--|
| Surface Layer | 0 to 17 inches; brown gravelly loam; strong granular structure; soft; 20 percent rock fragments; pH 7.0 | 0 to 14 inches; brown sandy loam; weak granular structure; soft; 15 percent rock fragments; pH 7.0 |
| Subsoil | | 14 to 40 inches; pale brown gravelly loamy sand; massive; soft; 20 percent rock fragments; pH 7.0 |
| Substratum | 17 inches; hard fractured schist | 40 to 60 inches; pale brown gravelly loamy sand; massive soft; 20 percent rock fragments; pH 7.0 |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------------------|---------------------|
| Effective Rooting Depth (inches) | 6 to 20 | 50 to 60 |
| Available Water Capacity | Very low to low | Low to moderate |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | A |
| Permeability | Moderate | Rapid |
| Maximum Erosion Hazard | High | Moderate |
| Erosion Factor K | .28 | .20 |
| Drainage Class | Somewhat excessively drained | Excessively drained |
| Soil Manageability Group Class | II 2Edp | II 2ep |
| Soil Productivity | Low | Low |
| Annual Forage Production (lbs/ac) | 1,500 | 1,000 to 1,200 |
| Forest Survey Site Class | NC | NC |

Included Areas and Remarks: Small areas of Hanford family soils, Typic Haploxeralfs, Millsholm family soils, and Exchequer family soils. Included areas make up about 10 percent of the map unit area. This unit is not extensive; it occurs in Bouquet Canyon, east of Bouquet Reservoir in the Saugus Ranger District.

**39 Tujunga - Capistrano families association,
2 to 20 percent slopes.**

Elevation: 2,600 to 4,200 feet Annual Precipitation: 17 to 20 inches

| Soil Map Unit Components | Tujunga family | Capistrano family |
|---------------------------|-----------------------------------|---|
| Approximate Proportion | 70 percent | 20 percent |
| Landscape Position | Alluvial fans and terraces | Alluvial fans and terraces, in older, more stable positions |
| Slope | 2 to 20 percent | 2 to 20 percent |
| Typical Vegetation Series | Coast live oak and annual grasses | Coast live oak and annual grasses |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | 0 to 14 inches; brown sandy loam; weak granular structure; structure; soft; 15 percent soft; 15 percent rock fragments; pH 7.0 | 0 to 17 inches; brown gravelly sandy loam; moderate granular rock fragments; pH 6.7 |
| Subsoil | 14 to 40 inches; pale brown gravelly loamy sand; massive; soft; 20 percent rock fragments; pH 7.0 | 17 to 42 inches; yellowish brown gravelly sandy loam; massive; soft; 30 percent rock fragments; pH 7.0 |
| Substratum | 40 to 60 inches; pale brown gravelly loamy sand; massive; soft; 20 percent rock fragments; pH 7.0 | 42 to 60 inches; yellowish brown gravelly sandy loam; massive; soft; 30 percent rock fragments; pH 7.0 |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------|
| Effective Rooting Depth (inches) | 60 | 60 |
| Available Water Capacity | Low to moderate | Moderate |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | A | B |
| Permeability | Rapid | Moderately rapid |
| Maximum Erosion Hazard | Moderate | Moderate |
| Erosion Factor K | .20 | .20 |
| Drainage Class | Excessively drained | Well drained |
| Soil Manageability Group Class | II 2ep | II 2ep |
| Soil Productivity | Low | High |
| Annual Forage Production (lbs/ac) | 1,000 to 1,200 | 1,500 to 1,800 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Baywood family soils, Hanford family soils, and Vista family soils. Included areas make up about 10 percent of the map unit area. This unit is not extensive; it is located in the Green Valley and Elizabeth Lake area. Residential development has taken place on this unit. | |

**43 Caperton - Baywood families complex,
45 to 80 percent slopes.**

Elevation: 2,000 to 4,800 feet Annual Precipitation: 17 to 21 inches

| Soil Map Unit Components | Caperton family | Baywood family |
|---------------------------|--------------------------|--|
| Approximate Proportion | 60 percent | 30 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides, particularly on colluvial/alluvial slopes |
| Slope | 45 to 80 percent | 45 to 80 percent |
| Typical Vegetation Series | Interior live oak | Interior live oak |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | 0 to 17 inches; dark grayish brown gravelly loam; moderate granular structure; soft; 15 percent rock fragments; pH 6.6 | 0 to 10 inches; brown gravelly sandy loam; weak granular structure; soft; 15 percent rock fragments; pH 7.0 |
| Subsoil | | 10 to 40 inches; brown gravelly loamy sand; massive; soft; 30 percent rock fragments; pH 7.0 |
| Substratum | 17 inches; highly weathered gneissic rock | 40 to 58 inches; brown gravelly loamy sand; massive; soft; 30 percent rock fragments; pH 7.0 58 inches; weathered gneissic rock |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|-----------------|------------------------------|
| Effective Rooting Depth (inches) | 4 to 20 | 44 to 60 |
| Available Water Capacity | Very low to low | Low to moderate |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | A |
| Permeability | Moderate | Rapid |
| Maximum Erosion Hazard | High | Very high |
| Erosion Factor K | .20 | .17 |
| Drainage Class | Well drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3Ed | III 3Ep |
| Soil Productivity | Low | Moderate |
| Annual Forage Production (lbs/ac) | 1,000 to 1,300 | 1,200 |
| Forest Survey Site Class | NC | NC |

Included Areas and Remarks: Small areas of Tujunga family soils, Capistrano family soils, and Pismo family soils. Included areas make up about 10 percent of the map unit area. This unit is bordering on the mesic soil temperature regime. It is not extensive and is located in the Saugus District in the areas of Elizabeth Lake Canyon, South Portal Canyon, and Jupiter Mountain.

**45 Vista family,
5 to 30 percent slopes.**

Elevation: 2,500 to 4,000 feet Annual Precipitation: 15 to 21 inches

| | |
|---------------------------|--|
| Soil Map Unit Components | Vista family |
| Approximate Proportion | 85 percent |
| Landscape Position | Broad ridges, alluvial fans, and mountainsides |
| Slope | 5 to 30 percent |
| Typical Vegetation Series | Annual grasses |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | 0 to 9 inches; brown sandy loam; weak granular structure; slightly hard; pH 7.0 |
| Subsoil | 9 to 50 inches; pale brown sandy loam; weak subangular blocky structure; hard; pH 6.7 |
| Substratum | 50 to 60 inches; very pale brown gravelly coarse sandy loam; massive, slightly hard; 15 percent rock fragments; pH 6.5 |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 22 to 60 |
| Available Water Capacity | Low to moderate |
| Water Retention Class | 2 |
| Hydrologic Soil Group | C |
| Permeability | Moderately rapid |
| Maximum Erosion Hazard | High |
| Erosion Factor K | .28 |
| Drainage Class | Well drained |
| Soil Manageability Group Class | II 2Ep |
| Soil Productivity | High |
| Annual Forage Production (lbs/ac) | 1,500 to 2,0000 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Modesto family soils and Oak Glen family soils. Included areas make up about 15 percent of the map unit area. This unit is not extensive. It is found in small scattered 50 to 250-acre parcels. |

**46 Caperton - San Andreas - Modesto families complex,
15 to 60 percent slopes.**

Elevation: 3,200 to 4,200 feet Annual Precipitation: 17 to 19 inches

| Soil Map Unit Components | Caperton family | San Andreas family | Modesto family |
|---------------------------|--------------------------|---|---------------------------------|
| Approximate Proportion | 45 percent | 30 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides, ridges, and colluvial slopes | Stable mountainsides and ridges |
| Slope | 15 to 60 percent | 15 to 60 percent | 15 to 60 percent |
| Typical Vegetation Series | Ceanothus | Interior live oak | Interior live oak |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | 0 to 17 inches; dark grayish brown gravelly loam; moderate granular structure; soft; 15 percent rock fragments; pH 6.6 | 0 to 16 inches; dark gray loam; weak granular structure; slightly hard; pH 6.6 | 0 to 8 inches; brown loam; moderate granular structure; soft; pH 7.0 |
| Subsoil | | 16 to 32 inches; grayish brown loam; weak subangular blocky structure; slightly hard; pH 6.8 | 8 to 46 inches; yellowish red clay loam; moderate subangular blocky structure; hard; pH 7.0 |
| Substratum | 17 inches; highly weathered gneissic rock | 32 to 60 inches; light brownish gray sandy loam; massive; slightly hard; pH 6.8 | 46 inches; hard fractured schist |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|----------------|------------------|
| Effective Rooting Depth (inches) | 4 to 20 | 40 | 40 to 60 |
| Available Water Capacity | Very low to low | Moderate | Moderate to high |
| Water Retention Class | 2 | 1 | 1 |
| Hydrologic Soil Group | C | B | C |
| Permeability | Moderate | Moderate | Moderate to slow |
| Maximum Erosion Hazard | Very high | High | High |
| Erosion Factor K | .20 | .32 | .37 |
| Drainage Class | Well drained | Well drained | Well drained |
| Soil Manageability Group Class | III 3Ed | III 3E | III 3E |
| Soil Productivity | Low | High | High |
| Annual Forage Production (lbs/ac) | 1,000 to 1,300 | 1,500 to 2,000 | 1,500 to 2,000 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Capistrano family soils, Trigo family soils, and Pismo family soils. Included areas make up about 5 percent of the map unit. This unit is bordering on the mesic soil temperature regime. | | |

**47 Pacifico - Preston families complex,
15 to 50 percent slopes.**

Elevation: 4,000 to 6,000 feet Annual Precipitation: 20 to 30 inches

| Soil Map Unit Components | Pacifico family | Preston family |
|---------------------------|---|---|
| Approximate Proportion | 45 percent | 35 percent |
| Landscape Position | Mountainsides | Mountainsides |
| Slope | 15 to 50 percent | 15 to 50 percent |
| Typical Vegetation Series | Coulter pine and bigcone Douglas-fir | Coulter pine and bigcone Douglas-fir |

Soil Profile Description

| | | |
|---------------|--|---|
| Surface Layer | 0 to 5 inches; grayish brown loamy sand; weak granular structure; soft; pH 6.0 | 0 to 13 inches; light brownish gray gravelly loamy sand; weak granular structure; soft; 15 percent rock fragments; pH 6.6 |
| Subsoil | 5 to 17 inches; light brownish gray loamy sand; weak granular structure; loose; pH 7.0 | 13 to 30 inches; pale brown gravelly loamy sand; massive; slightly hard; 20 percent rock fragments; pH 6.5 |
| Substratum | 17 inches; highly weathered granitic rock | 30 inches; highly weathered diorite or granodiorite |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|--|
| Effective Rooting Depth (inches) | 10 to 20 | 30 to 39 |
| Available Water Capacity | Very low | Low |
| Water Retention Class | 3 | 2 |
| Hydrologic Soil Group | C | B |
| Permeability | Rapid | Rapid |
| Maximum Erosion Hazard | High | Moderate |
| Erosion Factor K | .17 | .17 |
| Drainage Class | Somewhat excessively drained and excessively drained | Somewhat excessively drained and excessively drained |
| Soil Manageability Group | III | III |
| Class | 3EP | 3ep |
| Soil Productivity | Very low | Low |
| Annual Forage Production (lbs/ac) | 300 to 500 | 500 to 700 |
| Forest Survey Site Class | 6 | 6 |
| Included Areas and Remarks: | Small areas of Springdale family soils, Tollhouse family soils, Rock outcrop, and soils similar to Pacifico family soils. Included areas make up about 20 percent of the map unit. | |

**48 Trigo - Modesto - San Andreas families association,
15 to 70 percent slopes.**

| Soil Map Unit Components | Elevation: 1,300 to 2,500 feet Annual Precipitation: 16 to 20 inches | | |
|---------------------------|---|----------------------|--------------------------------------|
| | Trigo family | Modesto famiy | San Andreas family |
| Approximate Proportion | 35 percent | 20 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Old terrace remnants | Old colluvium on toe slopes and fans |
| Slope | 15 to 70 percent | 15 to 70 percent | 15 to 60 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | 0 to 8 inches; pale brown silt loam; weak granular structure; slightly hard; pH 7.0 | 0 to 8 inches; brown loam; moderate granular structure; soft; pH 7.0 | 0 to 16 inches; dark gray loam; weak granular structure; slightly hard; pH 6.6 |
| Subsoil | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 7.0 | 8 to 46 inches; yellowish red clay loam; moderate subangular blocky structure; hard; pH 7.0 | 16 to 32 inches; grayish brown loam; weak subangular blocky structure; slightly hard; pH 6.8 |
| Substratum | 16 inches; highly weathered sandstone | 46 inches; hard fractured schist | 32 to 60 inches; light brownish gray sandy loam; massive; slightly hard; pH 6.8 |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|------------------|----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 40 to 60 | 40 |
| Available Water Capacity | Very low to low | Moderate to high | Moderate |
| Water Retention Class | 2 | 1 | 1 |
| Hydrologic Soil Group | C | C | B |
| Permeability | Moderate to rapid | Moderately slow | Moderate |
| Maximum Erosion Hazard | Very high | High | High |
| Erosion Factor K | .32 | .37 | .32 |
| Drainage Class | Somewhat excessively drained | Well drained | Well drained |
| Soil Manageability Group Class | III 3Ed | III 3E | III 3E |
| Soil Productivity | Very low | High | High |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,500 to 2,000 | 1,500 to 2,000 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Caperton, Osito, Calleguas, Vista, and Hanford family soils, Calcixerollic Xerochrepts, Haploxerolls, warm, Typic Xerorthents, and escarpments of sedimentary strata. Included areas make up about 25 percent of the map unit. | | |

**50 Trigo, granitic substratum - Pismo families complex,
20 to 60 percent slopes.**

Elevation: 3,600 to 4,600 feet Annual Precipitation: 14 to 19 inches

| Soil Map Unit Components | Trigo family, granitic substratum | Pismo family |
|---------------------------|--|--------------------------|
| Approximate Proportion | 55 percent | 35 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 20 to 60 percent | 20 to 60 percent |
| Typical Vegetation Series | Chamise and manzanita | Chamise and manzanita |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | 0 to 3 inches; dark grayish brown loam; weak granular structure soft; pH 6.7 | 0 to 9 inches; light brownish gray gravelly loamy sand; moderate granular structure; soft; 15 percent rock fragments; pH 7.0 |
| Subsoil | 3 to 17 inches; pale brown sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | |
| Substratum | 17 inches; highly weathered granitic rock. | 9 inches; highly weathered anorthosite rock |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|--|
| Effective Rooting Depth (inches) | 3 to 19 | 4 to 20 |
| Available Water Capacity | Very low to low | Very low |
| Water Retention Class | 3 | 3 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid | Rapid |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .24 | .15 |
| Drainage Class | Somewhat excessively drained | Somewhat excessively and excessively drained |
| Soil Manageability Group Class | III 3EP | III 3EPd |
| Soil Productivity | Very low | Very low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 500 to 800 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Vista family soils, Modesto family soils, Hanford family soils, Tujung family soils, and granitic Rock outcrop. Included areas make up about 10 percent of the map unit. | |

**54 Caperton - Trigo, granitic substratum - Lodo families complex,
50 to 85 percent slopes.**

| Soil Map Unit Components | Elevation: 2,000 to 5,000 feet Annual Precipitation: 15 to 30 inches | | |
|---------------------------|---|--|--------------------|
| | Caperton family | Trigo family, granitic substratum | Lodo family |
| Approximate Proportion | 45 percent | 25 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides |
| Slope | 50 to 85 percent | 50 to 85 percent | 50 to 85 percent |
| Typical Vegetation Series | Chamise and ceanothus | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | 0 to 17 inches; dark grayish brown gravelly loam; moderate granular structure; soft; 15 percent rock fragments; pH 6.6 | 0 to 3 inches; dark grayish brown loam; weak granular structure; soft; pH 6.7 | 0 to 17 inches; brown gravelly loam; strong granular structure; soft; 20 percent rock fragments; pH 7.0 |
| Subsoil | | 3 to 17 inches; pale brown sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | |
| Substratum | 17 inches; highly weathered gneissic rock | 17 inches; highly weathered granitic rock | 17 inches; hard fractured schist |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|------------------------------|------------------------------|
| Effective Rooting Depth (inches) | 4 to 20 | 3 to 19 | 6 to 20 |
| Available Water Capacity | Very low to low | Very low | Very low to low |
| Water Retention Class | 2 | 2 | 2 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Moderate Moderate rapid | Moderate | |
| Maximum Erosion Hazard | Very high | Very high | Very high |
| Erosion Factor K | .20 | .24 | .28y |
| Drainage Class | Well drained | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group | IV | IV | IV |
| Class | 4Ed | 4Ed | 4Ed |
| Soil Productivity | Low | Very low | Low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,300 | 800 to 1,500 | 1,000 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Pismo family soils, Vista family soils, Hanford family soils, Caperton family soils, Exchequer family soils, Chilao family soils, and Rock outcrop. Included areas make up about 15 percent of the map unit. | | |

**57 Pacifico family - Xerorthents complex,
50 to 90 percent slopes.**

Elevation: 3,3400 to 6,500 feet Annual Precipitation: 19 to 28 inches

| Soil Map Unit Components | Pacifico family | Xerorthents |
|---------------------------|---|---|
| Approximate Proportion | 50 percent | 35 percent |
| Landscape Position | Mountainsides | Mountainsides |
| Slope | 50 to 90 percent | 50 to 90 percent |
| Typical Vegetation Series | Bigcone Douglas-fir and canyon live oak | Bigcone Douglas-fir and canyon live oak |

Soil Profile Description

| | | |
|---------------|--|---|
| Surface Layer | 0 to 5 inches; grayish brown loamy sand; weak granular structure; soft; pH 6.0 | These soils are 4 to 60 inches deep over highly weathered granitic, metamorphic, or anorthosite rock. They have a brown gravelly sandy loam surface layer and a pale brown very gravelly sandy loam substratum. The profile is 5 to 85 percent rock fragments. Reaction is very strongly acid to moderately alkaline (pH 4.5 to 8.4). |
| Subsoil | 5 to 17 inches; light brownish gray loamy sand; weak granular structure; loose; pH 7.0 | |
| Substratum | 17 inches; highly weathered granitic rock | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------------------|
| Effective Rooting Depth (inches) | 10 to 20 | 4 to 60 |
| Available Water Capacity | Very low | Very low |
| Water Retention Class | 3 | 3 |
| Hydrologic Soil Group | C | C to B |
| Permeability | Rapid | Moderate rapid |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .17 | |
| Drainage Class | Somewhat excessively drained and excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4EPd | IV 4EPd |
| Soil Productivity | Very low | Low |
| Annual Forage Production (lbs/ac) | 300 to 500 | 1,000 |
| Forest Survey Site Class | 6 | 6 |
| Included Areas and Remarks: | Small areas of Tollhouse family soils, Rock outcrop, and soils similar to Springdale family soils. Included areas make up about 15 percent of the map unit. | |

**59 Tollhouse - Knutsen - Stukel families complex,
30 to 70 percent slopes.**

Elevation: 4,000 to 6,200 feet Annual Precipitation: 17 to 25 inches

| Soil Map Unit Components | Tollhouse family | Knutsen family | Stukel family |
|---------------------------|--------------------------|--------------------------|--------------------------|
| Approximate Proportion | 55 percent | 20 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Bigcone Douglas-fir | Bigcone Douglas-fir | Canyon live oak |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | 0 to 6 inches; grayish brown gravelly sandy loam; moderate granular structure; soft; 30 percent rock fragments; pH 7.0 | 0 to 19 inches; brown gravelly sandy loam; moderate granular structure; soft; 30 percent rock fragments; pH 6.5 | 0 to 11 inches; very dark grayish brown gravelly loam; moderate granular structure; soft; 20 percent rock fragments; pH 6.5 |
| Subsoil | | 19 to 40 inches; yellowish brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 25 percent rock fragments; pH 7.0 | |
| Substratum | 6 inches; highly weathered granitic rock | 40 to 60 inches; yellowish brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 25 percent rock fragments; pH 7.0 | 11 inches; hard, fractured granitic rock |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------|------------------------------|
| Effective Rooting Depth (inches) | 6 to 18 | 26 to 60 | 8 to 18 |
| Available Water Capacity | Very low | Low to moderate | Very low to low |
| Water Retention Class | 3 | 2 | 2 |
| Hydrologic Soil Group | C | B | C |
| Permeability | Moderately rapid | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Very high | High | High |
| Erosion Factor K | .20 | .20 | .28 |
| Drainage Class | Somewhat excessively drained | Well drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3EPd | III 3Ep | III 3Ed |
| Soil Productivity | Low | High | Low |
| Annual Forage Production (lbs/ac) | 750 to 1,000 | 1,000 to 1,200 | 750 to 1,000 |
| Forest Survey Site Class | 6 | 5 | 6 |
| Included Areas and Remarks: | Small areas of Oak Glen family soils, Rock outcrop, and soils similar to Knutsen family soils except that they have finer textures. Included areas make up about 10 percent of the map unit. | | |

**62 Oak Glen family,
2 to 35 percent slopes.**

Elevation: 3,600 to 5,700 feet Annual Precipitation: 15 to 21 inches

| | |
|---------------------------------|--------------------------|
| Soil Map Unit Components | Oak Glen family |
| Approximate Proportion | 75 percent |
| Landscape Position | Broad mountain ridgetops |
| Slope | 2 to 35 percent |
| Typical Vegetation Series | Black oak |

Soil Profile Description

| | |
|---------------|---|
| Surface Layer | 0 to 26 inches; grayish brown sandy loam; moderate granular structure; soft; pH 6.8 |
| Subsoil | 26 to 40 inches; brown sandy loam; massive; slightly hard; pH 7.0 |
| Substratum | 40 to 60 inches; brown sandy loam; massive; slightly hard; pH 7.0 |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|--|
| Effective Rooting Depth (inches) | 60 |
| Available Water Capacity | Moderate |
| Water Retention Class | 2 |
| Hydrologic Soil Group | B |
| Permeability | Moderately rapid |
| Maximum Erosion Hazard | Moderate |
| Erosion Factor K | .20 |
| Drainage Class | Well drained |
| Soil Manageability Group | II |
| Class | 2ep |
| Soil Productivity | High |
| Annual Forage Production (lbs/ac) | 1,000 to 2,000 |
| Forest Survey Site Class | 5 |
| Included Areas and Remarks: | Small areas of Stukel family soils and Vista family soils. Included areas make up about 25 percent of the map unit. This soil occurs extensively in Liebre Mt. area. |

**64 Oak Glen - Tollhouse families complex,
30 to 70 percent slopes.**

Elevation: 4,000 to 5,400 feet Annual Precipitation: 15 to 21 inches

| Soil Map Unit Components | Oak Glen family | Tollhouse family |
|---------------------------|------------------------|-------------------------|
| Approximate Proportion | 70 percent | 20 percent |
| Landscape Position | Mountainsides | Mountainsides |
| Slope | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Canyon live oak | Canyon live oak |

Soil Profile Description

| | | |
|---------------|---|--|
| Surface Layer | 0 to 26 inches; grayish brown sandy loam; moderate granular structure; soft; pH 6.8 | 0 to 6 inches; grayish brown gravelly sandy loam; moderate granular structure; soft; 30 percent rock fragments; pH 7.0 |
| Subsoil | 26 to 40 inches; brown sandy loam; massive; slightly hard; pH 7.0 | |
| Substratum | 40 to 60 inches; brown sandy loam; massive; slightly hard; pH 7.0 | 6 inches; highly weathered granitic rock |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|------------------------------|
| Effective Rooting Depth (inches) | 60 | 6 to 18 |
| Available Water Capacity | Moderate | Very low |
| Water Retention Class | 2 | 3 |
| Hydrologic Soil Group | B | C |
| Permeability | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Moderate to high | Very high |
| Erosion Factor K | .20 | .20 |
| Drainage Class | Well drained | Somewhat excessively drained |
| Soil Manageability Group | III | III |
| Class | 3gp | 3EPd |
| Soil Productivity | High | Low |
| Annual Forage Production (lbs/ac) | 1,000 to 2,000 | 750 to 1,000 |
| Forest Survey Site Class | 5 | 6 |
| Included Areas and Remarks: | Small areas of Rock outcrop and colluvial soils. Included areas make up about 10 percent of the map unit area. | |

**69 Tujunga - Pismo families association,
15 to 70 percent slopes.**

Elevation: 3,400 to 4,600 feet Annual Precipitation: 16 to 20 inches

| Soil Map Unit Components | Tujunga family | Pismo family |
|---------------------------|------------------------------------|----------------------|
| Approximate Proportion | 50 percent | 35 percent |
| Landscape Position | Alluvial fans and colluvial slopes | Eroded mountainsides |
| Slope | 15 to 50 percent | 15 to 70 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | 0 to 14 inches; brown sandy loam; weak granular structure; soft; 15 percent rock fragments; pH 7.0 | 0 to 9 inches; light brownish gray gravelly loamy sand; moderate granular structure; soft; 15 percent rock fragments; pH 7.0 |
| Subsoil | 14 to 40 inches; pale brown gravelly loamy sand; massive; soft; 20 percent rock fragments; pH 7.0 | |
| Substratum | 40 to 60 inches; pale brown gravelly loamy sand; massive; soft; 20 percent rock fragments; pH 7.0 | 9 inches; highly weathered anorthosite |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|--|
| Effective Rooting Depth (inches) | 60 | 4 to 20 |
| Available Water Capacity | Low to moderate | Very low |
| Water Retention Class | 2 | 3 |
| Hydrologic Soil Group | A | C |
| Permeability | Rapid | Rapid |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .20 | .15 |
| Drainage Class | Excessively drained | Somewhat excessively drained and excessively drained |
| Soil Manageability Group Class | III 3Ep | III 3EPd |
| Soil Productivity | Low | Very low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,200 | 500 to 800 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Baywood family soils, Typic Xerorthents, warm, soils, and Rock outcrop. Included areas make up about 15 percent of the map unit area. | |

**72 Osito - Trigo families complex,
25 to 55 percent slopes.**

Elevation: 2,200 to 3,500 feet Annual Precipitation: 19 to 21 inches

| Soil Map Unit Components | Osito family | Trigo family |
|---------------------------|--------------------------|--------------------------|
| | Approximate Proportion | 60 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 25 to 55 percent | 25 to 55 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|--|---|
| Surface Layer | 0 to 1.5 inches; brown loam; moderate subangular blocky structure; hard; pH 7.3 | 0 to 8 inches; pale brown silt loam; weak granular structure; slightly hard; pH 7.0 |
| Subsoil | 1.5 to 15 inches; pale brown silty clay loam; moderate subangular blocky structure; hard; pH 7.0 | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 |
| Substratum | 15 inches highly; weathered fine-grained sandstone | 16 inches; highly weathered sandstone |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------------------|
| Effective Rooting Depth (inches) | 10 to 20 | 3 to 19 |
| Available Water Capacity | Very low to low | Very low to low |
| Water Retention Class | 1 | 2 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately slow | Moderately rapid |
| Maximum Erosion Hazard | High | High |
| Erosion Factor K | .37 | .32 |
| Drainage Class | Well drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3Ed | III 3Ed |
| Soil Productivity | Low | Very low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 | 800 to 1,500 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of other fine textured soils on stable landscapes of under 45 percent slopes. Included areas make up about 10 percent of the map unit area. | |

**74 Trigo - Calleguas families - Rock outcrop complex,
60 to 100 percent slopes.**

Elevation: 2,200 to 3,700 feet Annual Precipitation: 14 to 20 inches

| Soil Map Unit Components | Trigo family | Calleguas family | Rock outcrop |
|---------------------------|--------------------------|--------------------------|--------------------------------------|
| Approximate Proportion | 35 percent | 30 percent | 25 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Resistant faces of very steep scarps |
| Slope | 60 to 100 percent | 60 to 100 percent | 60 to 100 percent |
| Typical Vegetation Series | Chamise | Chamise | Barren |

Soil Profile Description

| | | | |
|---------------|---|--|---|
| Surface Layer | 0 to 8 inches; pale brown silt loam; weak granular structure; | 0 to 4 inches; pale brown silty clay loam; moderate granular structure; slightly | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soil material capable of supporting plants. |
| Subsoil | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 | 4 to 10 inches; very pale brown silty clay loam; massive; hard; pH 7.8 | |
| Substratum | 16 inches; highly weathered sandstone | 10 inches; highly weathered fine-grained sandstone | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|-----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 6 to 19 |
| Available Water Capacity | Very low to low | Very low to low |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid | Moderate |
| Maximum Erosion Hazard | High | High |
| Erosion Factor K | .32 | .32 |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | IV 4Sdx | IV 4Sdx |
| Soil Productivity | Very low | Very low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 300 to 600 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of rubble land below rock ledges, soils similar to Trigo family soils except that they have finer textures and 35 percent shale fragment content, and other colluvial soils. Included areas make up about 10 percent of the map unit area. | |

**75 Trigo-Calleguas families-Haploxeralfs complex,
30 to 70 percent slopes.**

Elevation: 2,400 to 4,000 feet Annual Precipitation: 13 to 20 inches

| Soil Map Unit Components | Trigo family | Calleguas family | Haploxeralfs |
|---------------------------|--------------------------|--------------------------|--------------------------|
| Approximate Proportion | 45 percent | 25 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|---|---|---|
| Surface Layer | 0 to 8 inches; pale brown silt loam, weak granular structure; slightly hard; pH 7.0 | 0 to 4 inches; pale brown silty clay loam; moderate granular structure; slightly hard; pH 7.8 | These are shallow soils that formed in material weathered from sedimentary; gabbroic and dioritic rocks. They have a brown gravelly loam or sandy loam surface layer and a reddish brown clay loam or clay loam subsoil. In the profile, rock fragments range from 0 to 45 percent and reaction is slightly acid or neutral (pH 6.1 to 7.3) |
| Subsoil | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 | 4 to 10 inches; very pale brown silty clay loam; massive; hard; pH 7.8 | |
| Substratum | 16 inches; highly weathered sandstone | 10 inches; highly weathered fine grain sandstone | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|------------------------------|-----------------|-----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 6 to 19 | 7 to 17 |
| Available Water Capacity | Very low or low | Very low or low | Very low or low |
| Water Retention Class | 2 | 2 | 2 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Moderately rapid | Moderate | Moderately slow |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .32 | .32 | |
| Drainage Class | Somewhat excessively drained | Well drained | Well drained |
| Soil Manageability Group | III | III | III |
| Soil Manageability Class | 3Sd | 3Sd | 3Ed |
| Soil Productivity | Very low | Very low | Low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 300 to 600 | 500 to 1,000 |
| Forest Survey Site Class | NC | NC | NC |

Included Areas and Remarks: Small areas of Modesto family, moderately deep soils, Osito family soils, Caperton family soils, Vertic Xerochrepts, and sedimentary Rock outcrop. Included areas make up about 15 percent of the map unit area.

**79 Trigo - Lodo families - Haploxerolls, warm complex,
50 to 90 percent slopes.**

Elevation: 2,500 to 4,000 feet Annual Precipitation: 15 to 21 inches

| Soil Map Unit Components | Trigo family | Lodo family | Haploxerolls, warm |
|---------------------------|--------------------------|--|---|
| Approximate Proportion | 45 percent | 25 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges, generally northern aspects | Colluvial slopes |
| Slope | 50 to 90 percent | 50 to 90 percent | 50 to 85 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise on southern aspects and interior live oak on northern aspects |

Soil Profile Description

| | | | |
|---------------|---|---|---|
| Surface Layer | 0 to 8 inches; pale brown silt loam; weak granular structure; slightly hard; pH 7.0 | 0 to 17 inches; brown gravelly loam; strong granular structure; soft; 20 percent rock fragments; pH 7.0 | These are deep, well drained soils that formed in colluvial/alluvial deposits derived from mixed sources. They have a brown gravelly loam or sandy loam surface layer and a yellowish brown very gravelly loam or sandy loam subsoil and are 10 to 50 percent rock fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8). |
| Subsoil | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 | | |
| Substratum | 16 inches; highly weathered sandstone | 17 inches; hard fractured schist | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 6 to 20 | 60 |
| Available Water Capacity | Very low or low | Very low or low | Moderate |
| Water Retention Class | 2 | 2 | 2 |
| Hydrologic Soil Group | C | C | B |
| Permeability | Moderately rapid | Moderate | Moderate rapid |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .32 | .28 | |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | IV 4Ed | IV 4Ed | IV 4Sp |
| Soil Productivity | Very low | Low | High |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,000 | 1,000 to 1,200 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Caperton family soils, Mollic Haploxeralfs, and sedimentary rock outcrop. Included areas make up about 15 percent of the map unit area. | | |

82 Vertic Xerochrepts, 5 to 50 percent slopes.

Elevation: 2,200 to 4,000 feet Annual Precipitation: 19 to 21 inches

| | |
|---------------------------|---------------------------|
| Soil Map Unit Components | Vertic Xerochrepts |
| Approximate Proportion | 75 percent |
| Landscape Position | Swales and mountainsides |
| Slope | 5 to 50 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | These are shallow to deep, moderately well drained soils that formed in material derived from calcareous shale. They have a grayish brown silty clay loam surface layer and a light brownish gray silty clay or silty clay loam subsoil. The soils crack when dry. Reaction is neutral to moderately alkaline (pH 6.6 to 8.4). Gravel-size shale fragments range from 0 to 40 percent. |
| Subsoil | |
| Substratum | |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 18 to 45 |
| Available Water Capacity | Low to moderate |
| Water Retention Class | 1 |
| Hydrologic Soil Group | C |
| Permeability | Slow |
| Maximum Erosion Hazard | Moderate to high |
| Erosion Factor K | |
| Drainage Class | Moderately well drained |
| Soil Manageability Group | II |
| Class | 2e |
| Soil Productivity | Moderate |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Osito family soils and other deep, well developed soils. Included areas make up about 25 percent of the map unit area. This unit is not extensive and is found only in the Oak Flats area in the Saugus Ranger District. |

**86 Pismo Family - Rock outcrop complex,
50 to 80 percent slopes.**

Elevation: 2,200 to 3,800 feet Annual Precipitation: 13 to 25 inches

| | | |
|---------------------------|--------------------------|---------------------|
| Soil Map Unit Components | Pismo family | Rock outcrop |
| Approximate Proportion | 70 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides |
| Slope | 50 to 80 percent | 50 to 80 percent |
| Typical Vegetation Series | Chamise | Barren |

Soil Profile Description

| | | |
|---------------|--|---|
| Surface Layer | 0 to 9 inches; light brownish gray gravelly loamy sand; moderate granular structure; soft; 15 percent rock fragments; pH 7.0 | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soil material capable of supporting plants. |
| Subsoil | | |
| Substratum | 9 inches; highly weathered anorthosite rock. | |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 4 to 20 |
| Available Water Capacity | Very low |
| Water Retention Class | 3 |
| Hydrologic Soil Group | C |
| Permeability | Rapid |
| Maximum Erosion Hazard | Very high |
| Erosion Factor K | .15 |
| Drainage Class | Somewhat excessively drained and excessively drained |
| Soil Manageability Group | IV |
| Class | 4EPx |
| Soil Productivity | Very low |
| Annual Forage Production (lbs/ac) | 500 to 800 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Trigo family soils, Shortcut family soils, Chilao family soils, and other colluvial soils in steep drainages. Included areas make up about 15 percent of the map unit. |

**89 Pismo-Trigo, dry-Exchequer, dry families complex,
30 to 70 percent slopes.**

| Soil Map Unit Components | Elevation: 2,800 to 5,500 feet Annual Precipitation: 10 to 20 inches | | |
|---------------------------|---|----------------------------------|----------------------------------|
| | Pismo family | Trigo family, dry | Exchequer family, dry |
| Approximate Proportion | 35 percent | 35 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Chamise and California buckwheat | Chamise and California buckwheat | Chamise and California buckwheat |

Soil Profile Description

| | | | |
|---------------|--|---|---|
| Surface Layer | 0 to 9 inches; light brownish gray gravelly loamy sand; moderate granular structure; soft; 15 percent rock fragments; pH 7.0 | 0 to 9 inches; light brownish gray sandy loam; weak granular structure; loose; pH 6.0 | 0 to 10 inches; brown gravelly sandy loam; moderate granular structure; soft; 30 percent rock fragments; pH 7.1 |
| Subsoil | | 9 to 20 inches; very pale brown sandy loam; massive; slightly hard; pH 7.0 | |
| Substratum | 9 inches; highly weathered anorthosite | 20 inches; highly weathered granitic rock | 10 inches; hard, highly fractured granitic rock |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|------------------------------|
| Effective Rooting Depth (inches) | 4 to 20 | 9 to 20 | 5 to 19 |
| Available Water Capacity | Very low | Very low | Very low |
| Water Retention Class | 3 | 2 | 3 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Rapid | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Very high | Very high | Very high |
| Erosion Factor K | .15 | .24 | .20 |
| Drainage Class | Somewhat excessively drained and excessively drained | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3EPd | III 3Ed | III 3EPd |
| Soil Productivity | Very low | Very low | Very low |
| Annual Forage Production (lbs/ac) | 500 to 800 | 800 | 500 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Hanford family soils, Chilao family soils, Vista family soils, and Rock outcrop. Included areas make up about 15 percent of the map unit. | | |

**90 Stukel - Olete families association,
50 to 100 percent slopes.**

Elevation: 1,800 to 4,800 feet Annual Precipitation: 30 to 38 inches

| Soil Map Unit Components | Stukel family | Olete family |
|---------------------------|--------------------------|---------------------|
| Approximate Proportion | 50 percent | 25 percent |
| Landscape Position | Mountainsides and ridges | Colluvial slopes |
| Slope | 50 to 100 percent | 50 to 80 percent |
| Typical Vegetation Series | Canyon live oak | Canyon live oak |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | 0 to 11 inches; very dark grayish brown gravelly loam; moderate granular structure; soft; 20 percent rock fragments; pH 6.5 | 0 to 8 inches; dark brown cobbly loam; moderate granular structure; soft; 35 percent rock fragments; pH 6.3 |
| Subsoil | | 8 to 57 inches; yellowish brown extremely cobbly sandy loam; weak subangular blocky structure; slightly hard; 65 percent rock fragments; pH 6.4 |
| Substratum | 11 inches; hard, fractured granitic rock | 57 to 60 inches; pale brown extremely stony sandy loam; massive; slightly hard; 80 percent rock fragments; pH 6.6 |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|------------------|
| Effective Rooting Depth (inches) | 8 to 18 | 60 |
| Available Water Capacity | Very low | Low |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | B |
| Permeability | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Very high | High |
| Erosion Factor K | .28 | .28 |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | IV 3Ed | IV 3Ep |
| Soil Productivity | Low | High |
| Annual Forage Production (lbs/ac) | 750 to 1,000 | 1,200 |
| Forest Survey Site Class | 6 | 5 |
| Included Areas and Remarks: | Small areas of Sur, Winthrop, Bakeoven, Exchequer, Springdale, Shortcut and Green Bluff family soils and Rock outcrop. Included areas make up about 25 percent of the map unit area. | |

**91 Stukel - Sur - Winthrop families complex,
60 to 100 percent slopes.**

Elevation: 2,000 to 5,800 feet Annual Precipitation: 27 to 39 inches

| Soil Map Unit Components | Stukel family | Sur family | Winthrop family |
|---------------------------|----------------------|---|---|
| Approximate Proportion | 50 percent | 15 percent | 15 percent |
| Landscape Position | Mountainsides and | Colluvial slopes | Colluvial slopes |
| Slope | 60 to 100 percent | 60 to 80 percent | 60 to 80 percent |
| Typical Vegetation Series | Canyon live oak | Canyon live oak and bigcone Douglas-fir | Canyon live oak and bigcone Douglas-fir |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | 0 to 11 inches; very dark grayish brown gravelly loam; moderate granular structure; soft; 20 percent rock fragments; pH 6.5 | 0 to 13 inches; grayish brown gravelly sandy loam; weak granular structure; soft; 30 percent rock fragments; pH 7.0 | 0 to 12 inches; brown gravelly loamy sand; moderate subangular blocky structure; soft; 25 percent rock fragments; pH 7.0 |
| Subsoil | | 13 to 40 inches; pale brown very gravelly sandy loam; massive; soft; 40 percent rock fragments; pH 7.0 | 12 to 33 inches; pale brown very gravelly loamy sand; massive; soft; 40 to 60 percent rock fragments; pH 6.5 |
| Substratum | 11 inches; hard, fractured granitic rock | 40 to 50 inches; pale brown very gravelly sandy loam; massive; soft; 40 percent rock fragments; pH 7.0 | 33 to 60 inches; pale brown very gravelly loamy sand; massive; soft; 40 to 60 percent rock fragments; pH 6.5 |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|------------------|------------------------------|
| Effective Rooting Depth (inches) | 8 to 18 | 50 | 60 |
| Available Water Capacity | Very low to low | Moderate | Low |
| Water Retention Class | 2 | 2 | 3 |
| Hydrologic Soil Group | C | B | A |
| Permeability | Moderately rapid | Moderately rapid | Rapid |
| Maximum Erosion Hazard | Very high | High | Very high to high |
| Erosion Factor K | .28 | .24 | .20 |
| Drainage Class | Somewhat excessively drained | Well drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4Ed | IV 4Ep | IV 4EP |
| Soil Productivity | Low | High | Moderate |
| Annual Forage Production (lbs/ac) | 750 to 1,000 | 1,000 to 1,500 | 1,000 |
| Forest Survey Site Class | 6 | 5 | 6 |
| Included Areas and Remarks: | Small areas of Olete family soils, Bakeoven family soils, Etsel family soils, Rock outcrop, and soils similar to Springdale family soils except that they are deep. Included areas make up about 20 percent of the map unit area. | | |

**92 Tollhouse - Stukel - Wrentham families complex,
60 to 90 percent slopes.**

Elevation: 2,200 to 6,000 feet Annual Precipitation: 20 to 26 inches

| Soil Map Unit Components | Tollhouse family | Stukel family | Wrentham family |
|---------------------------|-------------------------|----------------------|------------------------|
| Approximate Proportion | 40 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides | Mountainsides | Colluvial slopes |
| Slope | 60 to 90 percent | 60 to 90 percent | 60 to 80 percent |
| Typical Vegetation Series | Scrub oak | Scrub oak | Scrub oak |

Soil Profile Description

| | | | |
|---------------|--|---|---|
| Surface Layer | 0 to 6 inches; grayish brown gravelly sandy loam; moderate granular structure; soft; 30 percent rock fragments; pH 7.0 | 0 to 11 inches; very dark grayish brown gravelly loam; moderate granular structure; soft; 20 percent rock fragments; pH 6.5 | 0 to 8 inches; very dark grayish brown gravelly loam; moderate granular structure; soft; 15 percent rock fragments; pH 6.76 |
| Subsoil | | | 8 to 58 inches; brown very gravelly loam; weak subangular blocky structure; soft; 45 percent rock fragments; pH 6.6 |
| Substratum | 6 inches; highly weathered granitic rock | 11 inches; hard, fractured granitic rock | 58 inches; hard, highly fractured gneiss |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|-----------------|
| Effective Rooting Depth (inches) | 6 to 18 | 8 to 18 | 48 to 60 |
| Available Water Capacity | Very low | Very low to low | Low to moderate |
| Water Retention Class | 3 | 2 | 2 |
| Hydrologic Soil Group | C | C | B |
| Permeability | Moderately rapid | Moderately rapid | Moderate |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .20 | .28 | .32 |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained | Well drained |
| Soil Manageability Group | IV | IV | IV |
| Class | 4EPd | 4Ed | 4Ep |
| Soil Productivity | Low | Low | High |
| Annual Forage Production (lbs/ac) | 750 to 1,000 | 750 to 1,000 | 1,000 |
| Forest Survey Site Class | 6 | 6 | 6 |
| Included Areas and Remarks: | Small areas of Bakeoven family soils, Balder family soils, Sur family soils, Olete family soils, and Rock outcrop. Included areas make up about 15 percent of the map unit area. | | |

**93 Rock outcrop - Lithic Xerorthents - Rubble land association,
60 to 120 percent slopes.**

| Soil Map Unit Components | Elevation: 4,800 to 10,000 feet Annual Precipitation: 26 to 40 inches | | |
|---------------------------|--|---|---|
| | Rock outcrop | Lithic Xerorthents | Rubble land |
| Approximate Proportion | 40 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides, ridges | Mountainsides and ridges | Landslide surfaces in steep drainages and below rock outcroppings |
| Slope | 60 to 120 percent | 60 to 90 percent | 60 to 120 percent |
| Typical Vegetation Series | B | Jeffrey pine, sugar pine, and incense cedar | Barren |

Soil Profile Description

| | | | |
|---------------|---|--|---|
| Surface Layer | Rock outcrop consists of contiguous bare bedrock and less than 15 percent inclusions of soil material capable of supporting plants. | These soils are 3 to 18 inches deep over hard metamorphic or granitic rock. The profile is gravelly sandy loam or very gravelly loamy coarse sand and 25 to 85 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3). | Rubble land consists of areas of detached rock fragments (colluvium) which have accumulated on very steep mountainsides as talus. These areas support little or no vegetation and are subject to frequent landslides. |
| Subsoil | | | |
| Substratum | | | |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|--|
| Effective Rooting Depth (inches) | 3 to 18 |
| Available Water Capacity | Very low |
| Water Retention Class | 3 |
| Hydrologic Soil Group | C |
| Permeability | Moderately rapid |
| Maximum Erosion Hazard | Very high |
| Erosion Factor K | |
| Drainage Class | Excessively drained |
| Soil Manageability Group Class | 4EPd |
| Soil Productivity | Very low |
| Annual Forage Production (lbs/ac) | 500 |
| Forest Survey Site Class | 6 |
| Included Areas and Remarks: | Small areas of Springdale family soils, Winthrop family soils, and Lithic Xerorthents. Included areas make up about 15 percent of the map unit area. |

**95 Bakeoven family - Lithic Xerorthents - Sur family moderately deep complex,
45 to 80 percent slopes**

| | | | |
|---------------------------|--------------------------------|---------------------------|---------------------------------------|
| | Elevation: 3,200 to 8,600 feet | | Annual Precipitation: 23 to 35 inches |
| Soil Map Unit Components | Bakeoven family | Lithic Xerorthents | Sur family, moderately deep |
| Approximate Proportion | 45 percent | 20 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Colluvial slopes |
| Slope | 45 to 80 percent | 45 to 80 percent | 45 to 80 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine |

Soil Profile Description

| | | | |
|---------------|--|---|--|
| Surface Layer | 0 to 14 inches; dark grayish brown gravelly loam; weak granular structure; soft; 35 percent rock fragments; pH 6.9 | These soils are 3 to 18 inches deep over hard metamorphic or granitic rock. The profile is gravelly sandy loam or very gravelly loamy coarse sand and 25 to 85 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3) | 0 to 19 inches; grayish brown very cobby sandy loam; weak granular structure; soft; 45 percent rock fragments; pH 6.3 |
| Subsoil | | | 19 to 26 inches; light brownish gray very gravelly sandy loam; massive; slightly hard; 60 percent rock fragments, pH 6.5 |
| Substratum | 14 inches; hard fractured schist | | 26 inches; highly weathered gneiss |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|---------------------|------------------|
| Effective Rooting Depth (inches) | 5 to 20 | 3 to 18 | 20 to 40 |
| Available Water Capacity | Very low | Very low | Very low to low |
| Water Retention Class | 2 | 3 | 2 |
| Hydrologic Soil Group | C | C | B |
| Permeability | Moderate | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .37 | | .20 |
| Drainage Class | Well drained | Excessively drained | Well drained |
| Soil Manageability Group Class | IV 4Ed | IV 4EPd | IV 4Ep |
| Soil Productivity | Low | Very low | Moderate |
| Annual Forage Production (lbs/ac) | 700 | 500 | 1,000 |
| Forest Survey Site Class | 6 | 6 | 5 |
| Included Areas and Remarks: | Small areas of Mollic Haploxeralfs, cool, Stukel family soils, Olete, moderately deep family soils, and Rock outcrop. Included areas make up about 20 percent of the map unit area. | | |

**97 Trigo, granitic substratum - Green Bluff - Supan families association,
15 to 60 percent slopes**

| Soil Map Unit Components | Elevation: 3,400 to 5,500 feet Annual Precipitation: 28 to 30 inches | | |
|---------------------------|---|---------------------------|-----------------------------------|
| | Trigo family, granitic substratum | Green Bluff family | Supan family |
| Approximate Proportion | 40 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides | Mountainsides | Mountainsides and broad ridgetops |
| Slope | 20 to 60 percent | 20 to 60 percent | 15 to 50 percent |
| Typical Vegetation Series | Chamise | Canyon live oak | Coulter pine |

Soil Profile Description

| | | | |
|---------------|---|--|---|
| Surface Layer | 0 to 3 inches; dark grayish brown loam; weak granular structure; soft; pH 6.7 | 0 to 4 inches; grayish brown gravelly sandy loam; weak granular structure; soft; 20 percent rock fragments; pH 5.2 | 0 to 12 inches; brown loam; moderate granular structure; soft; pH 6.2 |
| Subsoil | 3 to 17 inches; pale brown gravelly sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | 4 to 27 inches; light gray gravelly sandy loam; massive; slightly hard; 25 percent rock fragments; pH 6.3 | 12 to 60 inches; brownish yellow clay loam; moderate angular blocky structure; hard; pH 5.8 |
| Substratum | 17 inches; highly weathered granitic rock | 27 inches; highly weathered grandiorite | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|--|-----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 20 to 38 | 60 |
| Available Water Capacity | Very low | Very low to low | High |
| Water Retention Class | 3 | 2 | 1 |
| Hydrologic Soil Group | C | B | B |
| Permeability | Moderately rapid | Moderately rapid | Moderately slow |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .20 | .24 | .37 |
| Drainage Class | Somewhat excessively drained | Well drained to somewhat excessively drained | Well drained |
| Soil Manageability Group Class | III 3EPd | III 3Ep | III 3E |
| Soil Productivity | Very low | Moderate | High |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,500 | 2,000 |
| Forest Survey Site Class | NC | 5 | 5 |
| Included Areas and Remarks: | Small areas of Pismo family soils, Chilao family soils Haploxeralfs, shallow, and soils similar to Oak Glen family soils except that they are 35 percent rock fragments. Included areas make up about 15 percent of the map unit area. | | |

**109 Winthrop family, very stony - Lithic Xerorthents - Rock outcrop association,
15 to 70 percent slopes**

| | | | |
|---------------------------------|--|--|---------------------|
| | Elevation: 3,900 to 7,000 feet | Annual Precipitation: 30 to 39 inches | |
| Soil Map Unit Components | Winthrop family, very stony | Lithic Xerorthents | Rock outcrop |
| Approximate Proportion | 50 percent | 25 percent | 15 percent |
| Landscape Position | Colluvial slopes | Mountainsides | Mountainsides |
| Slope | 15 to 70 percent | 15 to 70 percent | 15 to 70 percent |
| Typical Vegetation Series | Bigcone Douglas-fir, ponderosa or Jeffrey pine | Bigcone Douglas-fir, ponderosa or Jeffrey pine | Barren |

Soil Profile Description

| | | | |
|---------------|---|--|--|
| Surface Layer | 0 to 12 inches; dark gray very stony sandy loam; weak granular structure; soft; 55 percent rock fragments; pH5.9 | These soils are 3 to 18 inches deep over hard metamorphic or granitic rock. The profile is gravelly sandy loam or very gravelly loamy coarse sand and 25 to 85 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3). | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soil capable of supporting plants. |
| Subsoil | 12 to 33 inches; light brownish gray extremely cobbly loamy sand; massive; loose; 75 percent rock fragments; pH 7.0 | | |
| Substratum | 33 to 60 inches; light brownish gray extremely cobbly loamy sand; massive; loose; 75 percent rock fragments; pH 7.0 | | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------------------|---------------------|
| Effective Rooting Depth (inches) | 60 | 3 to 18 |
| Available Water Capacity | Low | Very low |
| Water Retention Class | 3 | 3 |
| Hydrologic Soil Group | A | C |
| Permeability | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Moderate to high | High |
| Erosion Factor K | .20 | |
| Drainage Class | Somewhat excessively drained | Excessively drained |
| Soil Manageability Group Class | III 3PX3 | III 4EPxd |
| Soil Productivity | Moderate | Very low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 | 500 |
| Forest Survey Site Class | 6 | 6 |

Included Areas and Remarks: Small areas of Sur family soils, Haploxerolls, soils, Bakeoven family soils, Rubble land, and soils similar to Springdale family soils except that they are more than 60 inches deep. Included areas make up about 10 percent of the map unit area. The soils in this unit have an abundance of rock fragments on the surface, which is a limitation to management.

**300 Trigo, granitic substratum - Modjeska families association,
5 to 60 percent slopes.**

Elevation: 2,400 to 4,000 feet Annual Precipitation: 25 to 30 inches

| Soil Map Unit Components | Trigo family, granitic substratum | Modjeska family |
|---------------------------|--|--|
| Approximate Proportion | 70 percent | 15 percent |
| Landscape Position | Mountainsides | Dissected alluvial fans and terraces and mountain toe slopes |
| Slope | 5 to 60 percent | 5 to 60 percent |
| Typical Vegetation Series | Chamise | Chamise |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | 0 to 3 inches; dark grayish brown loam; weak granular structure; soft; pH 6.7 | 0 to 3 inches dark brown cobbly sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 5.8 |
| Subsoil | 3 to 17 inches; pale brown gravelly sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | 3 to 56; yellowish brown very cobbly sandy clay loam; moderate subangular blocky structure; hard; 45 percent rock fragments; pH 6.6 |
| Substratum | 17 inches; highly weathered granitic or metamorphic rock | 56 inches; partly consolidated sediments derived from metamorphic rocks |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------------------|-----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 40 |
| Available Water Capacity | Very low | Low to moderate |
| Water Retention Class | 3 | 2 |
| Hydrologic Soil Group | C | B |
| Permeability | Moderately rapid | Moderately slow |
| Maximum Erosion Hazard | Very high | High |
| Erosion Factor K | .24 | .24 |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | III 3EPd | III 2Ep |
| Soil Productivity | Very low | High |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,200 to 1,500 |
| Forest Survey Site Class | NC | NC |

Included Areas and Remarks: Small areas of Rock outcrop and of Vista, Hanford, Modesto, Shortcut, and Chilao family soils. Included areas make up about 15 percent of the map unit area.

**306 Chilao family,
20 to 60 percent slopes.**

Elevation: 3,800 to 5,500 feet Annual Precipitation: 20 to 30 inches

| | |
|---------------------------|--------------------------|
| Soil Map Unit Components | Chilao family |
| Approximate Proportion | 75 percent |
| Landscape Position | Mountainsides and ridges |
| Slope | 20 to 60 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | 0 to 5 inches; light brownish gray gravelly loam; weak granular structure; soft; 20 percent rock fragments; pH 6.4 |
| Subsoil | 54 to 18 inches; light yellowish brown very gravelly loam; massive; soft; 60 percent rock fragments; pH 6.8 |
| Substratum | 18 inches; highly weathered and fractured granitic rock |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|--|
| Effective Rooting Depth (inches) | 6 to 19 |
| Available Water Capacity | Very low |
| Water Retention Class | 3 |
| Hydrologic Soil Group | C |
| Permeability | Moderately rapid |
| Maximum Erosion Hazard | Very high |
| Erosion Factor K | .17 |
| Drainage Class | Somewhat excessively drained |
| Soil Manageability Group | III |
| Class | 3EPd |
| Soil Productivity | Very low |
| Annual Forage Production (lbs/ac) | 700 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Rock outcrop and soils similar to Chilao family soils except that they are more than 20 inches deep. Included areas make up about 25 percent of the map unit area. |

**308 Pismo - Chilao - Shortcut families complex,
45 to 80 percent slopes.**

| Soil Map Unit Components | Elevation: 2,000 to 5,500 feet Annual Precipitation: 20 to 30 inches | | |
|---------------------------|---|--------------------------|--------------------------|
| | Pismo family | Chilao family | Shortcut family |
| Approximate Proportion | 35 percent | 35 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 45 to 80 percent | 45 to 80 percent | 45 to 80 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|--|--|--|
| Surface Layer | 0 to 9 inches; light brownish gray gravelly loamy sand; moderate granular structure; soft; 15 percent rock fragments; pH 7.0 | 0 to 5 inches; light brownish gray gravelly loam; weak granular structure; soft; 20 percent rock fragments; pH 6.4 | 0 to 5 inches; gray bravelly loamy sand; weak granular structure; soft; 20 percent rock fragments; pH 6.2 |
| Subsoil | | 5 to 18 inches; light yellowish brown very gravelly loam; massive; soft; 60 percent rock fragments; pH 6.8 | 5 to 14 inches; light gray very gravelly loamy sand; massive; slightly hard; 45 percent rock fragments; pH 5.9 |
| Substratum | 9 inches; highly weathered anorthosite | 18 inches; highly weathered anorthosite rock | 14 inches; highly weathered anorthosite |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|---------------------|
| Effective Rooting Depth (inches) | 4 to 20 | 6 to 19 | 5 to 17 |
| Available Water Capacity | Very low | Very low | Very low |
| Water Retention Class | 3 | 3 | 3 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Rapid | Moderately rapid | Rapid |
| Maximum Erosion Hazard | Very high | Very high | High to very high |
| Erosion Factor K | .15 | .17 | .15 |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained | Excessively drained |
| Soil Manageability Group Class | IV 4EPd | IV 4EPd | IV 4EPd |
| Soil Productivity | Very low | Very low | Very low |
| Annual Forage Production (lbs/ac) | 500 to 800 | 700 | 500 to 700 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of soils similar to Chilao family soils and of Pismo family soils, Haploxeralfs, and Rock outcrop. Included areas make up about 15 percent of the map unit area. | | |

**313 Trigo family, granitic substratum,
60 to 90 percent slopes.**

Elevation: 1,400 to 3,600 feet Annual Precipitation: 25 to 30 inches

| | |
|---------------------------|--|
| Soil Map Unit Components | Trigo family, granitic substratum |
| Approximate Proportion | 75 percent |
| Landscape Position | Mountainsides and ridges |
| Slope | 60 to 90 percent |
| Typical Vegetation Series | Chamise |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | 0 to 3 inches; dark grayish brown loam; weak granular structure; soft; pH 6.7 |
| Subsoil | 3 to 17 inches; pale brown sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 |
| Substratum | 17 inches; highly weathered granitic rock |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 3 to 19 |
| Available Water Capacity | Very low |
| Water Retention Class | 3 |
| Hydrologic Soil Group | C |
| Permeability | Moderately rapid |
| Maximum Erosion Hazard | Very high |
| Erosion Factor K | .24 |
| Drainage Class | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4EPd |
| Soil Productivity | Very low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Rock outcrop, alluvial/colluvial deposits, soils similar to Trigo family soils except that they are 20 to 40 inches deep, and soils similar to Vista family soils. Included areas make up about 25 percent of the map unit area. |

**314 Chilao - Trigo, granitic substratum - Lodo families complex,
55 to 85 percent slopes.**

| Soil Map Unit Components | Elevation: 1,800 to 4,400 feet | | Annual Precipitation: 24 to 30 inches |
|---------------------------|--------------------------------|--|---------------------------------------|
| | Chilao family | Trigo family, granitic substratum | Lodo family |
| Approximate Proportion | 35 percent | 30 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 55 to 85 percent | 55 to 85 percent | 55 to 85 percent |
| Typical Vegetation Series | Chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | 0 to 5 inches; light brownish gray gravelly loam; weak granular structure; soft; 20 percent rock fragments; pH 6.4 | 0 to 3 inches; dark grayish brown loam; weak granular structure; soft; pH 6.7 | 0 to 17 inches; brown gravelly loam; strong granular structure; soft; 20 percent rock fragments; pH 7.0 |
| Subsoil | 5 to 18 inches; light yellowish brown very gravelly loam; massive; soft; 60 percent rock fragments; pH 6.8 | 3 to 17 inches; pale brown sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | |
| Substratum | 18 inches; highly weathered and fractured granitic rock | 17 inches; highly weathered granitic or metamorphic rock | 17 inches; hard; fractured metamorphic rock |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|------------------------------|------------------------------|
| Effective Rooting Depth (inches) | 6 to 19 | 3 to 17 | 6 to 20 |
| Available Water Capacity | Very low | Very low | Very low or low |
| Water Retention Class | 3 | 3 | 2 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Moderately rapid | Moderately rapid | Moderate |
| Maximum Erosion Hazard | Very high | Very high | Very high |
| Erosion Factor K | .17 | .24 | .28 |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4EPx | IV 4Epd | IV 4Ed |
| Soil Productivity | Very low | Very low | Very low |
| Annual Forage Production (lbs/ac) | 700 | 800 to 1,500 | 1,000 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Rock outcrop, Haploxerolls, warm, Hanford family soils, and soils similar to Lodo family soils except that they are more than 35 percent rock fragments. Included areas make up about 15 percent of the map unit area. | | |

**316 Rock outcrop - Chilao family - Haploxerolls, warm association,
15 to 120 percent slopes.**

| | | | |
|---------------------------|--------------------------------|---------------------------------------|---------------------------|
| | Elevation: 2,200 to 5,500 feet | Annual Precipitation: 20 to 30 inches | |
| Soil Map Unit Components | Rock outcrop | Chilao family | Haploxerolls, warm |
| Approximate Proportion | 40 percent | 35 percent | 15 percent |
| Landscape Position | Mountainsides | Mountainsides | Colluvial slopes and fans |
| Slope | 20 to 120 percent | 20 to 85 percent | 20 to 85 percent |
| Typical Vegetation Series | Barren | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|---|--|--|
| Surface Layer | Rock outcrop consists of bedrock and less than 15 percent inclusions of soil material capable of supporting plants. | 0 to 5 inches; light brownish gray gravelly loam; weak granular structure; 20 percent rock fragments; pH 6.4 | These are deep, well drained soils that formed in colluvial/alluvial deposits derived from mixed sources. They have a brown gravelly loam or sandy loam surface layer and a brown very gravelly loam or sandy loam subsoil or substratum and are 10 to 50 percent rock fragments. Reaction is slightly acid to moderately alkaline (pH 6.1 to 8.4) |
| Subsoil | | 5 to 18 inches; light yellowish brown very gravelly loam; massive; 60 percent rock fragments; pH 6.8 18 inches; highly weathered and fractured granitic rock | |
| Substratum | | 18 inches; highly weathered and fractured granitic rock | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------------------|------------------|
| Effective Rooting Depth (inches) | 6 to 19 | 60 |
| Available Water Capacity | Very low | Low to moderate |
| Water Retention Class | 3 | 2 |
| Hydrologic Soil Group | C | B |
| Permeability | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Very high | Moderate to high |
| Erosion Factor K | .17 | |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | IV 4EPXd | IV 3ep |
| Soil Productivity | Very low | Low to high |
| Annual Forage Production (lbs/ac) | 700 | |
| Forest Survey Site Class | NC | |

Included Areas and Remarks: Small areas of Shortcut, Exchequer, Lodo, Hanford, Modjeska, and Vista family soils. Included areas make up about 10 percent of the map unit area.

**320 Vista - Trigo, granitic substratum - Modesto families complex,
40 to 70 slopes.**

| | | | |
|---------------------------|--------------------------------|--|-----------------------------------|
| | Elevation: 1,400 to 3,800 feet | Annual Precipitation: 21 to 30 inches | |
| Soil Map Unit Components | Vista family | Trigo family, granitic substratum | Modesto family |
| Approximate Proportion | 40 percent | 35 percent | 15 percent |
| Landscape Position | Mountainsides | Mountainsides and ridges | Mountainsides, generally midslope |
| Slope | 40 to 70 percent | 40 to 70 percent | 40 to 70 percent |
| Typical Vegetation Series | Interior live oak | Interior live oak | Interior live oak |

Soil Profile Description

| | | | |
|---------------|--|---|---|
| Surface Layer | 0 to 9 inches; brown sandy loam; weak granular structure; slightly hard; pH 7.0 | 0 to 3 inches; dark grayish brown oam; weak granular structure; soft; pH 6.7 | 0 to 8 inches; brown loam; moderate granular structure; soft; pH 7.0 |
| Subsoil | 9 to 50 inches; pale brown sandy loam; weak subangular blocky structure; hard; pH 6.7 | 3 to 17 inches; pale brown gravelly sandy loam; weak granular structure; slightly hard; 25 percent rock fragments; pH 6.5 | 8 to 46 inches; yellowish red clay loam; moderate subangular blocky structure; hard; pH 7.0 |
| Substratum | 50 to 60 inches; very pale brown gravelly coarse sandy loam; massive; slightly hard; 15 percent rock fragments; pH 6.5 | 17 inches; highly weathered granitic rock | 46 inches; hard fractured gneissic rock |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|------------------|
| Effective Rooting Depth (inches) | 22 to 60 | 3 to 19 | 40 to 60 |
| Available Water Capacity | Low to moderate | Very low | Moderate to high |
| Water Retention Class | 2 | 3 | 1 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Moderately rapid | Moderately rapid | Moderate |
| Maximum Erosion Hazard | Very high | Very high | High |
| Erosion Factor K | .28 | .24 | .37 |
| Drainage Class | Well drained | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | III 3Sp | III 3SPd | III 3S |
| Soil Productivity | High | Very low | High |
| Annual Forage Production (lbs/ac) | 1,500 to 2,000 | 800 to 1,500 | 1,500 to 2,000 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of San Andreas, Hanford, Modjeska, and Modesto family soils. Included areas make up about 10 percent of the map unit area. This unit borders on the mesic soil temperature regime. | | |

**333 Typic Xerorthents, warm,
55 to 90 percent slopes.**

Elevation: 2,100 to 5,000 feet Annual Precipitation: 25 to 30 inches

| | |
|---------------------------------|--------------------------------|
| Soil Map Unit Components | Typic Xerorthents, warm |
| Approximate Proportion | 80 percent |
| Landscape Position | Mountainsides |
| Slope | 55 to 90 percent |
| Typical Vegetation Series | Chamise and sumac |

Soil Profile Description

| | |
|---------------|--|
| Surface Layer | These soils are 15 to 60 inches deep and formed over granitic rocks. They are brown, pale brown very gravelly sandy loam or loamy sand. The soils are moderately acid to neutral (pH 5.6 to 7.3). Rock fragment content is 35 to 70 percent. |
| Subsoil | |
| Substratum | |

Soil Properties & Management Interpretations

| | |
|-----------------------------------|---|
| Effective Rooting Depth (inches) | 15 to 60 |
| Available Water Capacity | Very low to low |
| Water Retention Class | 3 |
| Hydrologic Soil Group | |
| Permeability | Rapid |
| Maximum Erosion Hazard | Very high |
| Erosion Factor K | |
| Drainage Class | Somewhat excessively drained |
| Soil Manageability Group | IV |
| Class | 4EP |
| Soil Productivity | Very low to moderate |
| Annual Forage Production (lbs/ac) | 700 to 1,000 |
| Forest Survey Site Class | NC |
| Included Areas and Remarks: | Small areas of Rock outcrop and of Trigo, Exchequer, Etsel, Green Bluff and Olete family soils and Haploxeralfs, shallow. Included areas make up about 20 percent of the map unit area. |

**405 Xerorthents - Green Bluff family - Rock outcrop complex,
15 to 50 percent slopes.**

| Soil Map Unit Components | Elevation: 5,000 to 6,200 feet | | Annual Precipitation: 25 to 29 inches |
|---------------------------|--------------------------------|----------------------------|---------------------------------------|
| | Xerorthents | Green Bluff family | Rock outcrop |
| Approximate Proportion | 40 percent | 35 percent | 15 percent |
| Landscape Position | Mountainsides | Mountainsides and ridges | Mountainsides |
| Slope | 15 to 50 percent | 15 to 50 percent | 15 to 50 percent |
| Typical Vegetation Series | Manzanita and Coulter pine | Coulter pine and manzanita | Barren |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | These soils are 4 to 60 inches deep over highly weathered granitic, metamorphic or anorthosite rock. They have a brown gravelly sandy loam surface layer and a pale brown very gravelly sandy loam substratum. The profile is 5 to 85 percent rock fragments. Reaction is very strongly acid to moderately alkaline (pH 4.5 to 8.4). | 0 to 4 inches; grayish brown gravelly sandy loam; weak granular structure; soft; 20 percent rock fragments; pH 5.2 | Rock outcrop consists of bedrock and less than 15 percent inclusions of soil material capable of supporting plants. |
| Subsoil | | 4 to 27 inches; light gray gravelly sandy loam; massive; slightly hard; 25 percent rock fragments; pH 6.3 | |
| Substratum | | 27 inches; highly weathered granodiorite | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|----------------------------------|----------------|
| Effective Rooting Depth (inches) | 4 to 60 | 20 to 37 | |
| Available Water Capacity | Very low to low | Very low to low | |
| Water Retention Class | 3 | 2 | |
| Hydrologic Soil Group | C to B | B | |
| Permeability | Moderately rapid | Moderately rapid | |
| Maximum Erosion Hazard | High to very high | Moderate to high | |
| Erosion Factor K | | .24 | |
| Drainage Class | Somewhat excessively drained | Well drained and somewhat excess | sively drained |
| Soil Manageability Group Class | III 3EPdx | III 3epx | |
| Soil Productivity | Low | Moderate | |
| Annual Forage Production (lbs/ac) | 1,000 | 1,500 | |
| Forest Survey Site Class | 6 | 6 | |
| Included Areas and Remarks: | Small areas of Hohmann family soils, Pacifico family soils and Preston family soils. Included areas make up about 10 percent of the map unit area. | | |

**406 Green Bluff - Hohmann families - Xerorthents complex,
15 to 60 percent slopes.**

Elevation: 4,400 to 6,700 feet Annual Precipitation: 20 to 35 inches

| Soil Map Unit Components | Green Bluff family | Hohmann family | Xerorthents |
|---------------------------|---------------------------|---------------------------|---------------------------|
| Approximate Proportion | 50 percent | 20 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 15 to 60 percent | 15 to 60 percent | 15 to 60 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | 0 to 4 inches; grayish brown gravelly sandy loam; weak granular structure; soft; 20 percent rock fragments; pH 5.2 | 0 to 14 inches; grayish brown gravelly loam; moderate ranular structure; soft; 30 percent rock fragments; pH 7.0 | These soils are 4 to 60 inches deep over highly weathered granitic, metamorphic or anorthosite rock. They have a brown gravelly sandy loam surface layer and a pale brown very gravelly sandy loam substratum. The profile is 5 to 85 percent rock fragments. Reaction is very strongly acid to moderately alkaline |
| Subsoil | 4 to 27 inches; light gray gravelly sandy loam; massive; slightly hard; 25 percent rock fragments; pH 6.3 | 14 to 39 inches; pale brown gravelly clay loam; weak subangular blocky structure; slightly hard; 20 percent rock fragments; pH 6.3 | |
| Substratum | 27 inches; highly weathered granodiorite | 39 to 50 inches; very pale brown very gravelly sandy clay loam; massive; hard; 25 percent rock fragments; pH 6.2 | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|------------------|------------------------------|
| Effective Rooting Depth (inches) | 20 to 37 | 33 to 60 | 4 to 60 |
| Available Water Capacity | Very low or low | Moderate | Very low |
| Water Retention Class | 2 | 1 | 3 |
| Hydrologic Soil Group | B | C | C to B |
| Permeability | Moderately rapid | Moderately slow | Moderately rapid |
| Maximum Erosion Hazard | Moderate to high | Moderate to high | High |
| Erosion Factor K | .24 | .28 | |
| Drainage Class | Well drained and somewhat excessively drained | Well drained | Somewhat excessively drained |
| Soil Manageability Group | III | III | III |
| Class | 3ep | 3e | 3EPd |
| Soil Productivity | Moderate | High | Low |
| Annual Forage Production (lbs/ac) | 1,500 | 2,000 | 1,000 |
| Forest Survey Site Class | 5 | 5 | 6 |
| Included Areas and Remarks: | Small areas of Oak Glen family soils. Sur family soils, and Knutsen family soils. Included areas make up about 10 percent of the map unit area. | | |

**420 Olete - Kilburn - Etsel families complex,
50 to 80 percent slopes.**

Elevation: 1,900 to 5,500 feet Annual Precipitation: 26 to 38 inches

| Soil Map Unit Components | Olete family | Kilburn family | Etsel family |
|---------------------------|---------------------|-----------------------|---------------------|
| Approximate Proportion | 40 percent | 20 percent | 20 percent |
| Landscape Position | Colluvial slopes | Colluvial slopes | Mountainsides |
| Slope | 50 to 80 percent | 50 to 80 percent | 50 to 80 percent |
| Typical Vegetation Series | Bigcone Douglas-fir | Bigcone Douglas-fir | Bigcone Douglas-fir |

Soil Profile Description

| | | | |
|---------------|---|---|---|
| Surface Layer | 0 to 8 inches; dark brown cobbly loam; moderate granular structure; soft; 35 percent rock fragments; pH 6.3 | 0 to 7 inches; dark grayish brown very gravelly loam; moderate granular structure; soft; 35 percent rock fragments; pH 6.2 | 0 to 4 inches; gray gravelly loam; weak granular structure; soft; 20 percent rock fragments; pH 6.4 |
| Subsoil | 8 to 57 inches; yellowish brown extremely cobbly sandy loam; weak subangular blocky structure; slightly hard; 65 percent rock fragments; pH 6.4 | 7 to 15 inches; yellowish brown very gravelly loam; weak subangular blocky structure; soft; 60 percent rock fragments; pH 6.2 | 4 to 9 inches; light gray extremely gravelly sandy loam; massive; soft; 75 percent rock fragments; pH 6.3 |
| Substratum | 57 to 60 inches; pale brown extremely stony sandy loam; massive; slightly hard; 80 percent rock fragments; pH 6.6 | 15 to 60 inches; pale brown extremely gravelly coarse sandy loam; massive; soft; 80 percent rock fragments; pH 6.8 | 9 inches; hard fractured granodiorite |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|------------------------------|
| Effective Rooting Depth (inches) | 60 | 60 | 5 to 9 |
| Available Water Capacity | Low | Moderate | Very low |
| Water Retention Class | 2 | 2 | 3 |
| Hydrologic Soil Group | B | B | C |
| Permeability | Moderately rapid | Moderate to moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | High | High | Very high |
| Erosion Factor K | .28 | .28 | .28 |
| Drainage Class | Well drained | Well drained | Somewhat excessively drained |
| Soil Manageability Group | IV | IV | IV |
| Class | 4Ep | 4Ep | 4ED |
| Soil Productivity | High | High | Very low |
| Annual Forage Production (lbs/ac) | 1,200 | 1,200 | 500 |
| Forest Survey Site Class | 5 | 6 | NC |
| Included Areas and Remarks: | Small areas of Sur family soils, Green Bluff family soils, and Rock outcrop. Included areas make up about 20 percent of the map unit area. | | |

**619 Typic Xerorthents, cold - Haploxerolls, cold - Typic Xerochrepts complex,
45 to 85 percent slopes.**

| Soil Map Unit Components | Elevation: 5,400 to 9,400 feet Annual Precipitation: 25 to 44 inches | | |
|---------------------------|---|---|---|
| | Typic Xerorthents, cold | Haploxerolls, cold | Typic Xerochrepts |
| Approximate Proportion | 45 percent | 25 percent | 20 percent |
| Landscape Position | Colluvial slopes | Colluvial slopes | Colluvial slopes |
| Slope | 45 to 85 percent | 45 to 85 percent | 45 to 85 percent |
| Typical Vegetation Series | Jeffrey pine, sugar pine, and incense cedar | Jeffrey pine, sugar pine, and incense cedar | Jeffrey pine, sugar pine, and incense cedar |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | These soils are 22 to more than 60 inches deep formed in material that weathered from granitic and and metamorphic rocks. The profile is very gravelly sandy loam or loamy sand and is 35 to 85 percent rock fragments. Reaction is very strongly acid to neutral (pH 4.5 to 7.3) | These are deep, well drained soils developing over granitic and metamorphic rocks. They have a grayish brown or brown, medium acid, very gravelly loam or sandy loam surface layer overlying a subsoil of lighter colors and slightly coarser textures. Rock fragments range from 35 to 85 percent. | These are shallow to deep soils developing from residual and colluvial materials derived from granitic and metamorphic rocks. They are sandy loam, loam, or sandy clay loam and can be gravelly or very gravelly. Rock fragments range from 10 percent in the surface layer to 70 percent in the subsoil. Reaction is moderately acid (pH 5.6 to 6.0). |
| Subsoil | | | |
| Substratum | | | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|-------------------|------------------------------|
| Effective Rooting Depth (inches) | 22 to 60 | 40 | Less than 20 to more than 60 |
| Available Water Capacity | Very low or low | Moderate | Very low to moderate |
| Water Retention Class | 3 | 2 | 2 |
| Hydrologic Soil Group | B | B | C |
| Permeability | Rapid | Moderately rapid | Moderate |
| Maximum Erosion Hazard | High or very high | High or very high | High or very high |
| Erosion Factor K | | | |
| Drainage Class | Somewhat excessively drained | Well drained | Well drained |
| Soil Manageability Group Class | IV 4EP | IV 4Ep | IV 4Ep |
| Soil Productivity | Low to moderate | Moderate | Low to moderate |
| Annual Forage Production (lbs/ac) | 500 | 500 | 500 |
| Forest Survey Site Class | 6 | 5 | 5 |
| Included Areas and Remarks: | Small areas of Xerorthents found on western facing slopes and Rock outcrops. Included areas make up about 10 percent of the map unit area. This unit has slopes of less than 45 percent in the upper areas of the unit near Mt. Islip and on colluvial benches. | | |

**620 Bakeoven - Sur, moderately deep families complex,
50 to 75 percent slopes.**

Elevation: 4,700 to 8,400 feet Annual Precipitation: 17 to 27 inches

| | | |
|---------------------------|---------------------------|------------------------------------|
| Soil Map Unit Components | Bakeoven family | Sur family, moderately deep |
| Approximate Proportion | 40 percent | 35 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 50 to 75 percent | 50 to 75 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | 0 to 14 inches; dark grayish brown gravelly loam; weak granular structure; soft; 35 percent rock fragments; pH 6.9 | 0 to 19 inches; grayish brown very cobbly sandy loam; weak granular structure; soft; 45 percent rock fragments; pH 6.3 |
| Subsoil | | 19 to 26 inches; light brownish gray very gravelly sandy loam; massive; slightly hard; 60 percent rock fragments; pH 6.6 |
| Substratum | 14 inches; hard fractured schist | 26 inches; highly weathered gneiss |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--------------|------------------|
| Effective Rooting Depth (inches) | 5 to 20 | 20 to 40 |
| Available Water Capacity | Very low | Very low to low |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | C | B |
| Permeability | Moderate | Moderately rapid |
| Maximum Erosion Hazard | High | High |
| Erosion Factor K | .37 | .20 |
| Drainage Class | Well drained | Well drained |
| Soil Manageability Group | IV | IV |
| Class | 4 Ed | 4Ep |
| Soil Productivity | Low | Moderate |
| Annual Forage Production (lbs/ac) | 700 | 1,000 |
| Forest Survey Site Class | 6 | 5 |

Included Areas and Remarks: Small areas of Rock outcrop, Rubble land, Winthrop family soils, Lithic Xerorthents, and soils similar to Springdale family soils except that they are deep. Included areas make up about 25 percent of the map unit area.

**621 Waterman - Springdale - Pacifico families complex,
30 to 70 percent slopes.**

| Soil Map Unit Components | Elevation: 5,000 to 8,000 feet Annual Precipitation: 23 to 33 inches | | |
|---------------------------|---|---------------------------|---------------------------|
| | Waterman family | Springdale family | Pacifico family |
| Approximate Proportion | 40 percent | 25 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides | Mountainsides and ridges |
| Slope | 30 to 70 percent | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine |

Soil Profile Description

| | | | |
|---------------|--|---|--|
| Surface Layer | 0 to 3 inches; light brownish gray gravelly loamy sand; single grain; loose; 30 percent rock fragments; pH 6.2 | 0 to 7 inches; grayish brown gravelly loamy sand; weak granular structure; loose; 35 percent rock fragments; pH 6.8 | 0 to 5 inches; grayish brown loamy sand; weak granular structure; soft; pH 6.0 |
| Subsoil | 3 to 10 inches; light gray gravelly loamy sand; single grain; soft; 45 percent rock fragments; pH 6.9 | 7 to 30 inches; white extremely gravelly loamy sand; massive; slightly hard; pH 7.2 | 5 to 17 inches; light brownish gray loamy sand; weak granular structure; loose; pH 7.0 |
| Substratum | 10 inches hard fractured granodiorite rock | 31 inches; highly weathered granodiorite rock | 17 inches; highly weathered granitic rock |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|------------------------------|
| Effective Rooting Depth (inches) | 10 to 19 | 21 to 43 | 10 to 20 |
| Available Water Capacity | Very low | Very low | Very low |
| Water Retention Class | 3 | 3 | 3 |
| Hydrologic Soil Group | C | B | C |
| Permeability | Rapid | Rapid | Rapid |
| Maximum Erosion Hazard | Very high | High or very high | Very high |
| Erosion Factor K | .15 | .15 | .17 |
| Drainage Class | Excessively drained | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | III 3EPd | III 3EP | III 3EPd |
| Soil Productivity | Very low | Low | Very low |
| Annual Forage Production (lbs/ac) | 300 to 500 | 500 to 700 | 300 to 500 |
| Forest Survey Site Class | 6 | 6 | 6 |
| Included Areas and Remarks: | Small areas of Rock outcrop, Xerorthents, Preston family soils, soils similar to Pacifico family soils, and Waterman family soils. Included areas make up about 15 percent of the map unit area. | | |

**624 Olete - Kilburn families, moderately deep - Mollic Haploxeralfs, cool complex,
40 to 70 percent slopes**

| | | | |
|---------------------------|-------------------------------------|--|----------------------------------|
| | Elevation: 5,200 to 8,200 | Annual Precipitation: 19 to 30 inches | |
| Soil Map Unit Components | Olete family moderately deep | Kilburn family, moderately deep | Mollic Haploxeralfs, cool |
| Approximate Proportion | 40 percent | 20 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 40 to 70 percent | 40 to 70 percent | 40 to 60 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine |

Soil Profile Description

| | | | |
|---------------|---|--|---|
| Surface Layer | 0 to 3 inches; grayish brown very cobbly loam; moderate granular structure; soft; 40 percent rock fragments; pH 7.4 | 0 to 8 inches; grayish brown fine sandy loam; weak granular structure; soft; pH 6.5 | These are moderately deep soils that formed in material weathered from schist or granitic rocks. They have a dark grayish brown gravelly sandy loam surface layer and yellowish brown sandy clay loam or clay loam subsoil that can be very gravelly or cobbly. Rock fragments range from 5 percent in the surface layer to 50 percent in the subsoil. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8) |
| Subsoil | 3 to 25 inches; gray extremely cobbly sandy loam; massive; soft; 70 percent rock fragments; pH 7.2 | 8 to 27 inches; brown very gravelly fine sandy loam; weak subangular blocky structure; soft; 50 percent rock fragments; pH 6.0 | |
| Substratum | 25 inches; highly weathered bedrock | 27 inches; highly weathered schist | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|-----------------|
| Effective Rooting Depth (inches) | 20 to 40 | 20 to 40 | 20 to 40 |
| Available Water Capacity | Very low or low | Very low or low | Low or moderate |
| Water Retention Class | 2 | 2 | |
| Hydrologic Soil Group | B | B | C |
| Permeability | Moderately rapid | Moderate or moderately rapid | Moderately slow |
| Maximum Erosion Hazard | High | High | High |
| Erosion Factor K | .28 | .20 | |
| Drainage Class | Well drained | Well drained | Well drained |
| Soil Manageability Group Class | III 3Ep | III 3Ep | III 3Ep |
| Soil Productivity | Moderate | Moderate | Moderate |
| Annual Forage Production (lbs/ac) | 1,000 | 1,000 | 1,000 |
| Forest Survey Site Class | 5 | 6 | 5 |
| Included Areas and Remarks: | Small areas of Knutsen family soils, Oak Glen family soils, Wrentham family soils, and soils similar to Olete, moderately deep family soils. Included areas make up about 20 percent of the map unit area. | | |

**628 Haploxerolls - Riverwash association,
2 to 25 percent slopes.**

Elevation: 4,800 to 7,200 feet Annual Precipitation: 18 to 28 inches

| Soil Map Unit Components | Haploxerolls | Riverwash |
|---------------------------|----------------------------|------------------|
| Approximate Proportion | 70 percent | 20 percent |
| Landscape Position | Alluvial fans and terraces | Stream channels |
| Slope | 2 to 25 percent | 2 to 25 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Barren |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | These soils are very deep and well drained or somewhat excessively drained. They are dark colored to a depth of 20 inches or more. The surface layer is generally dark grayish brown gravelly sandy loam, and the substratum is brown extremely gravelly sandy loam or loamy sand. Reaction is slightly acid to moderately alkaline (pH 6.1 to 8.4). Rock fragment content is 20 to 80 percent. | Riverwash consists of recent deposits of sand, gravel, cobbles, and stony materials. The areas are subject to flooding and are reworked by water so frequently that they support little or no vegetation. |
| Subsoil | | |
| Substratum | | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|---------------------|
| Effective Rooting Depth (inches) | 60 | |
| Available Water Capacity | Low or moderate | |
| Water Retention Class | | |
| Hydrologic Soil Group | B | |
| Permeability | Moderately rapid or rapid | Very rapid |
| Maximum Erosion Hazard | Moderate | |
| Erosion Factor K | | |
| Drainage Class | Well drained or somewhat excessively drained | Excessively drained |
| Soil Manageability Group Class | II 2ep | |
| Soil Productivity | Low to high | |
| Annual Forage Production (lbs/ac) | 1,000 to 1,200 | |
| Forest Survey Site Class | 5 | |
| Included Areas and Remarks: | Soils similar to Springdale family soils; they make up about 10 percent of the map unit area. | |

**630 Balder family - Mollic Haploxeralfs, cool - Lithic Haploxeralfs complex,
5 to 60 percent slopes.**

| Soil Map Unit Components | Elevation: 4,400 to 6,500 feet Annual Precipitation: 15 to 25 inches | | |
|---------------------------|---|-----------------------------------|-----------------------------------|
| | Balder family | Mollic Haploxeralfs, cool | Lithic Haploxeralfs |
| Approximate Proportion | 40 percent | 20 percent | 20 percent |
| Landscape Position | Broad ridgetops and mountainsides | Broad ridgetops and mountainsides | Broad ridgetops and mountainsides |
| Slope | 5 to 60 percent | 5 to 60 percent | 5 to 60 percent |
| Typical Vegetation Series | Pinyon pine | Pinyon pine | Pinyon pine |

Soil Profile Description

| | | | |
|---------------|--|--|---|
| Surface Layer | 0 to 12 inches; dark grayish brown gravelly sandy loam; moderate granular structure; soft; 20 percent rock fragments; pH 6.8 | These are moderately deep soils that formed in material weathered from schist or granitic rocks. They have a dark grayish brown gravelly sandy loam surface layer and a yellowish brown sandy clay loam or clay loam subsoil that can be very gravelly or cobbly. Rock fragments range from 5 percent in the surface layer to 40 percent in the subsoil. | These soils are 11 to 15 inches deep over hard rock. The surface layer is dark brown gravelly loam; it overlies a pale brown cobbly sandy clay loam subsoil. In the profile, rock fragments range from 20 to 90 percent and reaction is mildly acid to moderately alkaline (pH 5.8 to 7.9). |
| Subsoil | 12 to 20 inches; light yellowish brown gravelly sandy loam; weak subangular blocky structure; slightly hard; pH 7.0 | | |
| Substratum | 20 inches; highly weathered granodiorite | Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8). | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|-----------------|------------------|
| Effective Rooting Depth (inches) | 14 to 20 | 24 to 40 | 11 to 15 |
| Available Water Capacity | Very low or low | Low or moderate | Very low or low |
| Water Retention Class | 2 | 2 | 2 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Moderately rapid | Moderately slow | Moderately slow |
| Maximum Erosion Hazard | Moderate | High | Moderate to high |
| Erosion Factor K | .28 | | |
| Drainage Class | Well drained | Well drained | Well drained |
| Soil Manageability Group Class | II 2ed | II 3Ep | II 3Ed |
| Soil Productivity | Low | Moderate | Low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 | 1,000 | 500 to 800 |
| Forest Survey Site Class | 6 | 5 | NC |
| Included Areas and Remarks: | Small areas of Sur family soils, moderately deep, and Xerorthents. Included areas make up about 20 percent of the map unit area. This unit occurs mainly in the Pinyon Ridge and Table Mountain areas. | | |

**634 Mollic Haploxeralfs, cool - Xerorthents, dry - Green Bluff family, dry association,
5 to 60 percent slopes.**

Elevation: 4,400 to 6,000 feet Annual Precipitation: 15 to 22 inches

| Soil Map Unit Components | Mollic Haploxeralfs, cool | Xerorthents, dry | Green Bluff family, dry |
|---------------------------|----------------------------------|-------------------------|--------------------------------|
| Approximate Proportion | 45 percent | 20 percent | 20 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides terraces | Alluvial fans and |
| Slope | 5 to 60 percent | 5 to 60 percent | 5 to 60 percent |
| Typical Vegetation Series | Pinyon pine | Pinyon pine | Big sagebrush |

Soil Profile Description

| | | | |
|---------------|---|---|--|
| Surface Layer | These are moderately deep soils that formed in material weathered from schist or granitic rocks. dark grayish brown gravelly sandy loam surface layer and a yellowish brown sandy clay loam subsoil that can be very gravelly or cobbly. Rock fragments range from 5 percent in the surface layer to 40 percent in the subsoil. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8). | These are brownish, shallow to deep soils developing from a variety of different parent They have a ranging from uplands to alluvial fans and and terraces. Their position is limited to the desert-facing slopes under diminishing rainfall. They have little or no profile development, and textures range from medium to coarse. | 0 to 4 inches; light yellowish brown coarse sandy loam; weak granular structure; soft; pH 6.5 |
| Subsoil | | | 4 to 36 inches; yellowish brown cobbly coarse sandy loam; massive; hard; 30 percent rock fragments; pH 7.5 |
| Substratum | | | 36 inches; partly consolidated sediments |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|---|---|--------------------------------------|
| Effective Rooting Depth (inches) | 20 to 40 | 19 to 60 | 20 to 37 |
| Available Water Capacity | Low or moderate | Very low or low | Very low or low |
| Water Retention Class | 2 | 3 | 2 |
| Hydrologic Soil Group | C | C to B | B |
| Permeability | Moderately slow | Moderately rapid or rapid | Moderately rapid |
| Maximum Erosion Hazard | Moderate | Moderate | Moderate or high |
| Erosion Factor K | | | .20 |
| Drainage Class | Well drained | Well drained and somewhat excessively drained | Well drained and excessively drained |
| Soil Manageability Group Class | III 3ep | III 3Pe | III 2ep |
| Soil Productivity | Moderate | Very low to moderate | Moderate |
| Annual Forage Production (lbs/ac) | 1,000 | 500 | 1,500 |
| Forest Survey Site Class | 5 | NC | 6 |
| Included Areas and Remarks: | Small areas of Mollic Haploxeralf, cool but are shallow and Balder family soils. Included areas make up about 15 percent of the map unit area. This unit occurs only in the Mile High and Pinyon Flats areas. The unit is bordering on the thermic soil temperature regime. | | |

**640 Balder family - Xerorthents complex,
5 to 60 percent slopes.**

Elevation: 5,700 to 7,500 feet Annual Precipitation: 16 to 25 inches

| Soil Map Unit Components | Balder family | Xerorthents |
|---------------------------|--------------------------------|--------------------------------|
| Approximate Proportion | 55 percent | 25 percent |
| Landscape Position | Broad ridges and mountainsides | Broad ridges and mountainsides |
| Slope | 5 to 60 percent | 5 to 60 percent |
| Typical Vegetation Series | Ponderosa or Jeffrey pine | Ponderosa or Jeffrey pine |

Soil Profile Description

| | | |
|---------------|---|---|
| Surface Layer | 0 to 12 inches; dark grayish brown gravelly sandy loam; moderate granular structure; soft; 20 percent rock fragment; pH 6.8 | These soils are 4 to 60 inches deep over highly weathered granitic, metamorphic, or anorthosite rock. They have a brown gravelly sandy loam surface layer and a pale brown very gravelly sandy loam substratum. The profile is 5 to 85 percent rock fragments. Reaction is very strongly acid to moderately alkaline (pH 4.5 to 8.4). |
| Subsoil | 12 to 20 inches; light yellowish brown gravelly sandy loam; weak subangular blocky structure; slightly hard; pH 7.0 | |
| Substratum | 20 inches; highly weathered granodiorite | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|------------------------------|
| Effective Rooting Depth (inches) | 14 to 20 | 4 to 60 |
| Available Water Capacity | Very low or low | Very low to low |
| Water Retention Class | 2 | 3 |
| Hydrologic Soil Group | C | C to B |
| Permeability | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Moderate to high | Moderate to high |
| Erosion Factor K | .28 | |
| Drainage Class | Well drained | Somewhat excessively drained |
| Soil Manageability Group Class | II 2ed | II 3EP |
| Soil Productivity | Low | Low |
| Annual Forage Production (lbs/ac) | 1,000 to 1,500 | 1,000 |
| Forest Survey Site Class | 6 | 6 |
| Included Areas and Remarks: | Small areas of Knutsen family soils, Wrentham family soils, Springdale family soils, Olete family soils, moderately deep, and soils similar to Tollhouse family soils. Included areas make up about 20 percent of the map unit area. This unit occurs only in the Table Mountain area near Wrightwood. | |

**711 Trigo family, dry - Lithic Xerorthents, warm complex,
50 to 80 percent slopes.**

Elevation: 3,200 to 6,400 feet Annual Precipitation: 10 to 20 inches

| | | |
|---------------------------------|--------------------------|---------------------------------|
| Soil Map Unit Components | Trigo family, dry | Lithic Xerorthents, warm |
| Approximate Proportion | 60 percent | 25 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 50 to 80 percent | 50 to 80 percent |
| Typical Vegetation Series | California buckwheat | California buckwheat |

Soil Profile Description

| | | |
|---------------|---|--|
| Surface Layer | 0 to 9 inches; light brownish gray sandy loam; weak granular structure; loose; pH 6.0 | These soils are 5 to 17 inches deep and formed in material that weathered from granitic and meta profile is brown or pale brown gravelly coarse sandy loam to very gravelly loamy coarse sand. Rock fragments range from 15 percent in the surface layer to 90 percent in the substratum. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8) |
| Subsoil | 9 to 20 inches; very pale brown sandy loam; massive; slightly hard; pH 7. | |
| Substratum | 20 inches; highly weathered granitic rock | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------------------|
| Effective Rooting Depth (inches) | 9 to 20 | 5 to 17 |
| Available Water Capacity | Very low | Very low |
| Water Retention Class | 2 | 3 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid | Moderately rapid or rapid |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .24 | |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4Ed | IV 4EPd |
| Soil Productivity | Very low | Very low |
| Annual Forage Production (lbs/ac) | 800 | 500 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Rock outcrop, alluvial/colluvial deposits, Haploxerolls, shallow, Pismo family soils, Chilao family soils, and Shortcut, dry family soils. Included areas make up about 15 percent of the map unit area. | |

**714 Trigo - Millsholm families - Rock outcrop complex,
45 to 90 percent slopes.**

Elevation: 1,800 to 4,200 feet Annual Precipitation: 15 to 21 inches

| Soil Map Unit Components | Trigo family | Millsholm family | Rock outcrop |
|---------------------------|--------------------------|--------------------------|--------------------------|
| Approximate Proportion | 45 percent | 20 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 45 to 90 percent | 45 to 90 percent | 45 to 90 percent |
| Typical Vegetation Series | Chamise and scrub oak | Chamise and scrub oak | Barren |

Soil Profile Description

| | | | |
|---------------|---|--|--|
| Surface Layer | 0 to 8 inches; pale brown silt loam; weak granular structure; slightly hard; pH 7.0 | 0 to 5 inches; pale brown clay loam; moderate subangular blocky structure; slightly hard; pH 7.0 | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soil capable of supporting plants. |
| Subsoil | 8 to 16 inches; light yellowish brown gravelly silt loam; weak subangular blocky structure; hard; 15 percent rock fragments; pH 6.7 | 5 to 17 inches; brown clay loam; moderate subangular blocky structure; hard; pH 7.0 | |
| Substratum | 16 inches; soft weathered sandstone | 17 inches; hard fractured sandstone | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|-----------------|
| Effective Rooting Depth (inches) | 3 to 19 | 12 to 19 |
| Available Water Capacity | Very low or low | Very low or low |
| Water Retention Class | 2 | 1 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid | Moderately slow |
| Maximum Erosion Hazard | High | High |
| Erosion Factor K | .32 | .37 |
| Drainage Class | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | IV 4Edx | IV 4Ed |
| Soil Productivity | Very low | Low |
| Annual Forage Production (lbs/ac) | 800 to 1,500 | 1,200 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Osito family soils, Modesto family, moderately deep soils, and soils similar to Chilao family soils except that they are more than 20 inches deep. Included areas make up about 20 percent of the map unit area. | |

**718 Shortcut family, dry - Lithic Xerorthents, warm - Rock outcrop complex,
50 to 85 percent slopes.**

| Soil Map Unit Components | Elevation: 3,800 to 6,400 feet Annual Precipitation: 12 to 25 inches | | |
|---------------------------|---|---------------------------------|--------------------------|
| | Shortcut family, dry | Lithic Xerorthents, warm | Rock outcrop |
| Approximate Proportion | 40 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 50 to 85 percent | 50 to 85 percent | 50 to 85 percent |
| Typical Vegetation Series | Scrub oak | Scrub oak | Barren |

Soil Profile Description

| | | | |
|---------------|--|---|---|
| Surface Layer | 0 to 2 inches; pale brown very gravelly loamy coarse sand; weak granular structure; loose; 40 percent rock fragments; pH 6.5 | These soils are 5 to 17 inches deep and formed in material that weathered from granitic or metamorphic rocks. The profile is brown or pale brown gravelly coarse sandy loam to very gravelly loamy coarse sand. | Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soil material capable of supporting plants. |
| Subsoil | 2 to 5 inches; very pale brown loamy coarse sand; massive; loose; 50 percent rock fragments; pH 6.5 | Rock fragments range from 15 percent in the surface layer to 90 percent in the substratum. | |
| Substratum | 5 inches; highly weathered granitic rock | Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8) | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|--|------------------------------|
| Effective Rooting Depth (inches) | 5 to 17 | 5 to 17 |
| Available Water Capacity | Very low | Very low |
| Water Retention Class | 3 | 3 |
| Hydrologic Soil Group | C | C |
| Permeability | Rapid | Moderately rapid or Rapid |
| Maximum Erosion Hazard | Very high | Very high |
| Erosion Factor K | .10 | |
| Drainage Class | Somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4EDx | IV 4EPdx |
| Soil Productivity | Very low | Very low |
| Annual Forage Production (lbs/ac) | 500 | 500 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Pismo family soils, Chilao family soils, Haploxerolls, shallow, and soils similar to Shortcut family, dry soils except that they are more than 20 inches deep. Included areas make up about 15 percent of the map unit area. The soils in the southern part of the unit are bordering on mesic, particularly those at an elevation above 5,600 feet and on north aspects. | |

**734 Haploxerolls, warm - Vista family association,
2 to 30 percent slopes.**

Elevation: 4,300 to 5,200 feet Annual Precipitation: 13 to 16 inches

| | | |
|---------------------------------|---------------------------|-----------------------------------|
| Soil Map Unit Components | Haploxerolls, warm | Vista family |
| Approximate Proportion | 65 percent | 20 percent |
| Landscape Position | Alluvial fans | Older dissected pediment surfaces |
| Slope | 2 to 30 percent | 2 to 30 percent |
| Typical Vegetation Series | Pinyon pine | Juniper |

Soil Profile Description

| | | |
|---------------|--|--|
| Surface Layer | These are deep, well drained soils that formed in colluvial/alluvial deposits derived from mixed sources. They have a brown gravelly loam or sandy loam surface layer and a yellowish brown very gravelly loam or sandy loam | 0 to 9 inches; brown sandy loam; weak granular structure; slightly hard; pH 7.0 |
| Subsoil | subsoil/substratum. The soils are 10 to 50 percent coarse fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8). | 9 to 50 inches; pale brown sandy loam; weak subangular blocky structure; hard; pH 6.7 |
| Substratum | | 50 to 60 inches; very pale brown gravelly coarse sandy loam; massive; slightly hard; 15 percent rock fragments; pH 6.5 |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|------------------|------------------|
| Effective Rooting Depth (inches) | 60 | 22 to 60 |
| Available Water Capacity | Low to moderate | Low to moderate |
| Water Retention Class | 2 | 2 |
| Hydrologic Soil Group | B | C |
| Permeability | Moderately rapid | Moderately rapid |
| Maximum Erosion Hazard | Moderate | Moderate |
| Erosion Factor K | | .28 |
| Drainage Class | Well drained | Well drained |
| Soil Manageability Group Class | II 2ep | II 2ep |
| Soil Productivity | High | High |
| Annual Forage Production (lbs/ac) | 1,000 to 1,200 | 1,500 to 2,000 |
| Forest Survey Site Class | NC | NC |

Included Areas and Remarks: Small areas of Hanford family soils and of Rock outcrop. Included areas make up about 15 percent of the map unit area. This unit is not extensive; it occurs mainly in the Devil's Punchbowl County Park area. Some areas are near Mescal Creek and Puzzle Canyon. The soil temperature regime of this unit is bordering on mesic near Devil's Punchbowl.

735 Rock outcrop

Elevation: 2,200 to 5,000

Annual Precipitation: 14 to 20 inches

Soil Map Unit Components

Rock outcrop

Approximate Proportion

85 percent

Landscape Position

Folded, tilted beds of sedimentary rock

Slope

Barren

Typical Vegetation Series

Barren

Soil Profile Description

Surface Layer

Rock outcrop consists of continuous bare bedrock and less than 15 percent inclusions of soils capable of supporting plants.

Subsoil

Substratum

Soil Properties & Management Interpretations

Effective Rooting Depth (inches)

Available Water Capacity

Water Retention Class

Hydrologic Soil Group

Permeability

Maximum Erosion Hazard

Erosion Factor K

Drainage Class

Soil Manageability Group Class

Soil Productivity

Annual Forage Production (lbs/ac)

Forest Survey Site Class

Included Areas and Remarks:

Small areas of Lithic Xerorthents, warm, Haploxerolls, warm, and soils similar to Vista family soils. Included areas make up about 15 percent of the map unit area. This unit is not extensive; it occurs only in the Devil's punchbowl and Redrock Mountain areas.

**755 Haploxerolls, shallow - Lithic Xerorthents, warm complex,
45 to 70 percent slopes.**

| | | |
|---------------------------|--------------------------------------|---------------------------------------|
| | Elevation: 3,600 to 6,400 | Annual Precipitation: 10 to 23 inches |
| Soil Map Unit | Haploxerolls, shallow | Lithic Xerorthents, warm |
| Components | | |
| Approximate Proportion | 70 percent | 15 percent |
| Landscape Position | Mountainsides and ridges | Mountainsides and ridges |
| Slope | 45 to 70 percent | 45 to 70 percent |
| Typical Vegetation Series | California buckwheat and pinyon pine | California buckwheat |

Soil Profile Description

| | | |
|---------------|--|---|
| Surface Layer | These soils are 4 to 18 inches deep and formed in material that weathered from granitic and metamorphic rocks. The profile is dark brown to brown | These soils are 5 to 17 inches deep and formed in material that weathered from from granitic and metamorphic rocks. |
| Subsoil | gravelly sandy loam, loam, or loamy sand. Rock fragments range from 5 to 75 percent. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8). | The profile is brown or pale brown gravelly coarse sandy loam to very gravelly loamy coarse sand. Rock fragments range from 15 percent in the surface layer to 90 percent in the substratum. Reaction slightly acid to mildly alkaline (pH 6.1 to 7.8). |
| Substratum | | |

Soil Properties & Management Interpretations

| | | |
|-----------------------------------|---|------------------------------|
| Effective Rooting Depth (inches) | 4 to 18 | 5 to 17 |
| Available Water Capacity | Very low or low | Very low |
| Water Retention Class | 2 | 3 |
| Hydrologic Soil Group | C | C |
| Permeability | Moderately rapid or rapid | Moderately rapid or rapid |
| Maximum Erosion Hazard | High or very high | High or very high |
| Erosion Factor K | | |
| Drainage Class | Well drained and somewhat excessively drained | Somewhat excessively drained |
| Soil Manageability Group Class | IV 4Ed | IV 4EPd |
| Soil Productivity | Low | Very low |
| Annual Forage Production (lbs/ac) | 500 to 800 | 500 |
| Forest Survey Site Class | NC | NC |
| Included Areas and Remarks: | Small areas of Rock outcrop, Shortcut family soils, Trigo family, dry soils, Haploxeralfs, shallow, alluvial/colluvial deposits, and soils similar to Millsholm family soils. Included areas make up about 15 percent of the map unit area. | |

765 Haploxerolls, shallow - Trigo family, dry - Haploxeralfs, shallow complex, 30 to 70 percent slopes.

| Soil Map Unit Components | Elevation: 3,400 to 5,000 feet Annual Precipitation: 10 to 16 inches | | |
|---------------------------|---|--------------------------|------------------------------------|
| | Haploxerolls, shallow | Trigo family, dry | Haploxeralfs, shallow |
| Approximate Proportion | 45 percent | 30 percent | 15 percent |
| Landscape Position | Mountainsides, particularly northern aspects | Mountainsides and ridges | Mountainsides, lower part of slope |
| Slope | 30 to 70 percent | 30 to 70 percent | 30 to 70 percent |
| Typical Vegetation Series | Pinyon pine and chamise | Chamise | Chamise |

Soil Profile Description

| | | | |
|---------------|---|---|---|
| Surface Layer | These soils are 4 to 18 inches deep and formed in material that weathered from granitic and metamorphic rocks. The profile is dark brown to brown | 0 to 9 inches; light brownish gray sandy loam; weak granular structure; loose; pH 6.0 | These are shallow soils that formed in material weathered from sedimentary, gabbroic, and dioritic rocks. They have a brown gravelly loam or sandy loam surface layer and a reddish brown clay loam or gravelly sandy clay loam subsoil. In the profile, rock fragments range from 0 to 45 percent and reaction is slightly acid or neutral (pH 6.1 to 7.3) |
| Subsoil | gravelly sandy loam, loam, or loamy sand. Rock fragments range from 5 to 75 percent. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8) | 9 to 20 inches; very pale brown sandy loam; massive; slightly hard; pH 7.0 | |
| Substratum | | 20 inches; highly weathered granitic rock | |

Soil Properties & Management Interpretations

| | | | |
|-----------------------------------|--|------------------------------|-------------------|
| Effective Rooting Depth (inches) | 4 to 18 | 9 to 20 | 7 to 17 |
| Available Water Capacity | Very low or low | Very low | Very low or low |
| Water Retention Class | 2 | 3 | 2 |
| Hydrologic Soil Group | C | C | C |
| Permeability | Moderately rapid or rapid | Moderately rapid | Moderately slow |
| Maximum Erosion Hazard | High to very high | Very high | High to very high |
| Erosion Factor K | | .24 | |
| Drainage Class | Well drained and somewhat excessively drained | Somewhat excessively drained | Well drained |
| Soil Manageability Group Class | III 3Ep | III 3Ep | III 3Ed |
| Soil Productivity | Low | Very low | Low |
| Annual Forage Production (lbs/ac) | 500 to 800 | 800 | 500 to 1,000 |
| Forest Survey Site Class | NC | NC | NC |
| Included Areas and Remarks: | Small areas of Exchequer family, dry soils, Chilao family soils, Osito family soils, and Typic Haploxeralfs. Included areas make up about 10 percent of the map unit area. This unit occurs only in the Mt. Emma area. | | |

TABLE 2 Acreage and Proportionate Extent of the Map Units

| Map Symbol | Map Unit Name | Percent of Survey Area | Acres |
|------------|---|------------------------|--------|
| 1 | Exchequer family, 30 to 60 percent slopes | 0.92 | 6,280 |
| 6 | Typic Haploxerafls, 3 to 50 percent slopes | 0.36 | 2,440 |
| 7 | Hanford family, 3 to 25 percent slopes | 0.60 | 4,070 |
| 8 | Lodo-Modesto families complex, 30 to 70 percent slopes | 4.18 | 28,430 |
| 12 | Mollic Haploxerafls, 2 to 50 percent slopes | 0.48 | 3,290 |
| 15 | Calcixerollic Xerochrepts-Calleguas family-Modesto family, moderately deep complex, 30 to 60 percent slopes | 0.43 | 2,950 |
| 19 | Trigo family-Calcixerollic Xerochrepts-Vista family complex, 30 to 70 percent slopes | 1.28 | 8,740 |
| 21 | Riverwash, 2 to 10 percent slopes | 0.69 | 4,720 |
| 24 | Modesto, moderately deep-Trigo families complex, 25 to 75 percent slopes | 1.51 | 10,300 |
| 26 | Stonyford-Millsholm families complex, 30 to 70 percent slopes | 2.42 | 16,480 |
| 29 | Lodo family-Mollic Haploxerafls association, 15 to 50 percent slopes | 0.17 | 1,190 |
| 33 | Caperton-Capistrano families complex, 35 to 80 percent slopes | 2.89 | 19,640 |
| 35 | Trigo, granitic substratum-Exchequer families-Rock outcrop complex, 30 to 60 percent slopes | 3.19 | 21,700 |
| 36 | Trigo, granitic substratum-Exchequer families-Rock outcrop complex, 60 to 100 percent slopes | 7.78 | 55,289 |
| 37 | Lodo-Tujunga families association, 2 to 50 percent slopes | 0.13 | 870 |
| 39 | Tujunga-Capistrano families association, 2 to 20 percent slopes | 0.47 | 3,190 |
| 43 | Caperton-Baywood families complex, 45 to 80 percent slopes | 0.49 | 3,340 |
| 45 | Vista family, 5 to 30 percent slopes | 0.16 | 1,110 |

TABLE 2 Acreage and Proportionate Extent of the Map Units (continued)

| Map Symbol | Map Unit Name | Percent of Survey Area | Acres |
|------------|---|------------------------|--------|
| 46 | Caperton-San Andreas-Modesto families complex, 15 to 60 percent slopes | 0.61 | 4,120 |
| 47 | Pacifico-Preston families complex, 15 to 50 percent slopes | 0.58 | 3,930 |
| 48 | Trigo-Modesto-San Andreas families association, 15 to 70 percent slopes | 1.22 | 8,330 |
| 50 | Trigo, granitic substratum-Pismo families complex, 20 to 60 percent slopes | 0.67 | 4,590 |
| 54 | Caperton-Trigo, granitic substratum-Lodo families complex, 50 to 85 percent slope | 5.74 | 39,010 |
| 57 | Pacifico family-Xerorthents complex, 50 to 90 percent slopes | 1.18 | 8,000 |
| 59 | Tollhouse-Knutsen-Stukel families complex, 30 to 70 percent slopes | 1.17 | 7,980 |
| 62 | Oak Glen family, 2 to 35 percent slopes | 0.33 | 2,240 |
| 64 | Oak Glen-Tollhouse families complex, 30 to 70 percent slopes | 0.45 | 3,030 |
| 69 | Tujungua-Pismo families association, 15 to 70 percent slopes | 0.61 | 4,180 |
| 72 | Osito-Trigo families complex, 25 to 55 percent slopes | 0.65 | 4,410 |
| 74 | Trigo-Calleguas families-Rock outcrop complex, 60 to 100 percent slopes | 1.57 | 10,710 |
| 75 | Trigo-Calleguas families-Haploxerafls complex, 30 to 70 percent slopes | 2.97 | 20,210 |
| 79 | Trigo-Lodo families-Haploxerolls, warm complex, 50 to 90 percent slopes | 0.96 | 6,510 |
| 82 | Vertic Xerochrepts, 5 to 50 percent slopes | 0.21 | 1,400 |
| 86 | Pismo family-Rock outcrop complex, 50 to 80 percent slopes | 2.59 | 17,600 |
| 89 | Pismo-Trigo, dry-Exchequer, dry families complex, 30 to 70 percent slopes | 2.30 | 15,650 |

TABLE 2 Acreage and Proportionate Extent of the Map Units (continued)

| Map Symbol | Map Unit Name | Percent of Survey Area | Acres |
|------------|--|------------------------|--------|
| 90 | Stukel-Olete families association, 50 to 100 percent slopes | 1.18 | 8,030 |
| 91 | Stukel-Sur-Winthrop families complex, 60 to 100 percent slopes | 2.73 | 18,540 |
| 92 | Tollhouse-Stukel-Wrentham families complex, 60 to 90 percent slopes | 1.70 | 11,580 |
| 93 | Rock outcrop-Lithic Xerorthents-Rubble land association, 60 to 120 percent slopes | 5.37 | 36,480 |
| 95 | Bakeoven family-Lithic Xerorthents-Sur family, moderately deep complex, 45 to 80 percent slopes | 2.64 | 17,970 |
| 97 | Trigo, granitic substratum-Green Bluff-Supan families association, 15 to 60 percent slopes | 0.78 | 5,290 |
| 109 | Winthrop family, very stony-Lithic Xerorthents-Rock outcrop association, 15 to 70 percent slopes | 1.31 | 8,900 |
| 300 | Trigo, granitic substratum-Modjeska families association, 5 to 60 percent slopes | 0.76 | 5,170 |
| 306 | Chilao family, 20 to 60 percent slopes | 1.54 | 10,470 |
| 308 | Pismo-Chilao-Shortcut families complex, 45 to 80 percent slopes | 3.22 | 21,880 |
| 313 | Trigo family, granitic substratum, 60 to 90 percent slopes | 1.07 | 7,280 |
| 314 | Chilao-Trigo, granitic substratum-Lodo families complex, 55 to 85 percent slopes | 1.29 | 8,810 |
| 316 | Rock outcrop-Chilao family-Haploxerolls, warm association, 15 to 120 percent slopes | 5.22 | 35,540 |
| 320 | Vista-Trigo, granitic substratum - Modesto families complex, 40 to 70 percent slopes | 1.76 | 11,970 |
| 333 | Typic Xerorthents, warm, 55 to 90 percent slopes | 1.81 | 12,300 |
| 405 | Xerorthents-Green Bluff family-Rock outcrop complex, 15 to 50 percent slopes | 0.63 | 4,310 |
| 406 | Green Bluff-Hohmann families-Xerorthents complex, 15 to 60 percent slopes | 0.69 | 4,720 |

TABLE 2 Acreage and Proportionate Extent of the Map Units (continued)

| Map Symbol | Map Unit Name | Percent of Survey Area | Acres |
|------------|--|------------------------|--------------|
| 420 | Olete-Kilburn-Etsel families-complex, 50 to 80 percent slopes | 1.11 | 7,580 |
| 619 | Typic Xerorthents, cold-Haploxerolls, cold-Typic Xerocrepts complex, 45 to 85 percent slopes | 0.78 | 5,300 |
| 620 | Bakeoven-Sur, moderately deep families complex, 50 to 75 percent slopes | 1.41 | 9,560 |
| 621 | Waterman-Springdale-Pacifico families complex, 30 to 70 percent slopes | 2.18 | 14,800 |
| 624 | Olete-Kilburn families, moderately deep-Mollic Haploxerafls, cool complex, 40 to 70 percent slopes | 0.56 | 3,790 |
| 628 | Haploxerolls-Riverwash association, 2 to 25 percent slopes | 0.30 | 2,030 |
| 630 | Balder family-Mollic Haploxerafls, cool-Lithic Haploxerafls complex, 5 to 60 percent slopes | 0.52 | 3,550 |
| 634 | Mollic Haploxerafls, cool-Xerorthents, dry-Green Bluff family, dry association, 5 to 60 percent slopes | 0.50 | 3,380 |
| 640 | Balder family-Xerorthents complex, 5 to 60 percent slopes | 0.58 | 3,930 |
| 711 | Trigo family, dry-Lithic Xerorthents, warm complex, 50 to 80 percent slopes | 1.75 | 11,930 |
| 714 | Trigo-Millsholm families-Rock outcrop complex, 45 to 90 percent slopes | 0.60 | 4,060 |
| 718 | Shortcut family, dry-Lithic Xerorthents, warm-Rock outcrop complex, 50 to 85 percent slopes | 1.24 | 8,440 |
| 734 | Haploxerolls, warm-Vista family association, 2 to 30 percent slopes | 0.30 | 2,070 |
| 735 | Rock outcrop | 0.22 | 1,530 |
| 755 | Haploxerolls, shallow-Lithic Xerorthents, warm complex, 45 to 70 percent slopes | 1.71 | 11,660 |
| 765 | Haploxerolls, shallow-Trigo family, dry-Haploxerafls, shallow complex, 30 to 70 percent slopes | <u>0.58</u> | <u>3,920</u> |
| | | 100.00 | 680,324 |

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 use allocations to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land use.

Information in this section can provide a basis for assigning management priorities to land areas that have few or less severe limitations and for determining areas where more detailed or site-specific soil information is needed. Additional information about each soil and its use and management is given under "Detailed Soil Map Unit Descriptions." In that section, individual soils are evaluated for their productivity, their manageability limitations, and their potential for production of forage and timber.

Watershed

Many of the Los Angeles ground-water basins adjoin the forest boundary. The forest supplies approximately 13 percent of the total surface water demand in the Los Angeles basin. Because of the tremendous amount of fracturing throughout the rock mass of the San Gabriel Mountains, the capacity for reception and temporary storage of water in the rock mass is considerable. The fracturing and the associated deep weathering in the underlying rock mantles are important factors in determining the hydrologic response of these watersheds.

Total annual water production in the forest is estimated to be about 1.2 million acre-feet. Most of this water percolates through the thin soil mantle and enters the ground-water system. At the beginning of the rainy season when the shallow soils are dry and undisturbed, they normally have a high infiltration rate. Because of the degree of fracturing and deep weathering in the underlying bedrock, these soils have a more permeable substratum than other shallow soils. For watershed planning purposes, these soils were assigned a hydrologic soil group rating of moderately high runoff rather than high runoff potential.

Soils in the forest are managed for watershed protection by preventing soil erosion and maintaining productivity. Overland flow or runoff on shallow forest soils can increase tremendously when wildfires on chaparral lands induce the formation of water-repellent soil layers. Prevention of large wildfires through more intensive vegetative management is an important objective of soil management. The use of prescribed burning of chaparral

to develop age-class mosaics, along with fuelbreak construction, is an important tool for reducing soil erosion and sedimentation.

Range Production

In recent years the demand for use of forest soils for grass production has increased substantially. Currently there are about 30,000 acres of rangeland in the forest under grazing permit, producing about 4,000 animal-unit-months of grazing. (An animal-unit-month is the amount of forage required to feed one animal unit = one cow, one horse, one mule, five sheep, or five goats = for 30 days.) It is estimated that an additional 60,000 acres are suitable for range forage production. These lands need prescribed fire treatment and water development to be suitable for commercial grazing. Most of forage produced and eaten by livestock will be annual grasses, forbs, and resprouting chaparral species. Maximum production of annual grasses occurs in the winter and spring.

Soil properties that affect moisture supply and plant nutrients have the greatest influence on productivity of range plants. Generally, the most productive range soils are those that have a high available water capacity and are in higher rainfall zones. Deep upland soils like the San Andreas and Oak Glen families are in this category. In general, the least productive soils are the shallow, coarse textured soils that occur below an elevation of 4,000 feet, particularly those on south- or west-facing slopes. Deep colluvial soils or soils on north-facing slopes have a moisture regime that favors the buildup of organic matter; they therefore have better fertility. However, slope is a major limitation of colluvial soils for range use.

Proper forage utilization should ensure enough cover to protect the soil and maintain or improve site productivity. Adequate ground cover should include litter and duff deposits from previous years. Other practices that facilitate proper grazing are fencing, distribution of water for livestock, location of salt blocks, and supplemental feeding.

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. Soils information can be used in planning wildlife refuges, nature study areas, and other developments for wildlife.

Fish and Wildlife resources are important to the forest for many reasons. For one, urban developments surround 75 percent of the forest, turning forest lands into "habitat islands". In the future, most breeding activities of native animals may be confined to forest lands, as are those of the Cooper's hawk today. The forest provides Los Angeles area residents with places to fish and hunt, primarily for trout, deer, quail, dove, and pigeons, to observe wildlife, and for camping, picnicking, and hiking.

Fish, wildlife, and botanical resources occur forestwide. As in most natural systems, they are not evenly distributed. The riparian woodlands, oak woodlands, and conifer forest types provide the best opportunities for wildlife and plants to survive. Thus, these types of vegetation are rich in species variety and sometimes density. Other habitat types, such as chamise chaparral, present less variety or density of species.

Some animal species, such as deer and coyote, are cosmopolitan in their requirements and inhabit areas in all vegetation types during some time of the year. Certain wildlife species, for example, the least Bell's vireo, willow flycatcher, and yellow warbler, require riparian woodland and are very sensitive to changes within their habitat.

The Angeles National Forest is responsible for managing the land habitats on which fish, wildlife, and botanical resources depend, and forest management of the land is crucial to wildlife survival.

Recreation

The Angeles National Forest is the second most heavily used national forest in California. An estimated 19 million recreation visits were made in 1980. The heavy use is a result of the forest's location, less than an hour's drive for the 7.5 million people in the Los Angeles metropolitan area. Population in the area is expected to grow each year, putting additional demands on both dispersed and developed recreation sites. Increased use of the forest by recreational off-highway vehicles (trail bikes, 4-wheel jeeps, etc.) can cause major impact on soil resources. Overuse and heavy foot traffic can cause such severe soil compaction and reduced infiltration that it becomes necessary to close campgrounds for restoration.

Soils in the survey area are rated in the map unit descriptions for their manageability. The rating system considers soil properties useful in recreation planning. For site-specific planning, more detailed soil investigation and interpretations may be required. The following is a general discussion of soil characteristics important for some kinds of recreational sites.

Camp areas require site preparation such as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Steeper slopes and the presence of stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Forestry

Wood products in excess of 20 cubic feet per acre per year can be produced on about 40,000 acres of forest land in the survey area. This acreage, however, except for about 3,000 acres, is economically unsuitable because of low volume or extremely difficult terrain for access. Most of the timber sold from the forest is used as firewood. The forest should be able to produce about 2,300 cords of wood annually. Demand for fuelwood rather than sawtimber has increased significantly in the past few years. Those areas available for fuelwood gathering have the potential of being over-utilized, and care must be taken to protect the soils. The demand

for large fuelwood material such as trees is greater than for brush species. The demand for fuelwood is expected to continue and to increase beyond the capacity of the forest.

The demand for conifer trees is especially high in recreation sites. Management of native stands is very intensive in heavily used areas. Tree plantations have been es-

tablished, especially by converting brush stands in suitable locations to trees. The best sites for mixed conifers are generally at elevations above 4,000 feet where rainfall is more than 25 inches. Deep colluvial soils on north aspects at these higher elevations are the most suitable sites. As with forage production, moisture stress is the major limiting factor for tree growth.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 3, the soils of the survey area are listed alphabetically and are classified according to the system. In table 4, there are listed for each soil those map units in which the soil occurs as a major component. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haploxeralf (Hapl, meaning minimal horizonation, plus xeralf, the suborder of the Alfisols that have a xeric moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective Lithic identifies the subgroup that has hard parent rock within 50 centimeters of the surface. An example is Lithic Haploxeralfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy, mixed, thermic Lithic Haploxeralfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

TABLE 3 - CLASSIFICATION OF THE SOILS

| SOIL NAME | FAMILY OR HIGHER TAXONOMIC CLASS |
|---------------------------|--|
| Bakeoven family | Loamy-skeletal, mixed, mesic Lithic Haploxerolls |
| Balder family | Loamy, mixed, mesic, shallow Typic Haploxerolls |
| Baywood family | Sandy, mixed, thermic Entic Haploxerolls |
| Calcixerollic Xerochrepts | Calcixerollic Xerochrepts |
| Calleguas family | Loamy, mixed (calcareous), thermic, shallow Typic Xerorthents |
| Caperton family | Loamy, mixed, thermic, shallow Entic Haploxerolls |
| Capistrano family | Coarse-loamy, mixed, thermic Entic Haploxerolls |
| Chilao family | Loamy-skeletal, mixed, nonacid, thermic, shallow Typic Xerorthents |
| Etsel family | Loamy-skeletal, mixed, nonacid, mesic Lithic Xerorthents |
| Exchequer family | Loamy, mixed, nonacid, thermic Lithic Xerorthents |
| Green Bluff family | Coarse-loamy, mixed, mesic Typic Xerochrepts |
| Hanford family | Coarse-loamy, mixed, nonacid, thermic Typic Xerorthents |
| Haploxeralfs | Haploxeralfs |
| Haploxerolls | Haploxerolls |
| Hohmann family | Fine-loamy, mixed, mesic Typic Xerochrepts |
| Kilburn family | Loamy-skeletal, mixed, mesic Typic Haploxerolls |
| Knutsen family | Coarse-loamy, mixed, mesic Typic Haploxerolls |
| Lithic Haploxeralfs | Lithic Haploxeralfs |
| Lithic Xerorthents | Lithic Xerorthents |
| Lodo family | Loamy, mixed, thermic Lithic Haploxerolls |
| Millsholm family | Loamy, mixed, thermic Lithic Xerochrepts |
| Modesto family | Fine-loamy, mixed, thermic Mollic Haploxeralfs |
| Modjeska family | Loamy-skeletal, mixed, thermic Typic Xerochrepts |
| Mollic Haploxeralfs | Mollic Haploxeralfs |
| Oak Glen family | Coarse-loamy, mixed, mesic Pachic Haploxerolls |
| Olete family | Loamy-skeletal, mixed, mesic Typic Xerochrepts |
| Osito family | Loamy, mixed, thermic, shallow Typic Xerochrepts |
| Pacifico family | Mixed, mesic, shallow Typic Xeropsamments |
| Pismo family | Mixed, thermic, shallow Typic Xeropsamments |
| Preston family | Mixed, mesic Typic Xeropsamments |
| San Andreas family | Coarse-loamy, mixed, thermic Typic Haploxerolls |
| Shortcut family | Sandy-skeletal, mixed, thermic, shallow Typic Xerorthents |
| Springdale family | Sandy-skeletal, mixed, mesic Typic Xerorthents |
| Stonyford family | Loamy, mixed, thermic Lithic Mollic Haploxeralfs |
| Stukel family | Loamy, mixed, mesic Lithic Haploxerolls |
| Supan family | Fine-loamy, mixed, mesic Pachic Argixerolls |

TABLE 3 - CLASSIFICATION OF THE SOILS

| SOIL NAME | FAMILY OR HIGHER TAXONOMIC CLASS |
|--------------------|---|
| Sur family | Loamy-skeletal, mixed, mesic Entic Haploxerolls |
| Tollhouse family | Loamy, mixed, mesic, shallow Entic Haploxerolls |
| Trigo family | Loamy, mixed, nonacid, thermic, shallow Typic Xerorthents |
| Tujunga family | Mixed, thermic Typic Xeropsamments |
| Typic Haploxeralfs | Typic Haploxeralfs |
| Typic Xerochrepts | Typic Xerochrepts |
| Typic Xerorthents | Typic Xerorthents |
| Vertic Xerochrepts | Vertic Xerochrepts |
| Vista family | Coarse-loamy, mixed, thermic Typic Xerochrepts |
| Waterman family | Sandy-skeletal, mixed, mesic Lithic Xerorthents |
| Winthrop family | Sandy-skeletal, mixed, mesic Entic Haploxerolls |
| Wrentham family | Loamy-skeletal, mixed, mesic Pachic Haploxerolls |
| Xerorthents | Xerorthents |

Four soil orders are represented in the Angeles Forest survey area: Alfisols, Entisols, Inceptisols, and Mollisols.

The soils in the survey area have a xeric moisture regime and a mesic, frigid or thermic temperature regime. The xeric moisture regime is typical in Mediterranean climates, where winters are moist and cool and summers are warm and dry. Therefore, unless the soil is irrigated, its moisture control section is dry in all parts for 45 consecutive days or more from July until October in 6 out of 10 years. The moisture control section is moist in all parts for 45 consecutive days or more from December until May.

The temperature regime is thermic at the lower elevations, particularly on south-facing aspects. In a thermic temperature regime, the soil temperature at a depth of 20 inches ranges from 59 to 72 degrees F. At higher elevations, the temperature regime is mesic. In a mesic temperature regime, the soil temperature at a depth of 20 inches ranges from 47 to 59 degrees F. In a frigid temperature regime, which occurs at the highest elevations, particularly on north-facing aspects, the soil temperature at a depth of 20 inches ranges from 32 to 47 degrees F.

Alfisols are soils that have a massive and hard A horizon and an argillic B horizon. They have high base saturation, and water is held at less than 15 bar tension during at least 3 months of each year when the soil is warm enough for plants to grow. Alfisols in this area have been placed in the Xeralf suborder. They have a xeric moisture regime; winters are moist and cool, and summers are warm and dry.

Entisols are soils that have little or no evidence of development of pedogenic horizons.

The Entisols in this area are in the Orthent and Psamment suborders. The soils do not have a B horizon and generally are less than 1 percent organic matter.

Orthents have a particle-size class that is loamy or finer in texture in some horizon below the Ap horizon and have slope of more than 25 percent or have an organic carbon content that decreases regularly with increasing depth. The organic carbon reaches a level of 0.2 percent

or less within a depth of 1.25 meters. Psamments are loamy fine sand or coarser in the textural control section. These soils are on alluvial fans and are deep to very deep. The Orthents and Psamments have been placed in the Xerorthent and Xeropsamment great groups since they have a xeric moisture regime.

Inceptisols are soils in which altered horizons have lost bases of iron and aluminum but have retained some weatherable minerals. These soils do not have an illuvial horizon enriched either with silicate clay that contains aluminum or with an amorphous mixture of aluminum and organic carbon.

The Inceptisols in the survey area are in the Ochrept suborder. They have an ochric epipedon and a cambic horizon. They do not have a mollic epipedon because either the dark color, organic matter, or structure is lacking. The cambic horizon increases in clay content by 1 or 2 percent and has structure. The texture is coarse sandy loam or finer. These soils have a xeric moisture regime and thus have been placed in the Xerochrept great group.

Mollisols typically have a dark colored surface layer which is more than 25 cm thick, is more than 1 percent organic matter, and is not both hard and massive. Base saturation of this layer is more than 50 percent.

In this survey area, the Mollisols are in the Xeroll suborder. These soils formed in a warm, subhumid climate or in a semiarid climate where a natural, supplemental source of water extends the growing season. Winters are cool and moist, and summers are hot and dry. Unless irrigated, these soils are dry throughout the root zone for more than 60 consecutive days during the 3-month period following the summer solstice.

Xerolls are divided into two great groups: Argixerolls and Haploxerolls. Soils that do not have a clay-enriched B horizon or layers strong in calcium carbonates are classified in the Haploxeroll great group. Soils that have a clay-enriched B horizon and a clear to gradual boundary between the A and B horizons and do not have strongly calcareous layers have been placed in the Argixeroll great group.

TABLE 4.--Soil Components in Map Units
[Miscellaneous areas and minor components are not included]

| Soil Name | Map Unit | Soil Name | Map Unit |
|---------------------------|----------------------------------|--------------------|---|
| Bakeoven family | 95, 620 | Olete family | 90, 420, 624 |
| Balder family | 630, 640 | Osito family | 72 |
| Baywood family | 43 | Pacifico family | 47, 57, 621 |
| Calcixerollic Xerochrepts | 15, 18 | Pismo family | 50, 69, 86, 89, 308 |
| Calleguas family | 15, 74, 75 | Preston family | 47 |
| Caperton family | 33, 43, 46, 54 | San Andreas family | 46, 48 |
| Capistrano family | 33, 39 | Shortcut family | 308, 718 |
| Chilao family | 306, 308, 314, 316 | Springdale family | 621 |
| Etsel family | 420 | Stonyford family | 26 |
| Exchequer family | 1, 35, 36, 89 | Stukel family | 59, 90, 91, 92 |
| Green Bluff family | 97, 405, 406, 634 | Supan family | 97 |
| Hanford family | 7 | Sur family | 91, 95, 620 |
| Haploxeralfs | 75, 765 | Tollhouse family | 59, 64, 92 |
| Haploxerolls | 79, 316, 619, 628, 734, 755, 765 | Trigo family | 19, 24, 35, 36, 48, 50, 54, 72, 74, 75, 79, 86, 89, 97, 300, 313, 314, 320, 711, 714, 765 |
| Hohmann family | 406 | Tujunga family | 37, 39, 69 |
| Kilburn family | 420, 624 | Typic Haploxeralfs | 6 |
| Knutsen family | 59 | Typic Xerochrepts | 619 |
| Lithic Haploxeralfs | 630 | Typic Xerorthents | 333, 619 |
| Lithic Xerorthents | 93, 95, 109, 711, 718, 755 | Vertic Xerochrepts | 82 |
| Lodo family | 8, 29, 37, 54, 79, 314 | Vista family | 19, 45, 320, 734 |
| Millsholm family | 26, 714 | Waterman family | 621 |
| Modesto family | 8, 15, 24, 46, 48, 320 | Winthrop family | 91, 109 |
| Modjeska family | 300 | Wrentham family | 92 |
| Mollic Haploxeralfs | 12, 29, 624, 630, 634 | Xerorthents | 57, 405, 406, 634, 640 |
| Oak Glen family | 62, 64 | | |

Taxonomic Unit Descriptions

In this section, each soil family or higher category recognized in the survey area is described. The descriptions are arranged in alphabetic order. Characteristics of the soil and the material in which it formed are identified for each family. The pedon, a small three-dimensional area of the soil that is typical of the soil profile in the survey area, is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual.

Many of the technical terms used in the descriptions are defined in Soil Taxonomy. The soil moisture conditions at the time soil colors were described are given. Following the pedon description is the range of important characteristics of the soils in each family. The map units of each soil family are described in the section "Detailed Soil Map Units".

BAKEOVEN FAMILY

The Bakeoven family consists of very shallow or shallow, well drained soils that formed in material weathered from schist, gneiss, or granitic rock. The soils are on mountainsides and ridges at elevations of 3,200 to 8,600 feet. Slopes range from 45 to 80 percent. Annual precipitation is 17 to 35 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, mesic Lithic Haploxerolls.

Typical pedon of Bakeoven family, in an area of Bakeoven family-Lithic Xerorthents-Sur family, moderately deep complex, 45 to 80 percent slopes, under Jeffrey pine at an elevation of 7,800 feet.

O1-1 inch to 0; undecomposed pine needles.

A11-0 to 4 inches; dark grayish brown (2.5Y 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; 30 percent pebbles, 5 percent cobbles; neutral (pH 6.9); abrupt smooth boundary.

A12-4 to 14 inches; grayish brown (2.5Y 5/2) very stony loam, very dark grayish brown (2.5Y 3/2) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; many very fine and fine interstitial pores; 20 percent pebbles, 5 percent cobbles,

15 percent stones; neutral (pH 7.2); abrupt smooth boundary.

R-14 inches; hard fractured schist, not displaced; more than 4 inches between fractures; no roots.

Type location: 800 feet south of Blue Ridge Campground 300 feet downslope from road; 2,000 feet east and 1,400 feet north of the SW corner of sec. 11, T. 3 N., R. 8 W., Mount San Antonio Quadrangle.

Range in characteristics: Depth to a lithic contact is 5 to 20 inches. The mean annual soil temperature at the contact is 47 to 59 degrees F.

The A horizon has dry color of 2.5Y 6/2, 5/3, 5/2, or 4/2; 10YR 5/2 4/3 or 4/2; 5Y 5/2 or 4/1. It has moist color of 10YR 3/3, 3/2, 3/1, or 2/2 or 2.5Y 4/2, 3/2, or 2/1. It is gravelly loam, very gravelly loam, very gravelly sandy loam, or very gravelly coarse sandy loam and averages 20 to 60 percent rock fragments; it is more than 35 percent rock fragments in the particle-size control section. Reaction is moderately acid to neutral (pH 6.0 to 7.2). Typically, the A horizon is directly underlain by the bedrock, but in some pedons a thin C horizon separates the two.

In some pedons a weak cambic B horizon is present. It has weak subangular blocky structure.

Vegetation: Jeffrey pine, ponderosa pine, scattered white fir and sugar pine, Coulter pine, rabbitbrush, big sagebrush, mountain whitethorn, and canyon live oak.

BALDER FAMILY

The Balder family consists of shallow, well drained soils that formed in material weathered from granitic rock, schist, and mixed granitic and metamorphic rocks. The soils are on broad, gentle ridgetops and mountainsides at elevations of 4,400 to 7,500 feet. Slopes range from 5 to 60 percent. Annual precipitation is 15 to 25 inches.

Taxonomic class: These soils are loamy, mixed, mesic, shallow Typic Haploxerolls.

Typical pedon of Balder family, in an area of Balder family-Mollic Haploxeralfs, cool-Lithic Haploxeralfs complex, 5 to 60 percent slopes, under pinyon pine at an elevation of 6,400 feet:

A11-0 to 2 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, dark brown (10YR 3/3) moist; moderate very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; 30 percent pebbles; neutral (pH 6.7); abrupt smooth boundary.

A12-2 to 12 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; soft, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; many very fine and fine interstitial pores; 20 percent pebbles; neutral (pH 6.8); clear wavy boundary.

B2-12 to 20 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, fri-

able, slightly sticky and nonplastic; few fine, medium, and coarse roots; common fine interstitial pores and few fine tubular pores; neutral (pH 7.0); clear smooth boundary.

Cr-20 inches; yellowish brown (10YR 5/4) highly weathered granodiorite, breaks down to a very gravelly loamy coarse sand; few fine roots.

Type location: At the head of Fenner Canyon on the south side of Pinyon Ridge; 1,000 feet south and 3,300 feet east of the NW corner of sec. 31 (projected), T. 4 N., R. 8 W., Valermo Quadrangle.

Range in characteristics: Depth to a paralithic contact is 14 to 20 inches. Mean annual soil temperature at the contact is 47 to 59 degrees F. The profile is slightly acid or neutral (pH 6.2 to 7.0).

The A horizon has dry color of 10YR 5/3, 4/3, or 4/2 and moist color of 10YR 3/3, 3/2, or 2/2. It is gravelly sandy loam, loam, or loamy sand and averages 5 to 30 percent rock fragments.

The B2 horizon has dry color of 10YR 6/4, 4/2, 5/4, or 5/3 and moist color of 10YR 4/4, 3/3, or 3/2. The B2 horizon is gravelly sandy loam, loam, or sandy clay loam and averages 10 to 20 percent rock fragments. It has weak or moderate subangular blocky structure and has 3 to 5 percent more clay than the A horizon. The clay content averages less than 35 percent.

Vegetation: Jeffrey pine, pinyon pine, black oak, canyon live oak, mountain mahogany, buckwheat, flannelbush, yucca, big sagebrush, and annual grasses.

BAYWOOD FAMILY

The Baywood family consists of deep, somewhat excessively drained soils that formed in alluvial, colluvial, or residual material weathered from gneissic rocks. The soils are on mountainsides, alluvial fans, and colluvial slopes at elevations of 2,000 to 4,800 feet. Slopes range from 45 to 80 percent. Annual precipitation is 17 to 21 inches.

Taxonomic class: These soils are sandy, mixed, thermic Entic Haploxerolls.

Typical pedon of Baywood family, in an area of Caperton-Baywood families complex, 45 to 80 percent slopes, under shrub canyon live oak at an elevation of 2,800 feet:

A1-0 to 10 inches; brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine, fine, and medium granular structure; soft, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; 15 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C1-10 to 32 inches; brown (10YR 5/3) gravelly loamy sand, brown (10YR 4/3) moist; massive; soft, very friable; common medium roots; many very fine tubular and interstitial pores; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C2-32 to 58 inches; yellowish brown (10YR 5/4) grav-

elly loamy sand, dark yellowish brown (10YR 3/4) moist; massive; soft, very friable; few medium roots; many very fine tubular and interstitial pores; 30 percent pebbles; neutral (pH 7.0); gradual smooth boundary.

C3r-58 inches; decomposed gneissic rock.

Type location: 0.4 mile northwest of Cottonwood Campground and 600 feet south of Elizabeth Lake Canyon Road; 2,300 feet east and 800 feet south of the NW corner of sec. 6, T. 6 N., R. 15 W., Burnt Peak Quadrangle.

Range in characteristics: Depth to a paralithic contact is 44 inches to more than 60 inches. The mean annual soil temperature at 20 inches is 60 to 70 degrees F.

The A horizon is sandy loam, gravelly sandy loam, or loamy coarse sand and averages 10 to 20 percent gravel. It has dry color of 10YR 5/3 and moist color of 10YR 3/3 or 3/2. It is slightly acid or neutral (pH 6.5 to 7.0).

The C horizon is loamy sand, loamy coarse sand, gravelly loamy sand, or gravelly loamy coarse sand and averages 15 to 30 percent gravel. It has dry color of 10YR 6/3, 5/4, or 5/3 and moist color of 10YR 4/3, 3/4, or 3/3.

Vegetation: shrub canyon live oak, mountain mahogany, manzanita, chokecherry, poison oak, buckwheat, and annual grasses.

CALCIXEROLIC XEROCHREPTS

Calcixerollic Xerochrepts are well drained, have moderately slow permeability, and formed in material that weathered from soft, calcareous shale and sandstone. They are on mountainsides and ridges and have slopes of 30 to 70 percent. Elevation ranges from 1,400 to 2,200 feet. Annual precipitation is 12 to 20 inches.

Depth to a paralithic contact is 15 to 42 inches. Mean annual soil temperature is about 65 degrees F. The soil between depths of 5 and 15 inches is usually dry from mid-May to November and is moist in some or all parts the rest of the year.

The soil profile is silt loam, clay loam, or silty clay loam. The surface layer may also be loam, and the subsoil may be sandy clay loam, gravelly sandy clay loam, or gravelly very fine sandy loam. Rock fragments of gravel size make

up 2 to 30 percent of the profile. The dry color is 10YR 5/3, 5/4, 6/3 or 6/4 or 2.5Y 7/4; and the moist color is 10YR 3/3, 4/3, 4/4, 5/4, or 6/3 or 2.5Y 5/4.

In the upper 8 inches, the soil is neutral to moderately alkaline (pH 6.6 to 8.4); it can be slightly effervescent. Below this, effervescence is strong; reaction is mildly alkaline or moderately alkaline (pH 7.4 to 8.4). Also below 8 inches, coatings of soft powdery lime occur on faces of peds and on pebbles. Lime is also segregated in filaments and nodules. The amount of lime increases with depth and is greatest near the contact with the calcareous parent material.

Vegetation: chamise, yucca, black sage, buckwheat, scrub live oak, and annual grasses.

CALLEGUAS FAMILY

The Calleguas family consists of very shallow or shallow, well drained soils that formed in material weathered from sedimentary rocks. The soils are on mountainsides and ridges at elevations of 1,500 to 4,000 feet. Slopes range from 30 to 100 percent. Annual rainfall is 12 to 20 inches.

Taxonomic class: These soils are loamy, mixed (calcareous), thermic, shallow Typic Xerorthents.

Typical pedon of Calleguas family, in an area of Calcixerollic Xerochrepts-Calleguas family-Modesto family, moderately deep complex, 30 to 60 percent slopes, under chaparral at an elevation of 2,000 feet:

A1-0 to 4 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate fine and medium granular structure; slightly hard, friable, sticky and plastic; common very fine roots; common very fine and fine tubular and interstitial pores; 5 percent pebbles; mildly alkaline (PH 7.8); clear smooth boundary.

C1-4 to 10 inches; very pale brown (10YR 7/3) silty clay loam, yellowish brown (10YR 5/4) moist, massive; hard, friable, sticky and plastic; few very fine roots; common very fine and fine interstitial pores; violently effervescent; lime disseminated and as filaments and soft powdery coatings; mildly alkaline (pH 7.8); clear smooth boundary.

C2r-10 inches; semiconsolidated sandstone that crushes to silty clay loam; few very fine roots; violently effervescent; becomes more consolidated with increasing depth.

Type location: Between Forest Road 5N24 and Del Sur Ridge; 850 feet east and 1,600 feet south of the NW corner of sec. 29, T. 5 N., R. 15 W., Mint Canyon Quadrangle.

Range in characteristics: Depth to a paralithic contact is 6 to 19 inches. The mean annual soil temperature at the contact is 60 to 70 degrees F.

Rock fragments are mainly angular and subangular pieces of shale 0.25 to 1.5 inches in diameter. Rock fragments make up, on the average, 5 to 30 percent of the soil volume and are commonly most numerous just above the paralithic contact. The soil has dry color of 10YR 7/3, 6/3, or 5/2; 5Y 6/3 or 5/3; 2.5Y 6/2 or 5/2 and moist color of 10YR 4/4 or 4/2 or 5Y 4/4 or 4/3. It is loam, silt loam, silty clay loam, or gravelly silty clay loam; clay is estimated to be less than 35 percent. The soil is strongly effervescent throughout; however, in some pedons deeper than 10 inches, the upper few inches are noneffervescent.

Vegetation: chamise, *Ceanothus cuneatus*, manzanita, black sage, yerba santa, sugar bush, mountain mahogany, yucca, buckwheat, and annual grasses.

CAPERTON FAMILY

The Caperton family consists of very shallow or shallow, well drained soils that formed in material weathered from metamorphic, granitic, or sedimentary rocks. The soils are on mountainsides and ridges at elevations of 2,000 to 5,600 feet. Slopes range from 15 to 85 percent. Annual precipitation is 15 to 30 inches.

Taxonomic class: These soils are loamy, mixed, thermic, shallow Entic Haploxerolls.

Typical pedon of Caperton family, in an area of Caperton-Trigo, granitic substratum-Lodo families complex, 50 to 80 percent slopes, under chaparral at an elevation of 2,500 feet:

A11-0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam, dark brown (7.5YR 3/2) moist; moderate very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; 15 percent pebbles; neutral (pH 6.6), clear smooth boundary.

A12-3 to 17 inches; brown (10YR 4/3) gravelly loam, dark brown (7.5YR 3/2) moist; moderate fine, weak medium and coarse granular structure; soft, friable, slightly sticky and slightly plastic; few very fine and fine roots, common medium roots; common fine tubular and interstitial pores, 15 percent pebbles; slightly acid (pH 6.4); clear wavy boundary.

Cr-17 inches; dark yellowish brown (10YR 4/4) decomposed gneiss that breaks out into pebble-sized pieces; few very fine, fine, and medium roots.

Type location: 0.5 miles south of Bear Divide on Little Tujunga Canyon Road, 70 yards north of highway marker 8.89 and 30 feet upslope; 2,750 feet west and 1,700 feet north of the SE corner of sec. 7, T. 3 N., R. 14 W., San Fernando Quadrangle.

Range in characteristics: Depth to a paralithic contact is 4 to 20 inches. The mean annual soil temperature at the contact is 59 to 72 degrees F. The soil is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/4, 4/3, 4/2, or 3/3 or 2.5Y 4/2 and moist color of 10YR 3/3, 3/2, or 2/2 or 7.5YR 3/2. It is loam, gravelly loam, sandy loam, fine sandy loam, or silt loam and averages 0 to 30 percent gravel.

A few pedons have a thin C horizon that grades into the weathered rock. It has dry color of 10YR 6/6, 6/2, 5/4, 5/3, or 4/3 or 5Y 6/3 and moist color of 10YR 4/4, 4/3, 3/4, or 3/2; 2.5Y 4/2; or 7.5YR 3/2. It is sandy loam, fine sandy loam, gravelly sandy loam, gravelly loam, or silt loam and averages 5 to 30 percent gravel.

Vegetation: chamise, yucca, manzanita, *Ceanothus cuneatus*, *Ceanothus crassifolius*, yerba santa, buckwheat, sugar bush, black sage, mountain mahogany, scrub oak, and annual grasses.

CAPISTRANO FAMILY

The Capistrano family consists of deep, well drained soils that formed in material weathered from granitic or gneissic rock. The soils are on mountainsides, colluvial slopes, alluvial fans, and terraces at elevations of 2,200 to 5,600 feet. Slopes range from 2 to 70 percent. Annual precipitation is 15 to 21 inches.

Taxonomic class: These soils are coarse-loamy, mixed, thermic Entic Haploxerolls.

Typical pedon of Capistrano family, in an area of Caperton-Capistrano families complex, 35 to 80 percent slopes, under chamise at an elevation of 2,600 feet:

A11-0 to 8 inches; brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine tubular and interstitial pores; 15 percent pebbles; neutral (pH 6.7); clear smooth boundary.

A12-8 to 17 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; few very fine and common medium roots; many very fine interstitial pores; 15 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C1-17 to 42 inches; yellowish brown (10YR 5/4) gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common

medium roots; many very fine tubular and interstitial pores; 30 percent pebbles; neutral (pH 7.0); gradual smooth boundary.

C2-42 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy sand, dark yellowish brown (10YR 3/4) moist; massive; soft, very friable; few medium roots; many very fine and fine tubular and interstitial pores; 35 percent pebbles and 5 percent cobbles; neutral (pH 7.0).

Type location: Warm Springs Trail, approximately 2,200 feet from Elizabeth Lake Canyon Road; NW corner of sec. 22, T. 6 N., R. 16 W., (projected) Warm Springs Mountain Quadrangle.

Range in characteristics: This soil is 40 inches to more than 60 inches deep. The mean annual soil temperature at 20 inches is 60 to 70 degrees F.

The A horizon has dry color of 10YR 5/3, 5/2, or 4/2 or 2.5Y 5/2 and moist color of 10YR 3/3, 3/2, or 2/2. It is loam, sandy loam, or gravelly sandy loam and averages 0 to 20 percent gravel. It is estimated that the organic matter decreases to less than 1 percent at a depth of 20 inches.

The C horizon has dry color of 10YR 6/4, 6/3, 5/4, or 5/3 and moist color of 10YR 5/4, 4/3, 3/4, or 3/2. It is sandy loam, gravelly sandy loam, or very gravelly loamy sand and averages 5 to 30 percent gravel. Reaction is slightly acid or neutral (pH 6.1 to 7.3).

Vegetation: chamise, yucca, yerba santa, scrub oak, Digger pine, buckwheat, manzanita, and annual grasses.

CHILAO FAMILY

The Chilao family consists of very shallow or shallow, somewhat excessively drained soils that formed in material weathered from anorthosite, granodiorite, or metamorphic rocks. The soils are on mountainsides and ridges at elevations of 1,800 to 5,500 feet. Slopes range from 20 to 85 percent. Annual precipitation is about 20 to 30 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, nonacid, thermic, shallow Typic Xerorthents.

Typical pedon of Chilao family, in an area of Pismo-Chilao-Shortcut families complex, 45 to 80 percent slopes, under chamise at an elevation of 3,400 feet:

A1-0 to 5 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, non-sticky and nonplastic; few fine roots; many very fine and fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.4); clear wavy boundary.

C1-5 to 18 inches; light yellowish brown (10YR 6/4) very gravelly loam, yellowish brown (10YR 5/4) moist; massive; soft, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine interstitial pores; 60 percent pebbles; neutral (pH 6.8); clear wavy boundary.

C2r-18 inches; light gray highly weathered and fractured anorthosite rock which breaks down in the hands to sandy loam with about 50 percent pebble-sized pieces; few fine roots in the fractures.

Type location: 0.9 miles northeast of Monte Cristo Fire Station on the Angeles Forest Highway, 50 feet uphill from marker 15.87; 750 feet east and 1,500 feet south of the NW corner of sec. 23, T. 3 N, R. 12 W., Chilao Flat Quadrangle.

Range in characteristics: Depth to a paralithic contact is 6 to 19 inches. The mean annual soil temperature at the contact is 59 to 72 degrees F. The profile is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 6/2, 5/4, 5/3, 5/2 or 4/3 or 5Y 6/2; it has moist color of 10YR 4/3, 4/2, 3/3 or 3/2 or 5Y 4/2. It is gravelly loam, very gravelly loam, cobbly loam, gravelly sandy loam, or very gravelly sandy loam and averages 20 to 40 percent rock fragments.

The C horizon has dry color of 10YR 6/4, 6/3, 5/5 or 4/4 or 5Y 6/3; it has moist color of 10YR 5/6, 5/4, 4/3 or 3/4 or 5Y 5/2. It is very gravelly loam, very cobbly loam, very gravelly sandy loam, or very gravelly clay loam and averages 40 to 65 percent rock fragments. It grades into a Cr horizon.

Vegetation: chamise, manzanita, yucca, buckwheat, and annual grasses.

ETSEL FAMILY

The Etsel family consists of very shallow, somewhat excessively drained soils that formed in material weathered from granitic rocks. The soils are on mountainsides at elevations of 1,900 to 5,500 feet. Slopes range from 50 to 80 percent. Annual precipitation is 26 to 38 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, nonacid, mesic Lithic Xerorthents.

Typical pedon of Etsel family, in an area of Olete-Kilburn-Etsel families complex, 50 to 80 percent slopes, under bigcone Douglas-fir at an elevation of 4,600 feet.

A1-0 to 4 inches; gray (10YR 6/1) gravelly loam, dark gray (10YR 4/1) moist; weak medium granular structure; soft, friable, nonsticky and nonplastic; common fine roots and few medium roots; many very fine and fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.4); abrupt smooth boundary.

C-4 to 9 inches; light gray (10YR 7/2) extremely gravelly sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots and common medium roots; many very fine and fine interstitial pores; 75 percent pebbles, 5 percent cobbles; slightly acid (pH 6.3); clear wavy boundary.

R-9 inches; hard, highly fractured granodiorite; fractures 5 to 10 cm apart.

Type location: In the Rankin Peak area, 30 feet above Forest Road 2N31, about 1 mile off the Red Box-Rincon Road; 400 feet west and 20 feet north of the SE corner of sec. 36, T. 2 N., R. 11 W., Azusa Quadrangle.

Range in characteristics: Depth to a lithic contact is 5 to 9 inches. The mean annual soil temperature at the contact is 47 to 59 degrees F. The soil is moderately acid or slightly acid (PH 5.6 to 6.5).

The A horizon has dry color of 10YR 6/3, 6/1, or 5/3 and moist color of 10YR 4/4, 4/1, or 3/2. It is gravelly loam, gravelly sandy loam, or very cobbly sandy loam and averages 20 to 45 percent rock fragments. In some pedons the A horizon lies directly over the hard bedrock.

The C horizon has dry color of 10YR 7/2 or 6/3 and moist color of 10YR 5/3 or 4/3. It is very gravelly coarse sandy loam or extremely gravelly sandy loam and averages 40 to 80 percent rock fragments.

Vegetation: bigcone Douglas-fir, canyon live oak, ceanothus, California laurel, and various forbs.

EXCHEQUER FAMILY

The Exchequer family consists of very shallow or shallow, somewhat excessively drained soils that formed in material weathered from granitic, metamorphic, or sedimentary rocks. The soils are on ridgetops and mountainsides at elevations of 1800 to 5500 feet. Slopes range from 30 to 85 percent. Annual precipitation is 10 to 25 inches.

Taxonomic class: These soils are loamy, mixed, nonacid, thermic Lithic Xerorthents.

Typical pedon of Exchequer family, in an area of Exchequer family, 30 to 60 percent slopes, under chamise at an elevation of 2,850 feet.

A-0 to 8 inches; pale brown (10YR 6/3) sandy loam, dark yellowish brown (10YR 3/4) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine and fine tubular and interstitial pores; 10 percent pebbles; neutral (pH 7.3); clear wavy boundary.

R-8 inches; highly fractured, tilted, hard micaceous schist, which breaks out in pebble- to cobble-sized flakes.

Type location: Approximately 500 feet north of Forest Road 5N14 in Upper Rowher Canyon along a spur road; 1,600 feet west and 1,500 feet south of the NE corner of sec. 8, T. 5 N., R. 14 W., Sleepy Valley Quadrangle.

Range in characteristics: Depth to a lithic contact is 5 to 19 inches. The mean annual soil temperature is 60 to 72 degrees F. The soils on the desert-facing slopes and where rainfall diminishes rapidly probably have considerably higher evapotranspiration rates than elsewhere. Rock fragments are predominantly less than 3 inches in diameter and make up 5 to 30 percent of the soil volume. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8).

The A horizon is sandy loam, coarse sandy loam, or loam and may be gravelly. Dry color is 10YR 6/4, 6/3, 5/4, 5/3, 4/3, or 4/2 or 2.5Y 6/2 or 5/2; moist color is 10YR 5/3, 4/4, 4/3, 4/2, 3/4, or 3/3 or 2/5Y 4/4.

The C horizon is not present in all profiles. It has dry color of 10YR 7/3, 6/4, or 5/4 and moist color of 10YR 6/2 or 4/3. It is cobbly sandy loam or gravelly coarse sandy loam.

Vegetation: chamise, yucca, buckwheat, mountain mahogany, black sage, white sage, and annual grasses. On desert-facing slopes, the vegetation canopy is much more sparse and there is a higher percentage of bare ground.

GREEN BLUFF FAMILY

The Green Bluff family consists of moderately deep, well drained and somewhat excessively drained soils that formed in material weathered from granitic rock. The soils are on mountainsides, older alluvial fans, and terraces. Slopes range from 15 to 60 percent. Elevation is 3,400 to 6,700 feet. Annual precipitation is 25 to 35 inches.

Taxonomic class: These soils are coarse-loamy, mixed, mesic Typic Xerochrepts.

Typical pedon of Green Bluff family, in an area of Xerorthents-Green Bluff family-Rock outcrop complex, 15 to 50 percent slopes, under Jeffrey pine at an elevation of 5,850 feet:

A1-0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots and few medium roots; many very fine and fine interstitial pores; 20 percent pebbles, strongly acid (pH 5.2); abrupt smooth boundary.

B2-4 to 11 inches; light gray (10YR 7/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots, many medium and coarse roots; common fine interstitial pores and few fine tubular pores; 15 percent pebbles, 5 percent cobbles; strongly acid (pH 5.5); clear smooth boundary.

C1-11 to 17 inches; light gray (10YR 7/2) gravelly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots and common medium and coarse roots; common fine interstitial pores and few fine tubular pores; 20 percent pebbles, 5 percent cobbles; slightly acid (pH 6.3); clear smooth boundary.

C2-17 to 27 inches; light gray (10YR 7/2) coarse sandy loam, pale brown (10YR 6/3) moist, slightly hard, very friable, nonsticky and nonplastic; few fine, medium, and coarse roots; few fine interstitial pores and common fine tubular pores; 40 percent rock fragments; slightly acid (pH 6.4); clear wavy boundary.

C3r-27 inches; highly weathered granodiorite.

Type location: Roadcut on Forest Road 3N17 between Horseflats Campground and Camp Rosenita; 100 feet west and 300 feet south of the NE corner of sec. 15, T. 3 N., R. 11 W., Chilao Flat Quadrangle.

Range in characteristics: Depth to a paralithic contact is 20 to 40 inches. The mean annual soil temperature is 47 to 59 degrees F. The A horizon has dry color of 10YR 6/4, 6/3, 5/4, 5/3, 5/2, or 4/2; it has moist color of 10YR 4/4, 4/3, 4/2, 3/3, 3/2, or 2/2 or 7.5YR 4/4. It is very fine sandy loam, gravelly sandy loam, cobbly sandy loam, gravelly coarse sandy loam, or loam and averages 5 to 25 percent rock fragments. It is strongly acid to neutral (pH 5.1 to 7.3).

The B horizon has dry color of 10YR 7/6, 7/2, 6/4, 6/3, or 5/4; 7.5YR 4/6; or 2.5Y 7.2. It has moist color of 10YR 5/6, 5/4, 5/3, 4/4, 4/3, or 4/2. It is very fine sandy loam, sandy loam, coarse sandy loam, sandy clay loam, gravelly loam, or gravelly sandy clay loam and averages 5 to 30 percent rock fragments. It is very strongly acid to mildly alkaline (pH 4.5 to 7.8). In most pedons this horizon overlies a paralithic contact.

The C horizon has dry color of 10YR 7/2, 6/4, or 6/3 and moist color of 10YR 6/3, 4/4, or 4/3. It is coarse sandy loam, cobbly coarse sandy loam, or gravelly sandy loam and averages 25 to 40 percent rock fragments.

Vegetation: Jeffrey and Coulter pine, bigcone Douglas-fir, canyon and interior live oak, manzanita, mountain whitethorn, big sagebrush, mountain mahogany, and annual grasses. On desert-facing slopes: scrub oak, Joshua tree, pinyon pine, and rabbitbrush.

HANFORD FAMILY

The Hanford family consists of deep, well drained soils that formed in alluvium weathered from granitic or other mixed rock sources. The soils are on young alluvial fans and stream terraces at elevations of 2,700 to 4,400 feet. Slopes range from 3 to 25 percent. Annual precipitation is 11 to 15 inches.

Taxonomic class: These soils are coarse-loamy, mixed, nonacid, thermic Typic Xerorthents.

Typical pedon of Hanford family, in an area of Hanford family, 3 to 25 percent slopes, under chamise at an elevation of 3,500 feet:

A1-0 to 13 inches; brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 3/4) moist; weak very fine granular structure; soft, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial and tubular pores; 5 percent pebbles; neutral (pH 7.0); clear wavy boundary.

C1-13 to 36 inches; brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 3/4) moist; weak very fine granular structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial and tubular pores; 5 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C2-36 to 52 inches; brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial and

tubular pores; 5 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C3-52 to 60 inches; reddish brown (5YR 5/3) gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine interstitial and tubular pores; 15 percent pebbles; neutral (pH 7.3).

Type location: Roadcut on a power line maintenance road, about 1.5 miles from Aliso Canyon Road; 1,500 feet east and 300 feet north of the SW corner of sec. 3, T. 4 N., R. 12 W., Acton Quadrangle.

Range in characteristics: This soil is more than 60 inches deep. The mean annual soil temperature at 20 inches is 63 to 72 degrees F.

The A horizon has dry color of 10YR 5/4, 5/3, or 5/2 and moist color of 10YR 4/4, 4/3, 3/4, 3/3, or 3/2. It is sandy loam or fine sandy loam and averages 0 to 10 percent gravel. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8).

The C horizon has dry color of 10YR 6/4, 6/3, 5/4, or 5/3 or 5Y 5/3; it has moist color of 10YR 4/5, 4/4, 4/3, or 3/4; 2.5Y 4/2; or 7.5YR 4/4. It is sandy loam, fine sandy loam, gravelly sandy loam, or gravelly coarse sandy loam. Reaction is neutral to mildly alkaline (pH 6.6 to 7.8).

Vegetation: chamise, buckwheat, yucca, big sagebrush, juniper, and annual grasses.

HAPLOXERALFS

Haploxeralfs are shallow, well drained soils that formed in material weathered from sedimentary, gabbroic, and dioritic rocks. They are on ridges and mountainsides at elevations of 2,400 to 5,000 feet. Slopes range from 30 to 70 percent. Annual precipitation is 10 to 20 inches.

Depth to a paralithic contact is 7 to 17 inches. The mean annual soil temperature at the contact is 60 to 72 degrees F. The soil below a depth of 4 inches is usually dry from May to November and moist the rest of the year.

The A horizon is 2 to 8 inches thick. It has dry color of 10YR 5/3, 5/2, 4/3, or 3/2 and moist color of 10YR 3/4, 3/3, 3/2, or 2/2 or 7.5YR 3/2. The A horizon of some pedons is massive and hard when dry. It is loam, gravelly

loam, gravelly sandy loam, or silt loam and averages 0 to 20 percent gravel. Reaction is slightly acid to neutral (pH 6.1 to 7.3).

The B2t horizon is 5 to 15 inches thick. It has dry color of 10YR 6/3, 5/6, or 5/4 or 7.5YR 5/4, 4/4, or 4/2 and moist color of 10YR 4/4, 4/3, or 3/4; 7.5YR 4/4, 4/2, or 3/4; or 5YR 5/3 or 5/4. It is clay loam, gravelly sandy clay loam, very gravelly clay loam, or silty clay loam and averages 0 to 45 percent gravel. It grades into rock that can be dug with difficulty with a spade.

Vegetation: chamise, buckbrush, buckwheat, scrub oak, flannelbush, black sage, yucca, big sagebrush, juniper, mountain mahogany, annual and perennial grasses.

HAPLOXEROLLS

Haploxerolls are very shallow to deep soils that formed in residuum and colluvium weathered from granitic, metamorphic, or sedimentary rock. They are on mountainsides, colluvial slopes, ridges, and alluvial fans at elevations of 2,200 to 9,400 feet. Slopes range from 2 to 85 percent. Annual precipitation ranges from 10 to 44 inches.

The shallow soils are somewhat excessively drained. The deeper soils are well drained. Mean annual soil temperature at 20 inches ranges from 32 to 67 degrees F. The soil profile is usually dry below a depth of 4 inches from mid-May to early in November and is moist the rest of the year. Reaction throughout the profile is moderately acid to moderately alkaline (pH 5.6 to 8.4).

The A horizon is 2 to 21 inches thick. It has dry color of 10YR 5/3, 5/2, 4/3, or 4/2; or 2.5Y 5/4, 5/2, or 4/2. It has moist color of 10YR 3/3, 3/2, or 2/2 or 7.5YR 3/2. It is loam, gravelly loam, sandy loam, gravelly sandy loam, very gravelly sandy loam, or very gravelly loamy sand and averages 5 to 75 percent coarse fragments.

Some pedons have a B horizon that is reddish brown very gravelly coarse sandy loam or loamy sand and is about 50 percent rock fragments. It has weak subangular blocky structure.

The subsoil has dry color of 10YR 6/4, 6/3, 5/6, 5/4, 5/3, 5/2, or 4/3; 2.5Y 6/4 or 6/2. It has moist color of 10YR 4/3, 4/2, 3/4, 3/3, or 3/2; 2.5Y 4/4, 3/4, or 3/2; or 7.5YR 4/4 or 3/2. It is gravelly loam, very gravelly loam, sandy loam, very gravelly sandy loam, or very gravelly loamy sand and averages 20 to 85 percent rock fragments. Most pedons have weak granular structure or are massive.

Vegetation: chamise, buckwheat, manzanita, mountain mahogany, yucca, white sage, black sage, scrub oak, and annual grasses. On the desert front: pinyon pine, Joshua tree, big sagebrush, flannel-bush, scrub oak, and rabbitbrush. At higher elevations: white fir, Jeffrey pine, incense-cedar, lodgepole pine, and canyon live oak.

HOHMANN FAMILY

The Hohmann family consists of moderately deep to deep, well drained soils that formed in material weathered from granitic rock. The soils are on mountainsides and ridges on slopes of 15 to 60 percent. Elevation is 4,400 to 6,700 feet. Annual precipitation is 20 to 35 inches, much of which occurs as snow above 5,000 feet.

Taxonomic class: These soils are fine-loamy, mixed, mesic Typic Xerochrepts.

Typical pedon of Hohmann family, in an area of Green Bluff-Hohmann families-Xerorthents complex, 15 to 80 percent slopes, under mixed conifers at an elevation of 6,450 feet:

01-3 inches to 1 inch; undecomposed pine needles. .

02-1 inch to 0; mat of decomposed organic matter.

A11-0 to 6 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; soft, friable, nonsticky and nonplastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

A12-6 to 14 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; few fine roots and common medium and coarse roots; many very fine and fine interstitial pores; 25 percent pebbles; slightly acid (pH 6.1); clear smooth boundary.

B21-14 to 24 inches; pale brown (10YR 6/3) gravelly clay loam, dark yellowish brown (10YR: 4/4) moist; weak fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine roots and common medium and coarse roots; common very fine and fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.3); clear smooth boundary.

B22-24 to 39 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and plastic; few fine, medium, and coarse roots; common fine interstitial pores and few fine tubular pores; 15 percent pebbles; moderately acid (pH 6.0); clear smooth boundary.

C1-39 to 50 inches; very pale brown (10YR 7/4) very gravelly sandy clay loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine interstitial pores; 25 percent pebbles, 15 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.

C2r-50 inches; highly weathered granitic rock; crushes to gravelly sandy clay loam; few fine and medium roots.

Type location: Approximately 100 yards north of and below Ridge Crest Picnic Ground; 250 feet east and 550 feet north of the SW corner of sec. 12, T. 3 N., R. 10 W., Waterman Mountain Quadrangle.

Range in characteristics: Depth to a paralithic contact is 33 to 60 inches. Mean annual soil temperature at 20 inches is 47 to 59 degrees F. The profile is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 6/3, 5/3, 5/2, or 4/3 or 2.5Y 6/2. It has moist color of 10YR 4/3, 4/2, or 3/2 or 2.5Y 5/2. It is loam, sandy loam, gravelly loam, or gravelly sandy loam and averages 5 to 30 percent rock fragments.

The B horizon has dry color of 10YR 6/4, 6/3, 5/6, 5/4, or 4/6; 2.5Y 7/4 or 7/3; or 7.5YR 6/6. It has moist color of 10YR 5/4, 4/4, 4/3, or 3/4; 2.5Y 6/4, 5/3, or 4/4; or 7.5YR 4/4. It is loam, sandy loam, very gravelly sandy clay loam, sandy clay loam, gravelly sandy loam, or gravelly clay loam.

The C horizon has dry color of 10YR 8/3, 6/4, or 4/6 or 2.5Y 8/2 and moist color of 10YR 5/6, or 4/4 or

2.5Y 7/4. It is sandy loam, very gravelly clay loam, or gravelly coarse sandy loam. It grades into highly weathered granitic rock.

Douglas-fir, white fir, canyon and interior live oak, scrub oak, mountain whitethorn, and lupine.

Vegetation: Jeffrey, Coulter, and sugar pines, bigcone

KILBURN FAMILY

The Kilburn family consists of deep and moderately deep, well drained soils that formed in colluvium from metamorphic and granitic rocks. The soils are on colluvial slopes at elevations of 1,900 to 8,200 feet. Slopes range from 40 to 80 percent. Annual precipitation is 19 to 38 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, mesic Typic Haploxerolls.

Typical pedon of Kilburn family, in an area of Olete-Kilburn-Etsel families complex, 50 to 80 percent slopes, under ceanothus at an elevation of 3,400 feet:

A1-0 to 7 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; many very fine and fine interstitial pores; 25 percent pebbles, 10 percent cobbles; slightly acid (pH 6.2); abrupt smooth boundary.

B2-7 to 15 inches; yellowish brown (10YR 5/4) very gravelly loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine roots, many medium roots, and common coarse roots; common very fine and fine interstitial pores, few fine tubular pores; 45 percent pebbles and 15 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

C-15 to 60 inches; pale brown (10YR 6/3) extremely gravelly coarse sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots, common medium and

coarse roots; common fine interstitial pores; 60 percent pebbles, 20 percent cobbles; neutral (pH 6.8).

Type location: Roadcut, at a landslide, on FR 2N80, 0.2 miles west of the junction to Grizzly Flats; 900 feet west and 2,000 feet south of the NE corner of sec. 14, T. 2 N., R. 13 W., Condor Peak Quadrangle.

Range in characteristics: The soil is 20 to 60 inches deep. The mean annual soil temperature at 20 inches is 47 to 59 degrees F. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/2, or 4/3 and moist color of 10YR 4/3, 3/3, 3/2, or 2/2 or 7.5YR 3/2. It is gravelly loam, very gravelly loam, very gravelly sandy loam, or sandy loam and averages 5 to 60 percent rock fragments. The mollic epipedon is 10 to 16 inches thick.

The B horizon has dry color of 10YR 6/4, 6/3, 5/4, or 5/3 or 2.5Y 5/4 or 5/2 and moist color of 10YR 5/4, 4/4, 4/3, or 3/3 or 7.5YR 4/2 or 3/2. It is gravelly sandy loam, very gravelly loam, or very cobbly loam and averages 35 to 60 percent rock fragments. The clay content is estimated to be about 3 to 5 percent more than that of the A horizon.

The C horizon has dry color of 10YR 7/3, 6/4, 6/3, 6/2, or 5/6 or 2.5Y 6/2 and moist color of 10YR 5/6, 5/5, 4/4, or 4/3 or 2.5Y 4/2. It is very cobbly sandy loam, very gravelly sandy loam, extremely gravelly sandy loam, or very cobbly loam and averages 40 to 80 percent rock fragments.

Vegetation: canyon live oak, interior live oak, bigcone Douglas-fir, California laurel, poison oak, ceanothus.

KNUTSEN FAMILY

The Knutsen family consists of moderately deep or deep, well drained soils that formed in material weathered from granitic rock, schist, or gneiss. The soils are on mountainsides and ridges at elevations of 4,000 to 6,200 feet. Slopes range from 30 to 70 percent. Annual precipitation is 17 to 25 inches.

Taxonomic class: These soils are coarse-loamy, mixed, mesic Typic Haploxerolls.

Typical pedon of Knutsen family, in an area of Tollhouse-Knutsen-Stukel families complex, 30 to 70 percent slopes, under canyon live oak at an elevation of 5,600 feet:

A1-0 to 19 inches; brown (10YR 4/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; soft, friable, slightly sticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; 30 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

C1-19 to 60 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine, fine, and medium

roots; many very fine tubular and interstitial pores; 25 percent pebbles; neutral (pH 7.0).

Type location: About 1,200 feet southwest of the electronic site at Burnt Peak; northeast quarter of sec. 21 (projected), T. 7 N., R. 16 W., Burnt Peak Quadrangle.

Range in characteristics: Depth to a paralithic contact is 26 to 60 inches. The mean annual soil temperature at 20 inches is 47 to 59 degrees F. The profile is loam, gravelly loam, fine sandy loam, sandy loam, or gravelly sandy loam and averages 0 to 30 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/3, or 4/1 and moist color of 10YR 3/2 or 3/1 or 7.5YR 3/3.

Some pedons have a B2 horizon. It has dry color of 10YR 6/6, 6/5, 5/4, 5/2, or 4/3 or 2.5Y 5/2 and moist color of 10YR 5/6, 5/3, 4/3, 3/4, 3/3, or 3/2 or 2.5Y 4/2. It has weak subangular blocky structure and generally rests on highly weathered rock.

Vegetation: canyon live oak, mountain whitethorn, Jeffrey pine, black oak, bigcone Douglas-fir, mountain mahogany, Coulter pine, scrub oak, white fir, and big sagebrush.

LITHIC HAPLOXERALS

Lithic Haploxeralfs are shallow, well drained, well developed soils that formed in material weathered from granodiorite or shale. They are on broad ridgetops and mountainsides at elevations of 4,400 to 6,500 feet. Slopes range from 5 to 60 percent. Annual precipitation is 15 to 25 inches.

Depth to a lithic contact is 11 to 15 inches. Mean annual soil temperature at the contact is 47 to 59 degrees F.

The A horizon is 3 to 5 inches thick. The upper 3 inches can have dry color of 10YR 5/3, 4/2 or 3/3 and moist color of 10YR 5/3 or 2/2 or 2.5Y 4/2. The A horizon is gravelly loam or very gravelly loamy coarse sand and

averages 20 to 60 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.0).

The B2t horizon has dry color of 10YR 6/4 or 6/3 and moist color of 10YR 5/4, 5/3, 4/3, or 3/2. It is cobbly sandy clay loam, very gravelly sandy clay loam, or extremely gravelly sandy clay loam and averages 20 to 90 percent rock fragments. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8). The horizon lies over hard fractured bedrock.

Vegetation: Pinyon pine, Jeffrey pine, Coulter pine, canyon live oak, mountain mahogany, scrub oak, buckwheat, manzanita, yucca, and perennial grasses.

LITHIC XERORTHENTS

Lithic Xerorthents are very shallow or shallow, somewhat excessively drained or excessively drained soils that formed in material weathered from granitic and metamorphic rocks. The soils are on mountainsides and ridges at elevations of 3,200 to 10,000 feet. Slopes range from 45 to 90 percent. Annual precipitation is 10 to 43 inches.

Depth to a lithic contact is 3 to 18 inches. Mean annual soil temperature at the lithic contact is 47 to 72 degrees F, but it may go as low as 40 degrees F on north aspects above 7,500 feet and south aspects above 8,000 feet. Reaction is medium acid to mildly alkaline (pH 5.6 to 7.8).

The A horizon is 2 to 14 inches thick. Dry color is 10YR 6/3, 6/2, 5/3, 5/2, or 4/3 or 2.5Y 6/2, and moist color is 10YR 5/3, 4/3, 4/2, 3/3, or 3/2 or 2.5Y 4/2. The soil is gravelly sandy loam, very gravelly sandy loam,

very stony sandy loam, or very stony loamy coarse sand and averages 15 to 60 percent rock fragments. In some pedons the A horizon lies directly over the hard bedrock. In other pedons a C horizon separates the A from the lithic contact.

The C horizon is 3 to 12 inches thick. Dry color is 10YR 7/3, 7/2, 6/4, 6/3, 5/4, or 5/3, and moist color is 10YR 4/4, 4/3, or 6/2. The C horizon is very gravelly sandy loam, extremely stony sandy loam, extremely cobbly sand, or very gravelly sand and averages 20 to 90 percent rock fragments.

Vegetation: Jeffrey pine, white fir, sugar pine, incense-cedar, mountain whitethorn, mountain mahogany and chinquapin at higher elevations and buckwheat, yucca, scrub oak, manzanita, juniper, chamise, big sagebrush, rabbitbrush, Mormon tea, and annual grasses at lower elevations.

LODO FAMILY

The Lodo family consists of very shallow or shallow, well drained to somewhat excessively drained soils that formed in material weathered from metamorphic, granitic, or sedimentary rocks. The soils are on mountainsides, ridges, and basins at elevations of 1,800 to 5,000 feet. Slopes range from 15 to 90 percent, but the average is about 60 percent. Annual precipitation is 12 to 30 inches.

Taxonomic class: These soils are loamy, mixed, thermic Lithic Haploxerolls.

Typical pedon of Lodo family, in an area of Lodo-Modesto families complex, 30 to 70 percent slopes, under chamise at an elevation of 2,100 feet.

A11-0 to 7 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; strong fine and medium granular structure; soft, friable, slightly sticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; 20 percent pebbles; neutral (pH 7.0); clear wavy boundary.

A12-7 to 17 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and nonplastic; few very fine roots; many very

fine tubular and interstitial pores; 20 percent pebbles; neutral (pH 7.0); abrupt irregular boundary.

R-17 inches; hard fractured schist; few medium roots in fractures.

Type location: 500 feet northwest of the intersection of Forest Roads 5N24 and 6N18; 2,800 feet south and 800 feet east of the northwest corner of sec. 20, T. 5 N., R. 15 W., Green Valley Quadrangle.

Range in characteristics: Depth to a lithic contact is 6 to 20 inches. Mean annual soil temperature at the contact is 59 to 72 degrees F.

The A horizon has dry color of 10YR 5/4, 5/3, 5/2 4/3, or 4/2; 7.5YR 5/4, 4/4, or 4/2; 2.5Y 5/2; or 5Y 5/3. It has moist color of 10YR 3/3, 3/2, or 2/2; 7.5YR 3/2; or 2/5Y 3/2. It is loam, sandy loam, gravelly loam, gravelly sandy loam, or silt loam and averages 0 to 30 percent rock fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8). The A horizon rests directly on hard bedrock.

Vegetation: chamise, yucca, buckwheat, buckbrush, manzanita, yerba santa, black sage, white sage, mountain mahogany, scrub oak, and annual grasses.

MILLSHOLM FAMILY

The Millsholm family consists of shallow, well drained soils that formed in material weathered from sandstone and shale. Millsholm soils are on mountainsides and ridges at elevations of 1,800 to 4,200 feet. Slopes range from 30 to 90 percent. Annual precipitation is 15 to 21 inches.

Taxonomic class: These soils are loamy, mixed, thermic Lithic Xerochrepts.

Typical pedon of Millsholm family, in an area of Stonyford-Millsholm families complex, 30 to 70 percent slopes, under chamise at an elevation of 2,200 feet:

A1-0 to 5 inches; pale brown (10YR 6/3) clay loam, dark yellowish brown (10YR 3/4) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores; few shale fragments; neutral (pH 7.0); abrupt wavy boundary.

B2-5 to 17 inches; brown (7.5YR 5/4) clay loam; dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky

and slightly plastic; common medium roots; many very fine tubular and interstitial pores; neutral (pH 7.0); abrupt wavy boundary.

R-17 inches; hard, fractured sandstone.

Type location: Upper San Francisquito Canyon on Forest Road 6N21 in T. 6 N., R. 15 W., unsectioned, Green Valley Quadrangle.

Range in characteristics: Depth to a fractured lithic contact is 10 to 19 inches. The mean annual soil temperature at the contact is 47 to 59 degrees F. The profile is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 6/4, 6/3, or 5/3 and moist color of 10YR 4/3 or 3/4. In the B horizon dry colors are 7.5YR 6/4 or 5/4, 10YR 6/4, 6/3, 5/4, or 5/3. Moist colors are 7.5YR 4/4; 10YR 4/4, 4/3, or 3/4; 5Y 4/4 or 3/4. A few thin clay films are present in some pedons.

Vegetation: chamise, manzanita, yucca, yerba santa, black sage, white sage, and annual grasses.

MODESTO FAMILY

The Modesto family consists of deep, well drained soils that formed in material weathered from schist, gneiss, granitic rock, and partly consolidated old alluvial sediments. The soils are on mountainsides, ridges, or remnants of old alluvial fans or stream terraces. Elevation is 1,300 to 5,000 feet. Slopes range from 15 to 70 percent. Annual precipitation ranges from 12 inches in the Sierra Pelona area to 30 inches in the San Gabriel Reservoir area.

Taxonomic class: These soils are fine-loamy, mixed, thermic Mollic Haploxeralfs.

Typical pedon of Modesto family, in an area of Lodo-Modesto families complex, 30 to 70 percent slopes, under mountain mahogany at an elevation of 4,100 feet:

A11-0 to 3 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, slightly sticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; neutral (pH 7.0); clear smooth boundary.

A12-3 to 8 inches; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine roots, common medium roots; many very fine and fine tubular and interstitial pores; neutral (pH 7.2); clear smooth boundary.

B21t-8 to 22 inches; brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common medium roots; common very fine tubular and interstitial pores; common thin clay films lining pores; 5 percent pebbles; neutral (pH 7.0); abrupt smooth boundary.

B22t-22 to 46 inches; yellowish red (5YR 4/6) clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common medium roots; common very fine tubular and interstitial pores; many moderately thick clay films lining pores; 5 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

R-46 inches; hard fractured schist.

Type location: Roadcut on FR 6N08 at Artesian Spring Campground; 900 feet west and 1,200 feet south of the NE corner of sec. 33, T. 6 N., R. 14 W., Sleepy Valley Quadrangle.

Range in characteristics: Depth to a lithic or paralithic contact is 20 to 60 inches. The mean annual soil temperature at 20 inches is 59 to 72 degrees F.

The A horizon has dry color of 10YR 6/4, 6/3, 5/3, 5/2, 4/3, 4/2 or 3/3 or 7.5Y 5/4 or 4/4. It has moist color of 10YR 3/4, 3/3, 3/2, or 2/2; 7.5Y 3/2; or 5YR 3/4. It is loam, gravelly loam, or sandy loam and averages 0 to 20 percent gravel. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8).

The B2t horizon has dry color of 10YR 6/4, 5/6, 5/4, 5/3, or 4/4; 7.5YR 5/4, 6/4, 5/6, or 4/4; or 5YR 5/6, 4/6, or 4/4. It has moist color of 10YR 4/4 or 3/4; 7.5YR 5/4 or 4/4; or 5YR 4/4. It is loam, clay loam, gravelly clay loam, sandy clay loam, or silty clay loam and averages 0 to 30 percent gravel. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8). In some pedons this horizon rests directly on the paralithic or lithic contact. In others a C or B3 horizon is under the B2t.

Vegetation: canyon live oak, ceanothus, scattered coast live oak, mountain mahogany, chamise, poison oak, buckwheat, toyon, white sage, yucca, black sage, and white sage.

MODJESKA FAMILY

The Modjeska family consists of deep, well drained soils that formed in alluvium weathered from granitic or metamorphic rocks. The soils are on alluvial fans and terraces of 5 to 35 percent slope at elevations of 2,400 to 4,000 feet. Annual precipitation is 25 to 30 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, thermic Typic Xerochrepts.

Typical pedon of Modjeska family, in an area of Trigo, granitic substratum-Modjeska families association, 5 to 60 percent slopes, under chamise at an elevation of 3,500 feet:

A1-0 to 3 inches; dark brown (10YR 4/3) cobbly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; common very fine and fine interstitial pores; 15 percent cobbles, 10 percent pebbles; moderately acid (pH 5.8); clear smooth boundary.

B21-3 to 20 inches; dark yellowish brown (10YR 4/4) very cobbly sandy loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few fine interstitial pores and few fine and medium tubular pores; 5 percent stones, 20 percent cobbles, 15 percent pebbles; neutral (pH 6.6); clear smooth boundary.

B22-20 to 56 inches; yellowish brown (10YR 5/4) very cobbly sandy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky

structure; hard, firm, sticky and slightly plastic; few fine and medium roots; few fine interstitial and tubular pores; 5 percent stones, 20 percent cobbles, 20 percent pebbles; slightly acid (pH 6.5).

Cr-56 inches; partly consolidated metamorphic sediments; breaks down to sandy loam with 25 percent pebbles.

Type location: Road cut on the Upper Big Tujunga Road under construction, between the Lynx Gulch and Alder Creek Roads; 300 feet east and 200 feet south of the NW corner of sec. 30, T. 3 N., R. 11 W., Chilao Flat Quadrangle.

Range in characteristics: The solum is at least 39 inches thick. The mean annual soil temperature is 60 to 70 degrees F. The rock fragment content is 35 percent or more, by volume. The soil is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon is gravelly loam, very gravelly loam, gravelly sandy loam, or cobbly sandy loam and averages 20 to 35 percent rock fragments. Dry color is 10YR 5/4, 5/3, 4/3, or 3/3, and moist color is 10YR 4/4, 4/3, 3/4, 3/3, or 3/2.

The B horizon is gravelly sandy loam, very gravelly sandy loam, very cobbly sandy loam, very gravelly sandy clay loam, or very cobbly sandy clay loam and averages 30 to 55 percent rock fragments. Dry color is 10YR 6/6, 6/5, 5/5, 5/4, or 4/4 or 7.5YR 5/6 or 4/4, and moist color is 10YR 5/4, 4/4, 4/3, or 3/4 or 7.5YR 4/4.

Vegetation: chamise, manzanita, scrub oak, ceanothus, mountain mahogany, big sagebrush, rabbitbrush, yerba santa, and annual grasses.

MOLLIC HAPLOXERALS

Mollic Haploxeralfs are well drained soils that formed in material weathered from schist, granitic rock, gneiss, sandstone conglomerate, and alluvium from mixed sources. They are on old terraces and alluvial fans and on mountainsides and ridges. Slopes range from 5 to 60 percent. Elevation is 2,800 to 8,200 feet. Annual precipitation is 15 to 30 inches.

Mollic Haploxeralfs are 20 to 60 inches deep. Mean annual soil temperature at 20 inches is 50 to 65 degrees F.

The A horizon is 4 inches or more thick. It has dry color of 10YR 5/3, 4/3, or 4/2 or 2.5Y 5/2 and moist color of 10YR 3/3 or 3/2 or 2.5Y 2/2. It is coarse sandy loam, gravelly sandy loam, or gravelly loam and averages 5 to 20 percent rock fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8).

The B1 horizon is 6 to 10 inches thick. It has dry color

of 10YR 5/4 or 2.5Y 6/2 and moist color of 10YR 4/4 or 3/4 or 2.5Y 5/2. It is sandy loam, gravelly sandy loam, or gravelly clay loam and averages 20 to 30 percent rock fragments. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8).

The B2t horizon has dry color of 5YR 5/4, 10YR 5/4 or 5/3, 2.5Y 6/2, or 5Y 5/3 and moist color of 10YR 4/4, 2.5Y 5/2, or 5Y 4/2. It is sandy clay loam, gravelly sandy clay loam, cobbly clay loam, silty clay loam, or clay and averages 5 to 55 percent rock fragments. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8). The B2t horizon grades into weathered rock which is difficult to dig with a spade.

Vegetation: chamise, buckwheat, yucca, mountain mahogany, laurel sumac, buckbrush, big sagebrush, yerba santa, white sage, black sage, and scrub oak. At higher elevations: Jeffrey pine, white fir, black oak, and canyon live oak.

OAK GLEN FAMILY

The Oak Glen family consists of deep, well drained soils that formed in material weathered from granitic rocks. The soils are on mountainsides and ridges. Slopes range from 2 to 70 percent. Elevation is 3,600 to 5,700 feet. Annual precipitation is 15 to 21 inches.

Taxonomic class: These soils are coarse-loamy, mixed, mesic Pachic Haploxerolls.

Typical pedon of Oak Glen family, in an area of Oak Glen family, 2 to 35 percent slopes, under black oak at an elevation of 5,700 feet.

A11-0 to 4 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; neutral (pH 6.8); abrupt smooth boundary.

A12-4 to 26 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common medium roots; many very fine tubular and interstitial pores; neutral (pH 7.0); gradual smooth boundary.

C-26 to 60 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; common medium roots; many very fine tubular and interstitial pores; neutral (pH 7.0).

Type location: About 250 yards north of old radio tower site; 1,300 feet west and 1,100 feet south of the NE corner of sec. 10, T. 7 N., R. 17 W., Liebre Mountain Quadrangle.

Range in characteristics: This soil is at least 60 inches deep. The mean annual soil temperature at 20 inches is 47 to 59 degrees F. Texture is loam, gravelly loam, sandy loam, or gravelly sandy loam. The clay content averages less than 18 percent. Rock fragment content is 3 to 32 percent.

The A horizon has dry color of 10YR 5/3, 5/2, or 4/2 or 2.5Y 5/2 and moist color of 10YR 3/3, 3/2, or 2/2 or 2.5Y 3/3. It is at least 20 inches thick.

The C horizon has dry color of 10YR 5/3 and moist color of 10YR 3/3 or 3/2 or 2.5Y 3/2. Reaction is slightly acid to neutral (pH 6.1 to 7.3).

Vegetation: Black oak, Digger pine, canyon live oak, Coulter pine, blue oak, buckeye, mountain mahogany, and annual grasses.

OLETE FAMILY

The Olete family consists of moderately deep to deep, well drained soils that formed in colluvium from gneissic or granitic rocks. The soils are on colluvial slopes at elevations of 1,800 to 8,200 feet. Slopes range from 40 to 80 percent. Annual precipitation is 19 to 38 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, mesic Typic Xerochrepts.

Typical pedon of Olete family, in an area of Olete-Kilburn-Etsel families complex, 50 to 80 percent slopes, under canyon live oak at an elevation of 2,750 feet.

O-1/2 inch to 0; fresh and partly decomposed leaf litter.

A11-0 to 3 inches; dark brown (10YR 3/3) cobbly loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; common very fine, fine and medium roots; many very fine and fine interstitial pores; 10 percent pebbles, 20 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.

A12-3 to 8 inches; yellowish brown (10YR 5/4) very cobbly loam, dark yellowish brown (10YR: 3/4) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots, and many medium roots; many very fine and fine interstitial pores; 20 percent pebbles, 25 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

B21-8 to 30 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky struc-

ture; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common fine interstitial pores and few coarse tubular pores; 30 percent pebbles and 35 percent cobbles; slightly acid (pH 6.4); gradual wavy boundary.

B22-30 to 57 inches; light yellowish brown (10YR 6/4) extremely cobbly sandy loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; common fine interstitial pores and few fine tubular pores; 20 percent pebbles, 40 percent cobbles, and 15 percent stones; slightly acid (pH 6.4); gradual wavy boundary.

C-57 to 60 inches; pale brown (10YR 6/3) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine and fine interstitial pores; 15 percent pebbles, 45 percent cobbles, and 20 percent stones; neutral (pH 6.6).

Type location: Roadcut on Grizzly Flat road, 0.9 miles down from the junction with FR 2N80 where the road makes a bend and intersects a large gully; 1,200 feet west and 200 feet north of the SE corner of sec. 11, T. 2 N., R. 13 W., Condor Peak Quadrangle.

Range in characteristics: Depth to a lithic or paralithic contact is 20 to 60 inches. The mean annual soil temperature at 20 inches is 47 to 59 degrees F.

The A horizon has dry color of 10YR 5/4, 5/2, 4/2, or 3/3 or 2.5Y 4/2; it has moist color of 10YR 4/3, 3/4, 3/2, or 2/2, 7.5YR 3/2, 2.5Y 3/2, or 5Y 4/1. It is gravelly loam, very gravelly loam, cobbly loam, very cobbly loam, or very gravelly sandy loam and

averages 5 to 50 percent rock fragments. Reaction is moderately acid to mildly alkaline (pH 5.6 to 7.8).

The B horizon has dry color of 10YR 6/4, 6/3, 6/1, 5/4, 5/2, or 5/1; 7.5YR 4/4; or 2.5Y 6/2. It has moist color of 10YR 5/4, 4/4, 4/3, or 3/4; 7.5YR 4/4; or 2.5Y 5/2. It is very gravelly loam, very cobbly loam, extremely cobbly loam, very gravelly sandy loam, extremely cobbly sandy loam, or very gravelly sandy clay loam and averages 20 to 90 percent rock fragments. Reaction is strongly acid to neutral (pH 5.1 to 7.3).

The C horizon has dry color of 10YR 6/4, 6/3, or 5/4 and moist color of 10YR 5/4, 4/4, or 4/3. It is very gravelly sandy loam, extremely stony sandy loam, or very gravelly loamy sand. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

Vegetation: ceanothus, bigcone Douglas-fir, black oak, canyon live oak, interior live oak, scrub oak, California laurel, poison oak, coast live oak, toyon, sugar sumac, manzanita, Coulter pine, chamise, ferns, Jeffrey pine, and sugar pine.

OSITO FAMILY

The Osito family consists of shallow, well drained soils that formed in material weathered from sandstone and shale. The soils are on mountainsides and ridges at elevations of 2,200 to 3,500 feet. Slopes range from 25 to 55 percent. Annual precipitation is 19 to 21 inches.

Taxonomic class: These soils are loamy, mixed, thermic, shallow Typic Xerochrepts.

Typical pedon of Osito family, in an area of Osito-Trigo families complex, 25 to 55 percent slopes, under chamise at an elevation of 3,150 feet:

A1-0 to 1.5 inches; brown (10YR 5/3) loam; dark brown (10YR 3/3) moist; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular and interstitial pores; neutral (pH 7.3); clear wavy boundary.

B2-1.5 to 15 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and very plastic; common very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores; neutral (pH 7.0); abrupt wavy boundary.

Cr-15 to 20 inches; light yellowish brown semiconsolidated fine-grained sandstone, highly weathered, can

be easily dug with a spade, breaks to gravel-size fragments which when moistened break down to very fine sandy loam.

Type location: About 1.2 miles southeast of Oak Flat Campground on Forest Road 6N43, 1 mile northwest of trailer park; 2,250 feet east and 5 feet south of the NW corner of sec. 29, R. 17 W., T. 6 N., Whitaker Peak Quadrangle.

Range in characteristics: Depth to a paralithic contact is 10 to 20 inches. The mean annual soil temperature at the contact is 59 to 72 degrees F.

The A horizon is loam, silt loam, silty clay loam, or sandy loam and averages up to 15 percent gravel. Dry color is 10YR 6/3, 5/4, 5/3, 5/2, or 4/3; moist color is 10YR 4/3, 3/3, or 3/2. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8).

The B horizon is loam, silt loam, silty clay loam, or gravelly silty clay loam and averages up to 20 percent gravel. Clay content on the average is less than 35 percent and is 3 to 5 percent higher than in the A horizon. Dry color is 10YR 6/4, 6/3, 5/6, 5/4, or 5/3; moist color is 10YR 5/4, 4/4, or 4/3. Reaction is neutral to mildly alkaline (pH 6.6 to 7.8). In some profiles a thin C horizon is present above the paralithic contact. Roots can penetrate between fractures in the substratum.

Vegetation: chamise, scrub oak, manzanita, black sage, buckbrush, mountain mahogany, and annual grasses.

PACIFICO FAMILY

The Pacifico family consists of shallow, somewhat excessively drained to excessively drained soils that formed in material weathered from granitic and anorthosite rocks. The soils are on mountainsides and ridges with slopes of 15 to 90 percent. Elevation is 3,400 to 8,000 feet. Annual precipitation is 19 to 33 inches.

Taxonomic class: These soils are mixed, mesic, shallow Typic Xeropsamments.

Typical pedon of Pacifico family, in an area of Pacifico family-Xerorthents complex, 50 to 90 percent slopes, under bigcone Douglas-fir at an elevation of 5,300 feet:

O1-0.5 inch to 0; oak and conifer leaf and needle litter.

A1-0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; common very fine roots; many very fine interstitial pores; 10 percent pebbles; moderately acid (pH 6.0); clear wavy boundary.

C1-5 to 17 inches; light brownish gray (10YR 6/2) loamy sand, grayish brown (10YR 5/2) moist; weak very fine granular structure; loose, very friable; few very fine and fine roots; many very fine interstitial pores; 5 percent pebbles; neutral (pH 7.0); clear wavy boundary.

C2r-17 inches; highly weathered granitic rock which breaks out into 50 percent gravel-sized pieces and 50 percent loamy sand material; few fine roots in fractures.

Type location: About 1.1 miles northwest of Mill Creek Station on Forest Road 3N17, across from turnout; 2,500 feet west and 2,650 feet south of the NE corner of sec. 25, T. 4 N., R. 12 W., Pacifico Mountain Quadrangle.

Range in characteristics: Depth to a highly fractured paralithic contact is 10 to 20 inches. The mean annual soil temperature at the contact is estimated to be between 47 and 59 degrees F. The profile is loamy sand, loamy fine sand, loamy coarse sand, gravelly loamy sand, or gravelly loamy coarse sand and averages 0 to 20 percent rock fragments.

The A horizon has dry color of 10YR 6/3, 6/2, 5/3, or 5/2 or 2.5Y 6.2; it has moist color of 10YR 5/2, 4/3, 4/2, 3/3, 3/2, or 3/1 or 2.5Y 4/2. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

The C horizon has dry color of 10YR 8/2, 7/3, 7/2, or 6/2 or 2.5Y 6/2; it has moist color of 10YR 6/2, 5/4, 5/3, 5/2, or 4/3 or 2.5Y 4/2. It grades into highly weathered rock that generally breaks down to small pebbles or coarse sand.

Vegetation: canyon live oak, Coulter pine, bigcone Douglas-fir, Jeffrey pine, scrub oak, manzanita, chamise, annual and perennial grasses.

PISMO FAMILY

The Pismo family consists of very shallow or shallow, somewhat excessively drained or excessively drained soils that formed in material weathered from granitic and anorthosite rocks. The soils are on mountainsides at elevations of 2,000 to 5,500 feet. Slopes range from 15 to 80 percent. Annual precipitation is 10 to 30 inches.

Taxonomic class: These soils are mixed, thermic, shallow Typic Xeropsamments.

Typical pedon of Pismo family, in an area of Pismo family-Rock outcrop complex, 50 to 80 percent slopes, under chamise at an elevation of 2,500 feet:

A1-0 to 9 inches; light brownish gray (2.5Y 6/2) gravelly loamy sand, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; soft, friable; common very fine and fine roots; many very fine and fine interstitial pores; 15 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

Cr-9 inches; soft, highly weathered anorthosite, some soil material in fractures and in old root channels.

Type location: About 1 mile east of County Camp No. 11 on Forest Road 4N37 near Soledad Canyon Road; 750 feet west and 900 feet south of the NE corner of sec. 18, T. 4 N., R. 13 W., Agua Dulce Quadrangle.

Range in characteristics: Depth to a paralithic contact is 4 to 20 inches. The mean annual soil temperature at the contact is 59 to 72 degrees F. The soil is slightly acid to neutral (pH 6.1 to 7.3). It is loamy sand, gravelly loamy sand, or gravelly loamy coarse sand and averages 0 to 35 percent gravel.

The A horizon has dry color of 10YR 7/2, 6/3, 6/2, 5/4, 5/3, or 5/2 or 2.5Y 6/2; it has moist color of 10YR 5/4, 4/4, 4/3, 4/2, 3/4, 3/3, or 3/2 or 2.5Y 4/2. Typically, the A horizon rests directly on the paralithic contact.

A thin C horizon is present in some pedons. It is similar to the A horizon in texture and reaction. It has dry color of 10YR 6/4 or 6/2 or 7.5YR 5/3 and moist color of 10YR 4/6 or 4/3 or 7.5YR 5/4 or 4/4. Below the paralithic contact roots are found in the fracture joints.

Vegetation: chamise, yucca, hoaryleaf manzanita, buckwheat, yerba santa, mountain mahogany, Mormon tea, juniper, scrub oak, and annual grasses.

PRESTON FAMILY

The Preston family consists of moderately deep, somewhat excessively drained to excessively drained soils that formed in material weathered from granodiorite or diorite. The soils are on mountainsides with slopes of 15 to 50 percent. Elevation is 4,000 to 6,000 feet. Annual precipitation is 20 to 31 inches.

Taxonomic class: These soils are mixed, mesic Typic Xeropsamments.

Typical pedon of Preston family, in an area of Pacifico-Preston families complex, 15 to 50 percent slopes, under bigcone Douglas-fir at an elevation of 4,000 feet:

O1-1 inch to 0; bigcone Douglas-fir needles in various stages of decomposition.

A1-0 to 13 inches; light brownish gray (2.5Y 6/2) gravelly loamy sand, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, loose; common very fine and fine roots; many very fine and fine interstitial pores; 15 percent pebbles; neutral (pH 6.6); clear smooth boundary.

C1-13 to 30 inches; pale brown (10YR 6/3) gravelly loamy sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, loose; few medium and coarse roots; common fine and medium interstitial pores;

20 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

C2r-30 inches; highly weathered diorite.

Type location: Six feet above trail, 1/4 mile up from Camp Colby; 1,800 feet east and 300 feet north of the SW corner of sec. 35, T. 3 N., R. 12 W., Chilao Flat Quadrangle.

Range in characteristics: Depth to a paralithic or lithic contact is 30 to 39 inches. The mean annual soil temperature at 20 inches is 47 to 59 degrees F. The profile is 0 to 30 percent rock fragments. Reaction is slightly acid to neutral (pH 6.1 to 7.3). Texture is loamy sand, gravelly loamy sand, gravelly loamy coarse sand, or cobbly loamy sand.

The A horizon has dry color of 10YR 7/3, 6/2, or 5/3 or 2.5Y 6/2 and moist color of 10YR 5/4, 3/4, or 3/2 or 2.5Y 4/2.

The C horizon has dry color of 10YR 7/2, 6/4, 6/3, or 5/4 or 2.5Y 6/2; it has moist color of 10YR 6/4, 5/5, or 5/4 or 2.5Y 5/4 or 4/3. It grades into highly weathered granitic rock.

Vegetation: canyon live oak, Coulter pine, bigcone Douglas-fir, manzanita, Jeffrey pine (upper elevations), mountain whitethorn, scrub oak, perennial grasses.

SAN ANDREAS FAMILY

The San Andreas family consists of deep, well drained soils that formed in material weathered from gneissic, granitic, or sedimentary rocks. The soils are on mountainsides (mainly on toe slopes), ridges, colluvial slopes, and old terraces or fans. Elevation is 1,300 to 4,200 feet. Slopes range from 15 to 60 percent. Annual precipitation is 16 to 20 inches.

Taxonomic class: These soils are coarse-loamy, mixed, thermic Typic Haploxerolls.

Typical pedon of San Andreas family, in an area of Trigo-Modesto-San Andreas families association, 15 to 70 percent slopes, under chamise at an elevation of 1,400 feet:

A1-0 to 16 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky parting to weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots, few fine and few medium roots; many very fine and fine interstitial and tubular pores; neutral (pH 6.6); gradual wavy boundary.

B1-16 to 32 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few medium roots; many fine and medium tubular pores; neutral (pH 6.8); diffuse smooth boundary.

C1-32 to 46 inches; light brownish gray (2.5Y 6/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, firm, nonsticky and nonplastic; few medium roots; few fine and medium tubular pores; neutral

(pH 6.8); diffuse smooth boundary.

C2-46 to 60 inches; light brownish gray (10YR 6/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, firm, nonsticky and nonplastic; neutral (PH 6.8).

Type location: In the Little Tujunga Canyon area, about 80 yards southeast of the Angeles Gun Club gate, northeast side of the road; 900 feet east and 1,500 feet north of the SW corner of sec. 33, T. 3 N., R. 14 W., Sunland Quadrangle.

Range in characteristics: These soils are more than 40 inches deep and in most places are at least 60 inches deep. Mean annual soil temperature at 20 inches is 59 to 72 degrees F.

The A horizon has dry color of 10YR 5/3, 5/2, 4/3, 4/2, or 4/1; it has moist color of 10YR 4/3, 3/3, 3/2, or 2/2. It is loam, cobbly loam, sandy loam, or gravelly sandy loam and averages 0 to 30 percent coarse fragments. Reaction is slightly acid to neutral (pH 6.1 to 7.3).

The B horizon has dry color of 10YR 6/3, 5/4, 5/3, 5/2, or 4/2; it has moist color of 10YR 5/3, 4/4, 4/3, 3/4, 3/3, or 3/2 or 2.5Y 5/4. It is loam, gravelly loam or gravelly sandy loam and averages 0 to 25 percent gravel.

The C horizon has dry color of 10YR 7/4, 7/3, 7/2, 6/4, 6/2, or 5/3; it has moist color of 10YR 6/3, 5/4, 5/3, or 3/3 or 2.5Y 5/4. It is sandy loam or gravelly sandy loam and averages 5 to 20 percent gravel.

Vegetation: shrub canyon live oak, mountain mahogany, chamise, coastal sagebrush, scrub oak, buckwheat, yucca, and annual grasses.

SHORTCUT FAMILY

The Shortcut family consists of very shallow or shallow, excessively drained soils that formed in material weathered from granitic, anorthosite, or gneissic rocks. The soils are on mountainsides and ridges at elevations of 2,000 to 6,400 feet. Slopes range from 45 to 85 percent. Annual precipitation is 12 to 30 inches.

Taxonomic class: These soils are sandy-skeletal, mixed, thermic, shallow Typic Xerorthents.

Typical pedon of Shortcut family, in an area of Pismo-Chilao-Shortcut families complex, 45 to 80 percent slopes, under manzanita and chamise at an elevation of 4,350 feet:

A1-0 to 5 inches; gray (10YR 6/1) gravelly loamy sand, dark gray (10YR 4/1) moist; weak very fine and fine granular structure; soft, very friable; few very fine, fine, and medium roots; many fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.2); abrupt smooth boundary.

C1-5 to 14 inches; light gray (10YR 7/2) very gravelly loamy sand, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; few fine, medium, and coarse roots; many fine interstitial pores; 45 percent pebbles; moderately acid (pH 5.9); clear smooth boundary.

C2r-14 inches; strongly weathered granodiorite, breaks down to small pebbles.

Type location: Between the old and new Upper Big Tujunga Roads, 1/2 mile northeast of Shortcut Picnic Grounds; 300 feet west and 300 feet south of the NE corner of sec. 9, T. 2 N., R. 11 W., Chilao Flat Quadrangle.

Range in characteristics: Depth to a paralithic contact is 5 to 17 inches. The mean annual soil temperature at the contact is estimated to be between 59 and 72 degrees F.

The A horizon has dry color of 10YR 6/3, 6/2, 6/1, 5/4, 5/1, 4/4, or 4/3; it has moist color of 10YR 4/3, 4/2, 3/3, or 3/2. It is loamy sand or gravelly loamy sand and averages 10 to 50 percent rock fragments. Reaction is slightly acid to neutral (pH 6.1 to 7.3).

The C horizon has dry color of 10YR 7/3, 7/2, 6/3, 6/2, 6/1, or 5/2; it has moist color of 10YR 6/3, 5/6, 5/3, 5/2, 4/6, 4/4, or 4/3. It is gravelly loamy sand, very gravelly loamy sand, or extremely gravelly loamy sand and averages 35 to 65 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3). The C horizon grades into highly weathered rock.

Vegetation: chamise, manzanita, yucca, buckwheat, scrub oak, ceanothus crassifolius, laurel sumac, toyon, yerba santa, mountain mahogany, and rabbitbrush.

SPRINGDALE FAMILY

The Springdale family are somewhat excessively drained soils that formed in material weathered from granodiorite. The soils are on mountainsides with slopes of 30 to 70 percent. Elevation is 5,000 to 8,000 feet. Annual precipitation is 23 to 33 inches.

Taxonomic class: These soils are sandy-skeletal, mixed, mesic Typic Xerorthents.

Typical pedon of Springdale family, in an area of Waterman-Springdale-Pacifico families complex, 30 to 70 percent slopes, under Jeffrey pine at an elevation of 6,800 feet:

A1-0 to 7 inches; grayish brown (10YR 5/2) gravelly loamy sand, very dark brown (10YR: 3/2) moist; weak fine granular structure; loose, very friable; common very fine and fine roots and few medium roots; many very fine and fine interstitial pores; 35 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.

C1-7 to 31 inches; white (10YR 8/2) extremely gravelly loamy sand, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; few fine roots, common medium roots, and few coarse roots; common fine interstitial pores; neutral (pH 7.2); clear smooth boundary.

C2r-31 inches; highly weathered white (10YR 8/2) granodiorite that breaks down to loamy sand and 60

percent gravel-sized pieces; few medium roots.

Type location: 15 feet above the Pacific Crest Trail on the west side of Pacifico Mountain; 2,500 feet east and 600 feet north of the SW corner of sec. 33, T. 4 N., R. 11 W., Pacifico Mountain Quadrangle.

Range in characteristics: Depth to a paralithic or lithic contact is 21 to 43 inches. The mean annual soil temperature at 20 inches is 47 to 59 degrees F.

The A horizon has dry color of 10YR 6/3, 6/2, 5/3, 5/2, 4/3, or 4/2; it has moist color of 10YR 4/4, 4/3, 3/3, 3/2, or 2/2. It is gravelly loamy sand, extremely gravelly loamy coarse sand, or very cobbly coarse sand and averages 30 to 80 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3). Some pedons have an A12 horizon that is 10 to 15 inches thick.

The C horizon has dry color of 10YR 8/2, 7/3, 7/2, 6/4, 6/3, or 6/2; it has moist color of 10YR 6/3, 5/4, 5/2, 4/4 or 4/3. It is gravelly loamy sand, extremely gravelly loamy sand, extremely cobbly loamy coarse sand, or gravelly sand and averages 35 to 90 percent rock fragments. Reaction is strongly acid to mildly alkaline (pH 5.1 to 7.8). The C horizon grades to weathered or unweathered granodiorite rock.

Vegetation: Jeffrey pine, white fir, incense-cedar, sugar pine, stunted canyon live oak, big sagebrush, rabbitbrush, mountain whitethorn, buckwheat, manzanita, lupine, penstemon, and annual grasses.

STONYFORD FAMILY

The Stonyford family consists of shallow, well drained soils that formed in material weathered from shale and sandstone. The soils are on mountainsides with slopes of 30 to 70 percent. Elevation is 1,800 to 3,700 feet. Annual precipitation is 16 to 20 inches.

Taxonomic class: These soils are loamy, mixed, thermic Lithic Mollic Haploxeralfs.

Typical pedon of Stonyford family, in an area of Stonyford-Millsholm families complex, 30 to 70 percent slopes, under chamise at an elevation of 3,100 feet:

A1-0 to 5 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; many very fine tubular and interstitial pores; few thin clay films lining tubular pores; 15 percent pebbles; neutral (pH 7.0); clear wavy boundary.

B2t-5 to 19 inches; brown (10YR 5/3) gravelly clay loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many medium roots; many very fine tubular and interstitial pores; many moderately thick clay films on ped faces and lining tubular

pores; 20 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

R-19 inches; hard, highly fractured, fine-grained sandstone that breaks out into pebble-sized pieces; soil material in fractures.

Type location: Near the west shore of Bouquet Reservoir on Forest Road 6N14; 2,100 feet west and 1,900 feet south of the NE corner of sec. 30, T. 6 N., R. 14 W., Green Valley Quadrangle.

Range in characteristics: Depth to a lithic contact is 10 to 20 inches. Mean annual soil temperature at the contact is 60 to 70 degrees F.

The A horizon has dry color of 10YR 5/4, 5/3, or 4/2 or 7.5YR 5/4, and moist color of 10YR 3/4 or 7.5YR 3/2. It is cobbly loam, gravelly sandy loam, or gravelly clay loam and averages 15 to 30 percent rock fragments.

The B2t horizon has dry color of 10YR 6/4, 6/3, or 5/3; 7.5YR 6/4 or 5/4; or 5YR 4/4. It has moist color of 10YR 4/3 or 3/4; 7.5YR 4/4; or 5YR 5/6 or 3/4. It is loam, clay loam, gravelly loam, or gravelly clay loam and averages 10 to 25 percent rock fragments. It rests on hard fractured rock.

Vegetation: chamise, black sage, yucca, and manzanita.

STUKEL FAMILY

The Stukel family consists of very shallow or shallow, somewhat excessively drained soils that formed in material weathered from granitic or gneissic rocks. The soils are on mountainsides with slopes of 40 to 100 percent. Elevation is 1,800 to 6,200 feet. Annual precipitation is 17 to 39 inches.

Taxonomic class: These soils are loamy, mixed, mesic Lithic Haploxerolls.

Typical pedon of Stukel family, in an area of Stukel-Sur-Winthrop families complex, 60 to 100 percent slopes, under scrub oak at an elevation of 2,800 feet:

A11-0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

A12-4 to 11 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; 30 percent pebbles; medium acid (PH 6.0); abrupt smooth boundary.

R-11 inches; hard, fractured granitic rock; few roots in fractures.

Type location: In the Brown Mountain area at the end of Forest Road 2N66, 500 feet northwest of the water tank; 600 feet east and 2,400 feet north of the SW corner of sec. 20, T. 2 N., R. 12 W., Pasadena Quadrangle.

Range in characteristics: Depth to a lithic contact is 8 to 18 inches. Mean annual soil temperature at the contact is 47 to 59 degrees F. Rock fragments, mostly gravel sized, range from 0 to 30 percent. The soil is slightly acid to neutral (pH 6.1 to 7.3).

The A horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/4, 4/3, 4/2, 3/3, or 3/2 or 2.5Y 5/2 and moist color of 10YR 3/3, 3/2, or 2/2 or 2.5Y 3/2. It is loam, gravelly loam, cobbly loam, coarse sandy loam, or gravelly sandy loam.

Some pedons have a thin B2 horizon or C horizon between the A horizon and the bedrock.

Vegetation: canyon live oak, bigcone Douglas-fir, Coulter pine, California laurel, scrub oak, mountain whitethorn, manzanita, toyon, silktassel, ferns, poison oak, and annual grasses on firebreaks.

SUPAN FAMILY

The Supan family consists of deep, well drained soils that formed in material weathered from metamorphic rock. The soils are on mountainsides and broad ridgetops at elevations of 3,400 to 5,500 feet. Slopes range from 15 to 50 percent. Annual precipitation is 28 to 35 inches.

Taxonomic class: These soils are fine-loamy, mixed, mesic Pachic Argixerolls.

Typical pedon of Supan family, in an area of Trigo granitic substratum-Green Bluff-Supan families association, 15 to 60 percent slopes, under Coulter pine at an elevation of 5,450 feet:

A11-0 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; 5 percent pebbles; slightly acid (pH 6.2); clear smooth boundary.

A12-6 to 12 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few fine roots; common very fine and fine tubular pores; slightly acid (pH 6.1); clear smooth boundary.

B1-12 to 25 inches; yellowish brown (10YR 5/4) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and few medium tubular pores; 5 percent pebbles; moderately acid (pH 5.9); abrupt smooth boundary.

B2-25 to 38 inches; light yellowish brown (10YR 6/4) loam, dark brown (10YR 4/3) moist; moderate

medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; moderately acid (pH 5.6); clear smooth boundary.

B2t-38 to 60 inches; brownish yellow (10YR 6/6) clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse angular blocky structure; hard, firm, slightly sticky and plastic; few very fine roots; few fine tubular pores; 5 percent pebbles; common moderately thick clay films on ped faces; moderately acid (pH 5.8).

Type location: Near Barley Flats Heliport, roadcut, 50 yards up a spur road off the Barley Flats road; 1,200 feet west and 1,750 feet south of the NE corner of sec. 7, T. 2 N., R. 11 W., Chilao Flat Quadrangle.

Range in characteristics: This soil is more than 60 inches deep. The mean annual soil temperature at 20 inches is 47 to 59 degrees F. The profile averages 0 to 10 percent pebbles.

The A horizon has dry color of 10YR 5/3, 5/2, or 4/3 and moist color of 10YR 3/2, or 2/2. Reaction is slightly acid to neutral (pH 6.1 to 7.3).

The B1 and B2 horizons have dry color of 10YR 6/4, 5/4, or 4/3 or 7.5YR 4/4 and moist color of 10YR 4/3, 3/2, or 2/2 or 7.5YR 3/4. It is loam or clay loam. Reaction is moderately acid to slightly acid (pH 5.6 to 6.5).

The B2t horizon has dry color of 10YR 6/6 or 5/3 or 7.5YR 4/4 and moist color of 10YR 4/4 or 3/4. The average clay content is 18 to 34 percent. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

Vegetation: Coulter pine, incense-cedar, bigcone Douglas-fir, canyon live oak, ceanothus, annual and perennial grasses.

SUR FAMILY

The Sur family consists of moderately deep to deep, somewhat excessively drained soils that formed in mixed colluvial material weathered from granitic, gneiss, or schist rocks. The soils are on colluvial slopes, ridges, and fans that have 45 to 80 percent slopes. Elevation is 2,000 to 8,600 feet. Annual precipitation is 14 to 39 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, mesic Entic Haploxerolls.

Typical pedon of Sur family, in an area of Green Bluff-Hohmann family-Xerorthents complex, 15 to 60 percent slopes, as inclusion under bigcone Douglas-fir at an elevation of 7,800 feet:

A11-0 to 8 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

A12-8 to 13 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; 30 percent pebbles; neutral (pH 7.0); gradual smooth boundary.

C-13 to 50 inches; pale brown (10YR 6/3) very gravelly

sandy loam, dark brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; many medium roots; many very fine and fine interstitial pores; 35 percent pebbles, 5 percent cobbles; neutral (pH 7.0).

Type location: In the Mt. Mooney area, bordering the San Gabriel Wilderness; roadcut on Forest Road 3N16, 500 feet up from sharp switchback (coming from maintenance station); 2,500 feet east and 1,200 feet south of the NW corner of sec. 35, T. 3 N., R. 11 W., Chilao Flat Quadrangle.

Range in characteristics: Depth to a paralithic or lithic contact is 20 to 60 inches. The mean annual soil temperature at 20 inches is 47 to 59 degrees F. The soil profile is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/3, or 4/2 or 2.5Y 5/2 or 4/2; it has moist color of 10YR 3/3, 3/2, or 2/2. It is gravelly loam, very cobbly loam, gravelly sandy loam, extremely gravelly sandy loam, or very cobbly coarse sandy loam and averages 15 to 70 percent rock fragments.

The C horizon has dry color of 10YR 6/4, 6/3, 6/2, 5/4, or 5/3 or 5Y 6/3 or 6/2; it has moist color of 10YR 4/4, 4/3, or 4/2 or 2.5Y 5/4 or 4/2. It is very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam, or extremely cobbly sandy loam and averages 35 to 90 percent rock fragments.

Vegetation: canyon live oak, bigcone Douglas-fir, mountain whitethorn, bay laurel, sycamore, Jeffrey pine, ponderosa pine, scattered white fir, sugar pine, and mountain mahogany.

TOLLHOUSE FAMILY

The Tollhouse family consists of very shallow or shallow, somewhat excessively drained soils that formed in material weathered from granitic or gneissic rocks. The soils are on mountainsides and ridges at elevations of 2,200 to 6,200 feet. Slopes range from 30 to 90 percent. Annual precipitation is 15 to 26 inches.

Taxonomic class: These soils are loamy, mixed, mesic, shallow Entic Haploxerolls.

Typical profile of Tollhouse family, in an area of Tollhouse-Knutsen-Stukel families complex, 30 to 70 percent slopes, under canyon live oak at an elevation of 4,700 feet:

A1-0 to 6 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; soft, friable, nonsticky and nonplastic; many medium roots; many very fine tubular and interstitial pores; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

Cr-6 inches; highly weathered granitic rock that crushes to sandy loam with moderate difficulty.

Type location: About 0.2 mile southeast and above Upper Shake Campground along trail; 300 feet north and 2,300 feet west of the SE corner of sec. 13, T. 7 N., R. 16 W., Burnt Peak Quadrangle.

Range in characteristics: Depth to a paralithic contact is 6 to 18 inches. The mean annual soil temperature at the contact is 47 to 59 degrees F. Small pebbles make up 5 to 30 percent of the soil volume.

The A horizon has dry color of 10YR 5/3, 5/2, 4/2, 4/1, or 3/2 or 2.5Y 5/2; it has moist color of 10YR 3/3, 3/2, 3/1, 2/2, or 2/1 or 2.5Y 3/2. It is loam, fine sandy loam, sandy loam, or gravelly sandy loam. Reaction is slightly acid to mildly alkaline (pH 6.1 to 7.8). In some pedons the A horizon rests directly on the weathered rock. In others, a thin C horizon lies between them.

The C horizon has dry color of 10YR 7/2, 6/3 or 6/2 or 2.5Y 7/2 or 6/2; it has moist color of 10YR 4/5 or 4/3 or 2.5Y 4/4 or 4/2. It is loam, gravelly sandy loam, or gravelly loamy sand. Reaction is neutral or mildly alkaline (pH 6.6 to 7.8).

Vegetation: canyon and interior live oak, bigcone Douglas-fir, Coulter pine, incense-cedar, mountain mahogany, and flannelbush.

TRIGO FAMILY

The Trigo family consists of very shallow or shallow, somewhat excessively drained soils that formed in material weathered from granitic, metamorphic, or sedimentary rocks. The soils are on mountainsides and ridges at elevations of 1,300 to 6,400 feet. Slopes range from 5 to 100 percent. Annual precipitation is 10 to 30 inches.

Taxonomic Class: These soils are loamy, mixed, nonacid, thermic shallow Typic Xerorthents.

Typical pedon of Trigo family, in an area of Trigo-Calleguas families-Haploxeralfs complex, 30 to 70 percent slopes, under chamise at an elevation of 3,800 feet:

A1-0 to 8 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak very fine and fine granular structure; slightly hard, friable, slightly sticky and plastic; common very fine roots; many very fine tubular and interstitial pores; 7 percent pebbles; neutral (pH 7.0); clear smooth boundary.

C1-8 to 16 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium roots; common very fine tubular and interstitial pores; 15 percent pebbles; neutral (pH 6.7); abrupt smooth boundary.

C2r-16 inches; highly weathered, soft sandstone that crushes to fine sandy loam.

Type location: Road cut on the Old Ridge Route (FR 8N04) about 0.5 mile south of Reservoir Hill; NW quarter of sec. 31 (projected), T. 7 N., R. 17 W., Liebre Mountain Quadrangle.

Range in characteristics: Depth to a paralithic contact ranges from 3 to 20 inches. The soil from a depth of about 4 inches to the paralithic contact is dry 6 out of 8 months between April and November or 8 months where mapped as a dry phase. The soil is moderately acid to mildly alkaline (pH 5.6 to 7.8). Rock fragments range from 0 to 30 percent.

The A horizon has dry color of 10YR 6/3, 6/2, 5/3, 5/2, 4/3, or 4/2; 2.5Y 6/4 or 5/4; or 7.5YR 4/4; it has moist color of 10YR 4/4, 3/4, 3/2, or 2/2; 2.5Y 4/4; or 7.5YR 4/4. It is loam, gravelly loam, sandy loam, fine sandy loam, gravelly sandy loam, silt loam, or gravelly silt loam. In some pedons the A horizon rests directly on the paralithic contact. Some pedons have an A12 horizon.

The C horizon has dry color of 10YR 7/4, 6/4, 6/3, or 5/4; 2.5Y 7/4 or 6/3; or 5Y 5/4; it has moist color of 10YR 5/4, 4/4, or 4/3; 2.5Y 4/4; 7.5YR 4/4; or 5Y 4/4. It is gravelly loam, sandy loam, fine sandy loam, gravelly sandy loam, or sandy clay loam. It grades into highly weathered rock.

Vegetation: chamise, buckwheat, yucca, yerba santa, manzanita, hoaryleaf ceanothus, sugar bush, coffeeberry, scrub oak, interior live oak, mountain mahogany, toyon, black sage, white sage, coastal sagebrush, and annual grasses.

TUJUNGA FAMILY

The Tujunga family consists of deep, excessively drained soils that formed in recent alluvium and colluvial deposits from granitic and gneissic materials. The soils are on alluvial fans, terraces, and colluvial surfaces at elevations of 2,600 to 4,600 feet. Slopes range from 2 to 50 percent. Annual precipitation is 14 to 20 inches.

Taxonomic class: These soils are mixed, thermic Typic Xeropsamments.

Typical pedon of Tujunga family, in an area of Tujunga-Capistrano families association, 2 to 20 percent slopes, under annual grasses and coast live oak at an elevation of 3,100 feet:

A11-0 to 4 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak very fine and fine granular structure; soft, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; 10 percent pebbles; neutral (pH 7.0); clear smooth boundary.

A12-4 to 14 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable; few very fine roots; many very fine tubular and interstitial pores; 20 percent pebbles; neutral (pH 7.0); gradual smooth boundary.

C-14 to 60 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; massive; soft, very friable; few very fine roots; many very fine tubular and interstitial pores; 20 percent pebbles; neutral (pH 7.0).

Type location: Near the end of El Jornada Road in Green Valley; 100 feet east and 400 feet north of the SW corner of sec. 8, T. 6 N., R. 14 W., Green Valley Quadrangle.

Range in characteristics: Depth to gravelly sediments is more than 50 inches. Mean annual soil temperature at 20 inches is 60 to 70 degrees F. Rock fragments range from 5 to 30 percent. Reaction is slightly acid to neutral (pH 6.1 to 7.3).

The A horizon is fine sandy loam, sandy loam, gravelly sandy loam, gravelly loamy sand, or loamy fine sand. Dry color is 10YR 6/3, 5/3, or 5/2 or 2.5Y 6/2 or 5/2, and moist color is 10YR 4/3, 3/3, or 3/2 or 2.5Y 4/2.

The C horizon is loamy sand, gravelly loamy sand, loamy coarse sand, or gravelly sand. Dry color is 10YR 6/3, 6/2, or 5/2 or 2.5Y 6/2, and moist color is 10YR 4/3 or 2.5Y 5/2.

Vegetation: annual grasses, buckwheat, yerba santa, coastal sagebrush, coast live oak, sycamore, alder, and cottonwood.

TYPIC HAPLOXERALS

Typic Haploxeralfs are shallow to deep, moderately well drained or well drained soils that formed in old alluvial material weathered from granitic, metamorphic, or sedimentary rocks. They are on old alluvial fans, terraces, and dissected terrace slopes at elevations of 2,300 to 4,600 feet. Slopes range from 3 to 50 percent. Annual precipitation is 11 to 16 inches.

Depth to partly consolidated sediments is 15 to 50 inches. The mean annual soil temperature at 20 inches is 60 to 72 degrees F. Reaction throughout the profile is neutral to moderately alkaline (pH 6.6 to 8.4).

The A horizon is 1 inch to 19 inches thick. It has dry color of 10YR 6/4, 6/3, or 5/3; 7.5YR 5/4; or 5YR 6/5. It has moist color of 10YR 5/4 or 4/2, 7.5YR 4/4,

5YR 4/5 or 4/4, or 2.5Y 4/2. It is loam, gravelly loam, silt loam, fine sandy loam, or gravelly sandy loam and averages 0 to 25 percent gravel.

The B2t horizon is 11 to 42 inches thick. It has dry color of 10YR 6/4 or 5/4; 7.5YR 5/4; 5YR 5/8, 5/3, or 4/6; or 2.5Y 5/4. It has moist color of 10YR 5/3 or 4/4, 7.5YR 4/4, 5YR 4/6 or 4/4, or 2.5Y 4/4. It is clay loam, silty clay loam, sandy clay loam, very gravelly sandy clay loam or very gravelly clay and averages 0 to 65 percent rock fragments. It has moderate subangular blocky structure. Typically, this horizon rests directly on the partly consolidated sediments.

Vegetation: chamise, buckwheat, buckbrush, black sage, white sage, yucca, juniper, and annual grasses.

TYPIC XEROCHREPTS

Typic Xerochrepts are shallow to deep, well drained soils that formed in residual and colluvial material weathered from granitic and metamorphic rocks. They are on colluvial slopes at elevations of 5,400 to 9,400 feet. Slopes range from 45 to 85 percent. Annual precipitation is 25 to 44 inches. The mean annual soil temperature is 32 to 47 degrees F. The soils are usually moist, but they are dry in July and August.

The shallow soils have a paralithic contact at a depth of 20 inches or less. They are generally on the steeper slopes of 50 to 80 percent. The A horizon is 3 or 4 inches thick. It is loam or gravelly sandy loam and averages 10 to 35 percent rock fragments. The B horizon is 6 to 13 inches thick. It is gravelly sandy loam or very cobbly sandy clay loam and averages 15 to 55 percent rock fragments. It has weak subangular blocky structure.

Some pedons have a thin C horizon.

The deep colluvial soils are more than 60 inches deep and can be up to 20 feet deep. They are generally on slopes of 35 to 50 percent. The A horizon is 4 or 5 inches thick. It is gravelly loam, gravelly sandy loam, or gravelly loamy sand and averages 25 to 45 percent rock fragments. The B horizon is very cobbly sandy loam or very cobbly loamy sand and averages 35 to 70 percent rock fragments. It has weak subangular blocky structure. The C horizon or colluvium is very cobbly, extremely cobbly, or very stony loamy sand or sand and averages 50 to 90 percent rock fragments.

Vegetation: Jeffrey pine, white fir, sugar pine, scattered lodgepole pine, stunted canyon live oak, and mountain whitethorn.

TYPIC XERORTHENTS

Typic Xerorthents are shallow to deep, somewhat excessively drained soils that formed in material weathered from metamorphic and granitic rocks. They are on mountainsides and colluvial slopes at elevations of 2,100 to 9,400 feet. Slopes range from 45 to 90 percent. Annual precipitation is 25 to 44 inches.

Depth to a paralithic contact is 15 to 60 inches. Mean annual soil temperature at a depth of 20 inches ranges from 32 to 47 degrees F at higher elevations and from 59 to 72 degrees F at lower elevations. Where these soils occur at elevations below 5,000 feet, the soil moisture control section is usually dry from May to November. At higher elevations the soils are usually dry from late June to mid-September.

The A horizon is 1 inch to 12 inches thick. It has dry color of 10YR 6/4, 6/3, 6/1, 5/4, or 5/3 and moist color of 10YR 4/4, 4/2, 4/1, 3/4, or 3/2 or 2.5Y 4/2. It is gravelly or very gravelly sandy loam, loamy sand,

gravelly loamy sand, cobbly sandy loam, or very cobbly loamy coarse sand and averages 10 to 75 percent rock fragments.

The C horizon has dry color of 10YR 7/4, 7/3, 7/2, 5/4, 6/4, or 6/3 and moist color of 10YR 6/3 or 5/4. It is very gravelly or very cobbly sandy loam or very gravelly, extremely gravelly, or very stony loam and averages 35 to 85 percent rock fragments. Typically, the C horizon grades into highly weathered and fractured rock. Reaction is very strongly acid to slightly acid (pH 4.5 to 6.5).

Vegetation: chamise, yucca, manzanita, buckwheat, scrub oak, chaparral whitethorn, mountain mahogany, sugar bush, hoaryleaf ceanothus, and annual grasses. At higher elevations the vegetation is Jeffrey pine, white fir, sugar pine, scattered lodgepole pine, and mountain whitethorn.

VERTIC XEROCHREPTS

Vertic Xerochrepts are shallow to deep, moderately well drained soils that formed in material weathered from shale. They are in swales and on mountainsides with slopes of 5 to 50 percent. Elevation is 2,200 to 4,000 feet. Annual precipitation is 19 to 21 inches.

Depth to a paralithic contact of highly fractured calcareous shale is 18 to 45 inches. The shale can be dug with difficulty with a spade. The mean soil temperature is 60 to 72 degrees F.

The A horizon is 2 to 11 inches thick. It has dry color of 10YR 5/3, 5/2, or 4/2 or 2.5Y 5/2 and moist color of 10YR 3/2 or 2.5Y 4/2. It is clay, silty clay, or silty clay loam and averages 0 to 10 percent shale fragments. Reaction is neutral to moderately alkaline (pH 6.6 to 8.4). Lime is disseminated in some of these horizons. When dry, the soil profile usually has cracks 1/4 to 1/2

inches wide on the surface that may extend almost to the top of the contact.

The B2 horizon is 11 to 17 inches thick. It has dry color of 10YR 6/3, 5/3, or 5/2 or 2.5Y 6/2 or 5/2. It has moist color of 10YR 4/3 or 4/2 or 2.5Y 4/2. It is clay, shaly clay, very shaly clay, very shaly silty clay, or shaly silty clay loam and averages 5 to 40 percent shale fragments of gravel size. These soils shrink when dry and swell when wet. Reaction is neutral to moderately alkaline (pH 6.3 to 8.4). Lime is usually disseminated but is also present as nodules and soft powdery coatings on the shale fragments. The B horizon grades into fragmental calcareous shale.

Vegetation: chamise, buckbrush, mountain mahogany, interior live oak, toyon, scattered elderberry, annual and perennial grasses.

VISTA FAMILY

The Vista family consists of moderately deep to deep, well drained soils that formed in material weathered from granitic, sedimentary, or gneissic rocks. The soils are on mountainsides, ridges, alluvial fans, and dissected pediments. Slopes range from 2 to 70 percent. Elevation ranges from 1,400 to 5,200 feet. Annual precipitation is 13 to 30 inches and typically is about 20 inches.

Taxonomic class: These soils are coarse-loamy, mixed, thermic Typic Xerochrepts.

Typical pedon of Vista family, in an area of Vista family, 5 to 30 percent slopes, under annual grasses at an elevation of 3,800 feet:

A1-0 to 9 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine and fine tubular and interstitial pores; 5 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B21-9 to 29 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine random roots; many very fine and fine tubular and interstitial pores; 5 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B22-29 to 50 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/6) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; many very fine and fine tubular and interstitial pores; 5 percent pebbles; slightly acid (pH 6.5); gradual smooth boundary.

C-50 to 60 inches; very pale brown (10YR 7/4) gravelly coarse sandy loam, brownish yellow (10YR 6/6) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; many very fine and fine interstitial pores; 15 percent pebbles; slightly acid (pH 6.5).

Type location: Approximately 1 mile east of Sky Haven Ranch on Forest Road 7N03; 1,000 feet west and 800 feet north of the SE corner of sec. 24, T. 7 N., R. 15 W., Lake Hughes Quadrangle.

Range in characteristic: Depth to a paralithic contact is 22 to 60 inches. Mean annual soil temperature is 60 to 70 degrees F. The solum is loam, sandy loam, fine sandy loam, coarse sandy loam, or their gravelly equivalents. Gravel makes up 0 to 20 percent of the volume. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 6/3, 5/4, 5/3, 4/4, or 4/2; it has moist color of 10YR 4/3, 3/4, 3/3, 3/2, or 2/2 or 7.5Y 4/4.

The B2 horizon has dry color of 10YR 7/4, 6/4, 6/3, 5/4, 5/3, or 4/4 or 7.5YR 5/4; it has moist color of 10YR 6/4, 4/4, 4/3, or 3/4 or 7.5YR 4/4. The clay content is estimated to average less than 18 percent and is slightly higher than in the A horizon. In some pedons this horizon has clay bridges between mineral grains and colloid stains on mineral grains. Also, in some pedons, the B2 is directly underlain by highly weathered granitic rock (Cr horizon).

The C horizon has dry color of 10YR 7/4, 6/3, or 5/4; 2.5Y 5/4; or 7.5YR 6/6. It has moist color of 10YR 6/6, 4/4, or 4/3; 2.5Y 4/4; or 7.5YR 5/4. It has the same textures as the solum, but it can also be loamy sand.

Vegetation: chamise, buckwheat, yerba santa, mustard, annual grasses; Coulter pine plantations.

WATERMAN FAMILY

The Waterman family consists of shallow, excessively drained soils that formed in material weathered from granitic rocks. The soils are on mountainsides and narrow ridges with slopes of 30 to 70 percent slopes at elevations of 5,000 to 8,000 feet. Annual precipitation is 23 to 33 inches.

Taxonomic class: These soils are sandy-skeletal, mixed, mesic Lithic Xerorthents.

Typical pedon of Waterman family, in an area of Waterman-Springdale-Pacifico families complex, 30 to 70 percent slopes, under Jeffrey pine at an elevation of 6,800 feet:

A1-0 to 3 inches; light brownish gray (10YR 6/2) gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grained; loose, very friable; few very fine and fine roots; many fine interstitial pores; 25 percent pebbles, 5 percent cobbles; slightly acid (pH 6.2); clear smooth boundary.

C-3 to 10 inches; light gray (10YR 7/1) very gravelly loamy sand, brown (10YR 5/3) moist; single grained; soft, very friable; common fine, medium, and coarse roots; 40 percent pebbles, 5 percent cobbles; neutral (pH 6.9); abrupt wavy boundary.

R-10 inches; highly fractured, hard granodiorite, which can be broken out into cobble-sized pieces; roots in the fractures.

Type location: Above the Angeles Crest Highway, 75 feet south of the turnout at Cloudburst Canyon Drainage and 50 feet up from the road; 400 feet east and 1,400 feet south of the NW corner of sec. 16, T. 3 N., R. 10 W., Waterman Mountain Quadrangle.

Range in characteristics: Depth to a fractured lithic contact is 10 to 19 inches. The mean annual soil temperature at the contact is 47 to 59 degrees F. The profile is moderately acid to neutral (pH 5.6 to 7.3).

The A horizon has dry color of 10YR 6/2, 5/4, 5/3, 5/2, or 4/3 or 2.5Y 6/2 and moist color of 10YR 4/3, 4/2, 3/3, or 3/2. It is gravelly loamy sand, gravelly loamy coarse sand, very gravelly loamy sand, or very gravelly loamy coarse sand and averages 15 to 50 percent rock fragments which are mostly of pebble size.

The C horizon has dry color of 10YR 7/2, 7/1, 6/4, 6/3, 5/6, 5/4, or 5/3 or 2.5Y 6/2 and moist color of 10YR 5/3, 4/4, or 4/3 or 2.5Y 4/2. It is very gravelly loamy sand, cobbly loamy sand, gravelly loamy coarse sand, extremely gravelly loamy sand, or very gravelly sand and averages 35 to 90 percent rock fragments.

A Cr horizon is present in some pedons between the C horizon and the lithic contact.

Vegetation: Jeffrey pine, incense-cedar, sugar pine, white fir, canyon live oak, mountain whitethorn, manzanita, and scattered annual grasses.

WINTHROP FAMILY

The Winthrop family consists of deep, somewhat excessively drained soils that formed from colluvial material weathered from granitic rocks. The soils are on colluvial slopes. Slopes range from 15 to 80 percent, and elevation is 2,000 to 7,000 feet. Annual precipitation is 27 to 39 inches.

Taxonomic class: These soils are sandy-skeletal, mixed, mesic Entic Haploxerolls.

Typical pedon of Winthrop family, in an area of Stukel-Sur-Winthrop families complex, 60 to 100 percent slopes, under canyon live oak at an elevation of 3,300 feet:

A11-0 to 10 inches; brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; soft, very friable; many very fine and fine roots, common medium roots; many very fine and fine interstitial pores; 25 percent pebbles; neutral (pH 7.0); clear smooth boundary.

A12-10 to 12 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable; many very fine and fine roots, common medium roots; many very fine and fine tubular and interstitial pores; 30 percent pebbles, 10 percent cobbles; slightly acid (pH 6.5); gradual smooth boundary.

C1-12 to 33 inches; pale brown (10YR 6/3) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable; few very fine and fine roots, common medium roots; many micro interstitial pores; 30 percent pebbles, 10 percent cobbles; slightly acid (pH 6.5); gradual wavy boundary.

C2-33 to 60 inches; pale brown (10YR 6/3) very gravelly sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable; few very fine roots; many very fine interstitial pores; 60 percent pebbles; slightly acid (pH 6.5).

Type location: Roadcut on the Red Box-Rincon Road (FR 2N24), about 2 miles up from the West Fork Station; 1,200 feet east and 750 feet north of the SW corner of sec. 21, R. 11 W., T. 2 N., Mount Wilson Quadrangle.

Range in characteristics: The soil is more than 60 inches deep. The mean annual soil temperature at 20 inches is 47 to 59 degrees F.

The A horizon has dry color of 10YR 5/3, 5/2, 4/3, 4/2, 4/1, or 3/2; it has moist color of 10YR 3/3, 3/2, or 2/1. Below 10 inches, dry color may be 10YR 6/3 and moist color 10YR 4/3. It is very gravelly coarse sandy loam, loamy sand, gravelly loamy sand, very gravelly loamy sand, or extremely cobbly loamy sand and averages 10 to 75 percent rock fragments. Reaction is strongly acid to neutral (pH 5.1 to 7.3).

The C horizon has dry color of 10YR 7/3, 6/4, 6/3, 5/4, or 5/3 or 2.5Y 6/2 or 5/2; it has moist color of 10YR 5/4, 5/3, 4/3, 4/2, or 3/3 or 2.5Y 4/2. It is gravelly loamy coarse sand, very gravelly loamy sand, extremely cobbly loamy sand, very gravelly coarse sand, or extremely cobbly sand and averages 35 to 75 percent rock fragments. Reaction is moderately acid to neutral (pH 5.6 to 7.3).

Vegetation: bigcone Douglas-fir, canyon live oak, Jeffrey pine, mountain whitethorn, silktassel, yucca, mountain mahogany, rabbitbrush, ceanothus, buckwheat, incense-cedar, and scattered perennial grasses.

WRENTHAM FAMILY

The Wrentham family consists of deep, well drained soils that formed in colluvial material weathered from granitic rock, gneiss, gabbro, or diorite. The soils are on colluvial slopes at an elevation of 2,200 to 6,000 feet. Slopes range from 60 to 80 percent. Annual precipitation is 20 to 26 inches.

Taxonomic class: These soils are loamy-skeletal, mixed, mesic Pachic Haploxerolls.

Typical pedon of Wrentham family, in an area of Tollhouse-Stukel-Wrentham families complex, 60 to 90 percent slopes, under scrub oak at an elevation of 4,500 feet:

O1-3 to 0 inches; partly decomposed oak leaves.

A1-0 to 8 inches; very dark grayish brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; 15 percent pebbles; neutral (pH 6.6); clear wavy boundary.

B21-8 to 30 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; 35 percent pebbles, 10 percent cobbles; neutral (pH 6.6); gradual wavy boundary.

B22-30 to 58 inches; light olive brown (2.5Y 5/4) very gravelly loam, olive brown (2.5Y 4/3) moist; weak medium subangular blocky structure; slightly hard,

friable, nonsticky and slightly plastic; few very fine and fine roots, common medium and coarse roots; many very fine and fine interstitial pores; 50 percent pebbles, 10 percent cobbles; neutral (pH 6.6); gradual wavy boundary.

R-58 inches; hard, highly fractured gneiss.

Type location: Roadcut on Mendenhall Ridge Road (FR 3N32) between Mendenhall Saddle and Iron Mountain Saddle; 2,500 feet east and 1,500 feet south of the NW corner of sec. 18, T. 3 N., R. 13 W., Sunland Quadrangle.

Range in characteristics: Depth to a lithic contact is 48 to more than 60 inches. The mean annual soil temperature at a depth of 20 inches is 50 to 59 degrees F. The soil profile is slightly acid to neutral (pH 6.1 to 7.3).

The A horizon has dry color of 10YR 3/3, 3/2, or 3/1 or 2/5Y 3/2 and moist color of 10YR 2/2 or 2/1. It is gravelly loam or stony sandy loam and averages 15 to 35 percent rock fragments.

The B2 horizon has dry color of 10YR 5/4, 5/3, 4/6, 4/3, or 4/2 or 2/5Y 5/2 and moist color of 10YR 3/3 or 3/2 or 7.5YR 3/2. It is very gravelly loam, cobbly loam, very cobbly loam, very stony sandy loam, or very stony loamy sand. Rock fragments make up 35 to 60 percent of the horizon. Some pedons do not have a B2 horizon.

Vegetation: scrub oak, interior live oak, canyon live oak, whitethorn, ceanothus, mountain mahogany, chamise, scattered bigcone Douglas-fir, annual and perennial grasses.

XERORTHENTS

Xerorthents are shallow to deep, somewhat excessively drained soils that formed in material weathered from anorthosite, granitic, or metamorphic rocks. They are on mountainsides and ridges at elevations of 3,400 to 7,500 feet. Slopes range from 15 to 90 percent. Annual precipitation is 15 to 35 inches.

Depth to a lithic or paralithic contact is 4 to 60 inches. Mean annual soil temperature is 47 to 59 degrees F. The soils are usually dry in the moisture control section from late in May to October on the desert side and from late in June through September in the interior regions.

The A horizon is 3 to 19 inches thick. It has dry color of 10YR 6/4, 6/2, 5/3, 5/2, or 4/1; 2.5Y 6/4 or 5/2; or 5Y 6/1. It has moist color of 10YR 5/3, 4/3, 3/3, or 3/2; 2.5Y 5/3 or 4/2; or 5Y 3/2. It is cobbly loam, sandy loam, gravelly sandy loam, very cobbly sandy loam, gravelly sandy clay loam, or very gravelly loamy sand and averages 0 to 60 percent rock fragments. Reaction is slightly acid to moderately alkaline (pH 6.1 to 8.4). In some pedons the A horizon is directly underlain by the paralithic contact. In other pedons a C horizon separates

the A horizon from the contact.

The C horizon is 3 to 14 inches thick. It has dry color of 10YR 7/2, 6/3, 6/1, or 5/4 or 5Y 7/1 or 6/1; it has moist color of 10YR 5/4, 5/3, or 4/3; 2.5Y 3/2; or 5Y 5/2. It is very gravelly loam, gravelly sandy loam, extremely gravelly sandy loam, gravelly sandy clay loam, or extremely gravelly loamy sand and averages 5 to 85 percent rock fragments. Reaction is very strongly acid to moderately alkaline (pH 4.5 to 8.4). It grades into strongly weathered rock or highly fractured hard bedrock.

Vegetation: Below 5,500 feet elevation and under 25 inches of precipitation: bigcone Douglas-fir, canyon live oak, and chaparral shrubs; 5,000 to 6,000 feet: Coulter pine, scattered canyon live oak and Jeffrey pine, manzanita, mountain mahogany, and mountain whitethorn; above 6,000 feet: Jeffrey pine, white fir, and sugar pine. On the desert side: pinyon, juniper, buckwheat, Mormon tea, scrub oak, big sagebrush, rabbitbrush, Joshua tree, and annual grasses.

Formation of the Soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, and explains the processes of soil formation.

Soil is a mixture of rocks and minerals, organic matter, and water and air, in varying proportions. The factors that cause soils to differ are (1) the physical and chemical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) biological forces; (4) relief, or lay of the land; and (5) the length of time the forces of development have acted on the soil material. The relative importance of each factor differs from place to place, but generally the interaction of all the factors determines the kind of soil that forms in any given place.

Parent Material

The parent material of the soils in the survey area is both residual and transported. The parent material is the weathered rock or consolidated material from which soils form. The geologic parent materials in the survey area exhibit wide diversity of age and rock types.

The type of parent material has a strong influence on soil development and related properties. For example, soils developing over shale and fine-grained sandstone typically have finer textures and a higher percentage of silt particles. Soils that formed over schist and gneisses mostly have darker colors throughout their profile than soils developing over granitic and sedimentary rocks.

The main mass of the mountain area consists of crystalline metamorphic and granitic rocks. The crystalline metamorphic rocks are banded gneisses and schists with some scattered lenses of crystalline limestone. The granitic rocks are quartz diorite, granodiorite, and in one area, anorthosite.

The largest body of pre-Cretaceous metamorphic rocks is found in the San Gabriel River drainage and is called the San Gabriel Formation. It starts at a point east of Mount Wilson and continues east to the vicinity of San Antonio Peak then northwest to an area north of Islip Mountain. It is also found north of Pasadena and extends to a point northeast of San Fernando. The area contains numerous bodies of diorite and granodiorite. The entire formation has been extensively faulted, fractured, twisted, and contorted so that it is now very unstable and is weathering rapidly.

In the western part of the forest (Saugus unit), marine and nonmarine sedimentary rocks ranging in age from Oligocene to Pleistocene occur extensively. Rock types

include sandstone, shale, and conglomerate. Two large formations of metamorphic rocks consisting of Precambrian gneiss and Pelona schist (pre-Cretaceous) make up about one-third of the Saugus portion. The remaining Saugus area is composed primarily of Mesozoic granitic rocks. Recent alluvium deposits occur in many of the canyon bottoms and stream channels.

Climate

Climate has a major influence on the formation of soils in the San Gabriel Mountains. Climate and vegetation are the active influences on soil formation.

Moisture and heat influence the amount and kind of vegetation that grows, the rate at which minerals weather, and the removal of material from the different soil horizons or the accumulation of material in them.

The summers are virtually rainless except at the higher elevations where occasional thundershowers may occur. The winters are cool, and most precipitation falls between late in November and March. The soils are usually still moist late in spring, but late in summer these same soils are severely dry. Soil moisture is considered the most limiting factor for plant growth.

The maritime influence is very important, particularly along the front or southwestern part of the forest. The desert-facing slopes are strongly influenced by the rain shadow effect. High-intensity winter storms greatly increase the hazard of soil movement and runoff.

Biological Activity

Vegetation is the dominant biological force that affects the formation of soils. The main effects of vegetation result from the accumulation of organic material in the surface layer and the penetration of roots into the soil. Plants, small animals, insects, bacteria, fungi, and other organisms add organic matter to the soil. The activity of fauna in the cycle of transferring nutrients and returning them to the surface soil depends largely on the vegetation that grows on the soil.

The natural vegetation in the Angeles National Forest includes grasses, forbs, chaparral, hardwoods, mixed conifers, and riparian vegetation. The chaparral plant community consists of moderately dense to dense stands of evergreen, broadleaf shrubs. The hardwood vegetation type includes several species of oak and is found along drainage bottoms and at middle elevations on northern aspects. The mixed conifer type includes pines, bigcone Douglas-fir, white fir, and incense-cedar and is

found primarily above 4,500 feet. The riparian vegetation consists of oaks, alders, sycamore, cottonwood, and willows.

The north slopes are protected from direct sunlight. Water utilization by plants is more efficient because evaporation is less. The soils on north exposures support more vegetation. The vegetation adds organic material to the soil and influences the color, structure, and physical condition of the soil. In this survey area, soils forming on north aspects are more prone to have a mollic epipedon.

Vegetation provides shade and surface duff or litter, which reduces runoff and erosion. Leaf litter or duff also insulates the soil against heat and cold and reduces the rate of evaporation, thus increasing the length of time favorable for bacterial activity. Roots loosen the soil material and add organic matter. Sparse vegetative growth does not contribute an appreciable amount of organic matter. Soils that developed under chamise vegetation are low in organic matter and often have a light-colored surface layer and sparse litter deposits. Soils that developed under dense, mixed chaparral types normally have a higher organic matter content and a darker colored surface layer; duff or litter layers may be several inches thick.

Time

Generally, the age of a soil is related to the degree of profile development and horizon differentiation within the soil. A soil that has little or no horizonation in the profile is considered young. Most of the soils in the survey area are Entisols, for example, Trigo and Exchequer soils. A soil that is strongly developed is considered old or mature. Such soils might contain a clay enriched subsoil or a silica-cemented layer directly below the subsoil. The maturity of any one soil depends on the interaction of the soil-forming factors. A long period of time is generally required for soil formation. Factors that favor rapid soil profile development are: a humid, tropical climate; lush vegetation; unconsolidated, permeable parent material rich in weatherable minerals; and nearly level to gently sloping topography. Factors that contribute to

a slow rate of development are: an arid, cold climate; little or no vegetation; dense, hard, siliceous rock; and very steep slopes.

Relief

Relief influences soil formation primarily by its effect on drainage, runoff, and water erosion. Variations in exposure to the sun and wind and in air drainage also influence soil formation.

The San Gabriel Mountains represent mature topography that has well-developed drainage patterns. Slopes are steep, ridges are sharp, and valleys are narrow. Earthquake faulting is continuing to build or uplift the main mountain mass to the point where it exceeds the natural angle of repose for the geologic materials.

Relief is a very important factor in soil formation on steep slopes. Soils on very steep slopes, especially if not densely covered with vegetation, tend to have more erosion than soils on more gentle slopes. In very steep forest areas, the soil material may be removed by erosion as fast as it forms.

Very steep soils generally have rapid runoff and are shallow. The characteristics of Trigo family soils have been determined in part by their steep slopes. Associated with these shallow residual soils are deep colluvial soils. These colluvial soils are noncohesive and unstable and contain a high percentage of coarse fragments in the soil profile. Once the protective vegetation on these soils is removed, only minor disturbance is needed to cause the soils to move downslope.

Because of the east-west orientation of the San Gabriel Mountains, north- and south-facing slopes have a pronounced influence on soil development and vegetation composition. Aspect and slope of the soil affect the soil temperature. Sur soils are generally on north-facing slopes, which are cooler and support more dense vegetation. More vegetation generally results in darker colors in the surface soil. On broad ridgetops at higher elevations, soils are generally deeper. This is characteristic of the Oak Glen soils.

Soil Properties

The results of physical and chemical analyses of selected soils are given in table 5. The data are for soils sampled at carefully selected sites. The pedons are typical of the families and are described in the section "Taxonomic Unit Descriptions". Soil samples were analyzed by the U.S. Department of Agriculture, Soil

Conservation Service, National Soil Survey Laboratory, Lincoln, Nebraska. Most determinations, except those for grain-size analysis, were made on soil material less than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis.

TABLE 5.—PHYSICAL AND CHEMICAL PROPERTIES OF SELECTED SOILS

Absence of an entry indicates that data were not available or were not estimated.

| Soil Name and Sample No. | Depth in Horizon | <2 mm Particle Size | | | Sand | | | | | Water Content, 15-bar tension | | | |
|--------------------------------------|------------------------|------------------------|------|------|----------------------|-------------------|----------------------|---------------------|-------------------------|-------------------------------|------------------------|--------------------------------|------|
| | | Clay | Silt | Sand | Very Coarse 2-1mm | Coarse 1-0.5mm | Medium 0.5-0.10mm | Fine 0.25-0.10mm | Very Fine 0.10-.05mm | Percentage | Ratio to Total Clay | Organic Carbon pct. of <2mm | |
| Calcixerollic Xerochrepts | | | | | | | | | | | | | |
| 576CA-037-108 | A1 | 0-5 | 29.5 | 57.2 | 13.3 | 0.4 | 1.0 | 0.8 | 1.9 | 9.2 | 10.5 | 0.36 | 1.67 |
| | B1 | 5-16 | 32.1 | 45.0 | 22.9 | .7 | 3.9 | 4.7 | 5.4 | 8.2 | .32 | 10.2 | .45 |
| | B2 | 16-40 | 30.4 | 47.3 | 22.3 | .8 | 3.4 | 4.7 | 5.0 | 8.4 | .35 | 10.5 | .28 |
| | C | 40-43 | 27.4 | 48.7 | 23.9 | 1.0 | 4.4 | 5.5 | 5.4 | 7.6 | .40 | 11.0 | .21 |
| Calleguas Family | | | | | | | | | | | | | |
| 576CA-037-107 | A1 | 0-11 | 20.3 | 72.3 | 7.4 | 1.3 | 2.2 | 1.2 | 1.3 | 1.4 | .66 | 13.4 | |
| | C1 | 11-19 | 14.5 | 80.2 | 5.3 | .4 | .7 | .4 | 1.1 | 2.7 | .83 | 12.1 | |
| | C2 | 19 | 5.3 | 91.0 | 3.7 | .2 | .2 | .2 | .9 | 2.2 | 1.11 | 5.9 | |
| Exchequer Family | | | | | | | | | | | | | |
| 576CA-037-100 | A11 | 0-13 | 7.6 | 30.4 | 62.0 | 24.9 | 9.9 | 4.6 | 9.0 | 13.6 | .58 | 4.4 | .78 |
| | A12 | 3-10 | 9.5 | 30.4 | 60.1 | 18.8 | 10.1 | 5.7 | 10.7 | 14.8 | .57 | 5.4 | .53 |
| Hanford Family | | | | | | | | | | | | | |
| 576CA-037-102 | A1 | 0-13 | 5.5 | 14.9 | 79.6 | 8.9 | 12.9 | 11.2 | 25.3 | 21.3 | .55 | 3.0 | .33 |
| | C1 | 13-36 | 6.8 | 17.2 | 76.0 | 14.9 | 14.4 | 10.5 | 20.8 | 15.4 | .51 | 3.5 | .30 |
| | C2 | 36-53 | 6.5 | 18.3 | 75.2 | 18.4 | 11.7 | 9.1 | 19.5 | 16.5 | .57 | 3.7 | .12 |
| | C3 | 53-61 | 9.0 | 23.9 | 67.1 | 13.5 | 11.3 | 7.9 | 17.8 | 16.6 | .57 | 5.1 | .09 |
| Pismo Family | | | | | | | | | | | | | |
| 576CA-037-105 | A1 | 0-10 | 2.4 | 14.8 | 82.8 | 4.4 | 17.8 | 16.5 | 28.6 | 15.5 | 1.63 | 3.9 | 1.08 |
| Typic Xerochrepts | | | | | | | | | | | | | |
| 576CA-037-105 | A11 | 0-3 | 11.0 | 31.0 | 58.0 | 6.2 | 11.1 | 9.4 | 17.3 | 14.0 | .94 | 10.3 | 1.29 |
| | A12 | 3-14 | 7.2 | 34.4 | 58.4 | 5.7 | 10.0 | 9.9 | 18.0 | 14.8 | 1.35 | 9.7 | .61 |
| | C1 | 14-23 | .8 | 38.7 | 60.5 | 1.4 | 7.0 | 8.5 | 21.7 | 21.9 | | 10.3 | .23 |
| | C2 | 23 | 2.4 | 38.0 | 59.6 | 4.5 | 11.1 | 11.1 | 19.2 | 13.7 | | 9.7 | |
| Vertic Xerochrepts | | | | | | | | | | | | | |
| 576CA-037-106 | A1 | 0-11 | 53.1 | 42.9 | 4.0 | .3 | .1 | .3 | .9 | 2.4 | .39 | 18.9 | 1.97 |
| | C1 | 11-28 | 31.5 | 46.7 | 21.8 | .1 | .6 | .8 | 5.1 | 15.2 | .56 | 17.6 | .74 |
| | C2 | 28-41 | 27.2 | 55.6 | 17.2 | .5 | .5 | .5 | 4.6 | 11.1 | .53 | 14.5 | .41 |
| Xerorthents | | | | | | | | | | | | | |
| 576CA-037-14 | A1 | 0-5 | 2.8 | 17.4 | 79.8 | 25.5 | 15.9 | 9.4 | 17.3 | 11.7 | 1.32 | 3.7 | 1.69 |
| | C1 | 5-17 | 6.1 | 14.8 | 79.1 | 15.3 | 15.6 | 11.7 | 21.6 | 14.9 | .51 | 3.1 | .58 |

Tr means trace.

TABLE 5.-PHYSICAL AND CHEMICAL PROPERTIES OF SELECTED SOILS-CONTINUED

| Soil Family and Sample No. | Horizon | Depth in Inches | NH4OAc Extractable Bases meq/100 grams | | | | | Ratio Ca to Mg | Carbonate | CEC NH4OAc | % Base Saturation NH4OAc | pH H2O | pH CaCl2 |
|--------------------------------------|---------|-----------------------|---|-----|-----|-----|------|----------------------|-----------|---------------|--------------------------------|-----------|-------------|
| | | | Ca | Mg | Na | K | Sum | | | | | | |
| Calcixerollic Xerochrepts | | | | | | | | | | | | | |
| 567CA-037-108 | A1 | 0-5 | 26.9 | 1.6 | 0.1 | 1.0 | 29.6 | | Tr | 22.6 | 131 | 7.4 | 7.1 |
| | B1 | 5-16 | 34.0 | 1.0 | .2 | .5 | 35.7 | | Tr | 35.7 | 140 | 7.9 | 7.5 |
| | B2 | 16-40 | | 1.1 | .2 | .4 | | | 1 | 25.3 | | 8.0 | 7.4 |
| | C | 40-43 | | 2.1 | .3 | .4 | | | 3 | 22.6 | | 8.0 | 7.4 |
| Calleguas Family | | | | | | | | | | | | | |
| S76CA-037-107 | A1 | 0-11 | | 2.4 | .1 | .6 | | | Tr | 43.6 | | 7.8 | 7.4 |
| | C1 | 11-19 | | 2.4 | .1 | .6 | | | 4 | 37.6 | | 8.1 | 7.6 |
| | C2 | 19 | | 1.3 | .1 | .3 | | | 17 | 18.8 | | 8.1 | 7.5 |
| Exchequer Family | | | | | | | | | | | | | |
| S76CA-037-100 | A11 | 0-3 | 10.0 | 1.4 | .1 | .4 | 11.9 | 7.1 | | 11.5 | 104 | 7.3 | 6.9 |
| | A12 | 3-10 | 12.8 | 2.4 | .1 | .1 | 15.4 | 5.3 | | 15.6 | 99 | 7.3 | 7.0 |
| Hanford Family | | | | | | | | | | | | | |
| S76CA-037-102 | A1 | 0-13 | 5.5 | 1.0 | .1 | .4 | 7.0 | 5.5 | | 7.3 | 96 | 6.9 | 6.4 |
| | C1 | 13-36 | 6.4 | 1.7 | .2 | .3 | 8.6 | 3.8 | | 8.6 | 100 | 7.1 | 6.1 |
| | C2 | 36-53 | 6.9 | 2.3 | .1 | .3 | 9.6 | 3.0 | | 9.9 | 97 | 6.9 | 6.3 |
| | C3 | 53-61 | 10.1 | 3.3 | .1 | .3 | 13.8 | 3.1 | | 14.4 | 96 | 7.2 | 6.4 |
| Pismo Family | | | | | | | | | | | | | |
| S76CA-037-103 | A1 | 0-10 | | | | | | | | 9.9 | | 6.5 | 5.7 |
| Typic Xerochrepts | | | | | | | | | | | | | |
| S76CA-037-105 | A11 | 0-3 | | | | | | | | 26.2 | | 6.9 | 6.5 |
| | A12 | 3-14 | | | | | | | | 27.1 | | 6.7 | 6.0 |
| | C1 | 14-23 | | | | | | | | 31.1 | | 6.4 | 5.7 |
| | C2 | 23 | | | | | | | | 27.8 | | 6.6 | 5.5 |
| Vertic Xerochrepts | | | | | | | | | | | | | |
| S76CA-037-106 | A1 | 0-11 | 46.2 | 6.3 | .2 | 1.4 | 54.1 | | | 44.4 | 122 | 6.7 | 6.4 |
| | C1 | 11-28 | | 4.4 | .2 | .9 | | | 2 | 41.0 | | 7.8 | 7.4 |
| | C2 | 28-41 | | 5.6 | .2 | .7 | | | 9 | 30.3 | | 7.8 | 7.4 |
| Xerorthents | | | | | | | | | | | | | |
| S76CA-037-104 | A1 | 0-5 | | | | | | | | 10.1 | | 6.4 | 5.4 |
| | C1 | 5-17 | | | | | | | | 6.7 | | 6.5 | 5.7 |

Tr means trace.

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Glossary

Alkaline soil. Any soil having a pH higher than 7.0.
(See Reaction, soil.)

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alluvial fan. A sloping, fan-shaped mass of sediment deposited by a stream where it emerges from an upland onto a plain.

Aspect. The direction a slope is facing; its exposure in relation to the sun.

Association. An area in which two or more kinds of soil or a soil and miscellaneous areas are in some regular pattern and are individually large enough to be mapped separately at a scale of about 1:20,000.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined by 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.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

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

Calcareous soil. A soil containing enough calcium carbonate (commonly occurring with magnesium carbonate) to effervesce (fizz) visibly when treated with

cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels.

Claypan. A dense, compact layer in the subsoil having a much higher clay content than the overlying material, from which it is separated by a sharply defined boundary; formed by downward movement of clay or by synthesis of clay in place during soil formation. Claypans mainly are hard when dry and plastic and sticky when wet. They generally impede the movement of water and air and the growth of plant roots.

Cobble. A fragment of rock 3 to 10 inches in diameter.

Colluvium. A deposit of soil material, rock fragments, or both, accumulated on steep slopes or at the base of steep slopes primarily by the action of gravity but facilitated by the overland flow of water.

Complex. An area where two or more kinds of soil or a soil and miscellaneous areas are in such an intricate geographical pattern that they cannot be mapped separately at a scale of 1:20,000.

Conglomerate. A coarse-grained rock derived from preexisting rocks or minerals and composed of rounded to subangular rock fragments of gravel size or larger, commonly cemented in a matrix of finer material. Cements include silica, calcium carbonate, and iron oxides.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are-

Loose - Noncoherent when dry or moist; does not hold together in a mass.

Friable - When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm - When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic - When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky - When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard - When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft - When dry, breaks into powder or individual grains under very slight pressure.

Consociation. Map unit in which only one kind of soil or miscellaneous area dominates.

Depth class. The distance from the surface of the soil to underlying bedrock, consolidated substratum, or other material that would greatly restrict either root distribution or soil moisture and nutrient supply.

| | |
|-----------------|---------------------|
| Very shallow | less than 10 inches |
| Shallow | 10 to 20 inches |
| Moderately deep | 20 to 40 inches |
| Deep | 40 to 60 inches |
| Very deep | more than 60 inches |

Drainage class. Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained. Water removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained. Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained. Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained. Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained. Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained. Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, or nearly continuous rainfall, or a combination of these.

Very poorly drained. Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Very poorly drained soils are commonly level or depressed and are frequently ponded.

Erosion. The wearing away of the land surface by running water, waves, moving ice, wind, or other geological processes, such as mass wasting or gravitational creep. Also, the detachment and movement of soil or rock. Geologic erosion refers to natural processes occurring over long periods of time. Accelerated erosion is erosion much more rapid than natural geologic erosion, primarily as a result of the

influence of the activities of man or, in some cases, of animals.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. The steep face frequently presented by the abrupt termination of stratified rocks.

Flood plain. The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Granitic rock. Light-colored, coarse-grained rock formed by solidification from a molten or partially molten state.

Gravel. Collective term for fragments of rock up to 3 inches in diameter; a mass of pebbles.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

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

A horizon. The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon. The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon. The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is

presumed to have formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock that formed from the cooling and solidification of magma and that has not been changed appreciably since its formation.

Inclusions. Soils occurring in the map unit that are not identified by their names because the area they occupy is too small.

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.

Lithic contact. A boundary between soil and coherent underlying material. The underlying material must be continuous within the limits of a pedon except for cracks produced in place without significant displacement of the pieces. Cracks should be few, and their average horizontal spacing should be 10 cm or more. When moist, the material cannot be dug with a spade. If a single mineral, it must have a hardness by Mohs' scale of 3 or more. If it is not

a single mineral, chunks of gravel size that can be broken out must not disperse during shaking for 15 hours in water or in sodium hexametaphosphate solution.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

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

Miscellaneous areas. Types of land that have little or no natural soil material capable of supporting vegetation (for example, Rock outcrop, Riverwash).

Munsell notation. A designation of color by degrees of the three single variables hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil in which the surface layer, at least to normal plow depth, is neither acid nor alkaline in reaction. For most practical purposes it is a soil with a pH range from 6.6 to 7.3. (See Reaction, soil.)

Organic matter, soil. The organic fraction of the soil including plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by organisms living in the soil. Soil organic matter commonly is determined by measuring the amount of organic material in a soil sample passed through a 2-millimeter sieve.

Paralithic contact. A boundary between soil and continuous coherent underlying material. If the underlying material is a single mineral, it has a hardness by Mohs' scale of less than 3. If it is not a single mineral, chunks of gravel size that can be broken out will disperse more or less completely during 15 hours of end-over-end shaking in water or in sodium hexametaphosphate solution and, when moist, the

material can be dug with difficulty with a spade. There may be cracks in the rock, but the horizontal spacing between cracks should be 10 cm or more.

Parent material. The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of soils is developed by pedogenic processes.

Pebble. A fragment of rock, up to 3 inches in diameter. An individual piece of gravel.

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

Pediment. The foot slope component of an erosional slope.

Pedogenesis. Soil genesis or soil formation; the natural development of horizons. (See Soil formation factors.)

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.

Phase, soil. A subdivision of a soil family or other unit in the soil classification system, based on differences in the soil that affect its use and management but are too small to justify making it a separate taxonomic unit. The phases used in this survey are based on differences in slope, climate, depth, or stoniness. Phases used are:

Moderately deep. Soils that range in depth between 20 and 40 inches to the top of a limiting layer.

Very stony. Sufficient stones on surface to make tiliage of crops impractical. Stones occupy about 0.1 to 3.0 percent of the surface.

Cool. Soils occurring at an elevation ranging from 4,400 to 8,200 feet and having a mean annual soil temperature

ranging from 47 to 59 degrees F.

Cold. Soils occurring at higher elevations, generally above 5,400, feet and having a mean annual soil temperature lower than 47 degrees F.

Warm. Soils occurring at an elevation generally below 5,000 feet and having mean annual soil temperatures higher than 59 degrees F.

Dry. Droughty soils that have lower soil moisture than is typical, affecting the type of vegetation they can support. Lower soil moisture may be due to low precipitation, aspect, or elevation.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Pleistocene. The ice age or glacial epoch, from 10,000 to 1 million years ago.

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

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity (pH) is expressed as:

| | |
|---------------------|------------|
| extremely acid | below 4.5 |
| very strongly acid | 4.5 to 5.0 |
| strongly acid | 5.1 to 5.5 |
| medium acid | 5.6 to 6.0 |
| slightly acid | 6.1 to 6.5 |
| neutral | 6.6 to 7.3 |
| mildly alkaline | 7.4 to 7.8 |
| moderately alkaline | 7.9 to 8.4 |
| strongly alkaline | 8.5 to 9.0 |

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

Residuum or residual soil material. Unconsolidated, weathered, or partly weathered mineral materials accumulated by disintegration of consolidated rock in place.

Riverwash. Barren alluvial land, usually coarse-textured, exposed along streams at low water and subject to shifting during normal high water. A miscellaneous land type.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; in order of increasing size, gravel or pebbles, cobbles, stones, and boulders.

Rubble land. An area with 90 percent or more surface cover of stones and boulders.

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

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. A sedimentary rock containing dominantly sand-sized clastic particles. A cemented or otherwise compacted detrital sediment composed predominantly of quartz grains.

Sediment. Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or ice, and has come to rest on the earth's surface.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

surveys are classified according to the kind and intensity of field examination.

Shale. A sedimentary rock formed by induration of a clay or silty clay deposit and having the tendency to split into thin layers.

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.

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.

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

Soil formation factors. The variables - parent material, climate, organisms, topography, and time - active in and responsible for the formation of soil.

Soil pores. That part of the bulk volume of soil not occupied by soil particles; the interstices or voids.

Soil series. A group of soils having horizons similar in differentiating characteristics and arrangement in the soil profile, except for texture of the surface, slope, and erosion. A basic unit of soil classification, being a subdivision of a family and consisting of soils which are essentially alike in all major profile characteristics except the texture of the A horizon. The soil series is now the lowest category in soil taxonomy. Phases of the soil series are now the major components shown on detailed soil maps in the United States.

Soil survey. The systematic examination, description, classification, and mapping of soils in an area. Soil

Soil temperature regimes are based on mean annual soil temperature and difference between mean summer and mean winter temperature. Soil temperature is determined at a depth of 20 inches (50 cm) or at a lithic or paralithic contact, whichever is shallower. Unless indicated in a higher category, soil temperature classes are used at the family level.

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

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

Strata. Layers in sedimentary rock formations.

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

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. The soil structure grades are structureless, weak, moderate, and strong. Structureless soils are either single-grained (noncoherent) or massive (coherent).

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second

bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

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

Texture modifier. Adjective included in a soil textural class name, based on the percentage of rock fragments in the soil. Examples:

| | |
|--------------------|------------------|
| Gravelly | 15 to 35 percent |
| Very gravelly | 35 to 60 percent |
| Extremely gravelly | over 60 percent |

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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

Water table. The upper surface of ground water or that level in the ground where the water is at atmospheric pressure.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

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