

# Soil Survey of Los Padres 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)*

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# How To Use This Soil Survey

## General Soil Map

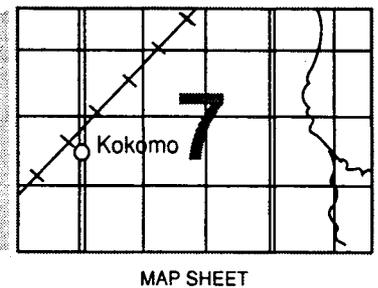
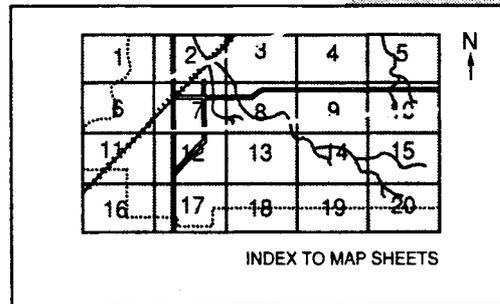
The general soil map, which is the small scale map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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.

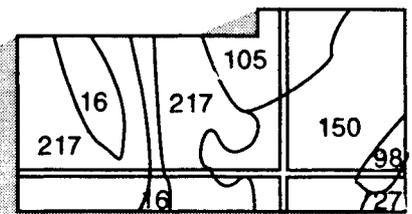
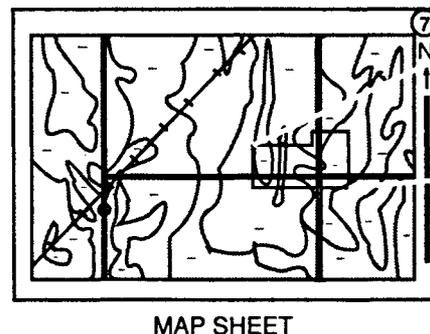
## Detailed Soil Maps

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.



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.



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.

# Los Padres National Forest Area, California

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This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal, state and local agencies. The Forest Service has had the leadership for this soil survey in cooperation with the Soil Conservation Service.

Major fieldwork for this soil survey was performed during the period 1976 - 1980. Soil names and descriptions were approved in 1980. Statements in this publication refer to conditions that existed in 1980.

Soil maps in this soil survey may be copied without permission. Enlargement of these maps, however, could lead to misinterpretation. A larger-scaled map warrants more detail and these maps may not show the small areas of contrasting soils.

Cover: Typical landscape and vegetation of the Santa Ynez Mountains on Millsholm and Millerton Family soils.

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## Foreword

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The Los Padres National Forest Area soil survey covers those portions of Los Padres National Forest that are within the counties of Kern, Los Angeles, San Luis Obispo, Santa Barbara and Ventura. The soil survey was designed to facilitate forestwide resource management planning and to increase the knowledge of our environment. The survey contains predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil.

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 evaluating more intensive soil survey needs. The survey should be used for detailed resource management planning and project level planning and design only after field verification.

Great differences in soil properties can occur even within short distances. Soils may be shallow to bedrock and incapable of producing commercial timber. Others may be seasonally wet or subject to flooding. A low available water capacity can make a soil poorly suited to reforestation. A high water table can make a soil suitable for use as summer range. These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each soil 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 is useful in the conservation, improvement, and productive use of soil, water, vegetation and other resources.



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Location of the Los Padres National Forest Area, California

# Soil Survey of Los Padres National Forest Area, California

By James P. O'Hare and Brent G. Hallock

Soils surveyed by James P. O'Hare, Brent G. Hallock, Gary L. Jackson and Terry Cooper.

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

The LOS PADRES NATIONAL FOREST area covers 1,647,329 acres. Included in the survey area are 211,551 acres of private land, the 149,170 acre San Rafael Wilderness and 19,218 acres of the Santa Lucia Wilderness unit. The survey area covers portions of Santa Barbara (699,048 acres), Ventura (608,080 acres), San Luis Obispo (239,107 acres), Kern (79,029 acres), and Los Angeles (22,065 acres) counties.

## General Nature of the Survey Area

This section provides general information about the Los Padres National Forest Area. The discussion contains the history and development, vegetation, geomorphology, water supply and climate.

The Soil Survey is bounded on the east by the Angeles National Forest. This boundary is roughly parallel to and just west of both the Los Angeles-Ventura County Line and Interstate Highway 5. It is bounded on the north by the San Joaquin and Cuyama Valleys. The northwest extension of the boundary follows the La Panza and Santa Lucia Mountain Ranges. The western boundary is roughly parallel to, but 10 to 30 miles east of, the Pacific Ocean coast line. The southern boundary is roughly parallel to but one to four miles north of the Santa Barbara Channel coast line and extends on to the east to the junction with the Angeles National Forest boundary.

The Los Padres National Forest Area consists of two Divisions and five Ranger Districts. The Main Division is southernmost and is made up of Santa Barbara, Ojai, Mt. Pinos and Santa Lucia Ranger Districts. A second Division farther north is covered by the Monterey Ranger District. The Soil Survey of Monterey County, California, U.S.D.A. Soil Conservation Service provides

soil survey coverage of the Monterey Ranger District. This Soil Survey of the Los Padres National Forest Area covers the four Ranger Districts on the Main Division.

The Los Padres National Forest Area is adjacent to the population centers of Ojai, Santa Barbara, Santa Maria and San Luis Obispo. Forest Service personnel are responsible for protecting the citizens from fire and flood hazards. They are also charged with providing outdoor recreation facilities and the majority of the surface water supply from the secluded watershed. Elevations range from approximately 800 feet to 8,826 feet.

## History and Development

The Chumash Indians were the primary users of land within the Forest's present Main Division at the time of European contact. Our knowledge of the Chumash results from archeological and mission records research, and from references in ethnographic and ethnohistoric accounts. References to the interior are particularly scarce. Two early expeditions into the interior recorded only ten small villages; yet it is here that Chumash rock art, considered among the most spectacular in the United States, reached its peak.

Although early Spanish explorers were impressed by Chumash cultural development, missionization of the Indians brought a rapid population decline and fatal cultural changes. Early estimates of the aboriginal Chumash population ranged from 10,000 to 18,000; by 1832 the Indians registered at the missions (the majority of the population) numbered only 2,471. In 1855, 109 Chumash were settled on 120 acres of land near the Santa Ynez Mission. The remaining 100 acres of the Santa Ynez Indian Reservation is still occupied by a small group of Chumash descendants.

As more people migrated to southern California, it became more important to protect agricultural lands and the developing infrastructure from fire and flood, and to provide for a reliable source of water. Public pressure had reached a point where, by 1898, the first Forest Reserve was established in the area north and east of Santa Barbara. Two other reserves within the present survey area had been established by 1906. Changes in nomenclature and consolidation of units resulted in designation of the Santa Barbara National Forest in 1908. Not until 1938 was the name "Los Padres" formally adopted. Fire control and law enforcement were the primary management responsibilities of these reserves.

The basic purpose for the establishment of Los Padres National Forest was for the management and protection of the highly erodible mountainous watersheds, for the reduction of the off-site (downstream) damages and for the provision of stored domestic water for local communities.

## Vegetation

The map unit descriptions give the common vegetation series found on each soil component of the map unit. Vegetation usually occurs in combination of series making up an association of mixed chaparral, oak woodland grass, oak forest mixed chaparral, etc.

Vegetation cover on upland soils is primarily composed of plants belonging to the chaparral and soft chaparral subformations. Approximately 72 percent of the survey area supports this fire adapted vegetation. Common chaparral series are chamise, ceanothus, manzanita and scrub oak; common soft chaparral series includes California buckwheat, coastal sagebrush, salvia and yucca.

Oak hardwood forests and woodlands cover nearly 15 percent of the survey area and occupy riparian zones and mountain habitats. These forests and woodlands are most common in drainages and on north-facing slopes. Common tree species are blue oak, coast live oak, canyon live oak, willow, California bay, tan oak, madrone, valley oak, western sycamore, and cottonwood.

Conifer forests and woodlands, approximately 6 percent of the survey area, are located mostly at the higher elevations, above 3,000 feet, in drainages and on north-facing slopes. Above 6,000 feet, they occur on both north and south-facing slopes. Common tree species are bigcone Douglas-fir, Coulter pine, knobcone pine, ponderosa pine, Jeffrey pine, Digger pine, juniper, white fir, and sugar pine.

Pinyon pine and/or juniper woodlands make up about 5 percent of the survey area and cover alluvial bottomlands and mountain uplands of the Mt. Pinos Ranger District in the northeast portion of the survey area.

Annual grasslands and areas with sagebrush make up the remainder of the survey area, about 2 percent. Alluvial bottomland and higher elevation valleys such as Lockwood, Cuddy and Cuyama Valleys on the Mt. Pinos Ranger District are vegetated with annual grasses and or sagebrush. Hillslopes of upper Salinas River Valley and natural potreros of the Sierra Madre Range are also vegetated with annual grasses.

## Geomorphology

The Los Padres National Forest Area, is located in the South Coast Range and western portion of the Transverse Range geomorphic provinces. The soil survey area consists of essentially northwest-southeast trending mountains and valleys, with a few approaching east-west.

The northern portion of the survey area includes the Santa Lucia Range, that covers the west half of San Luis Obispo County, the Salinas Basin and the La Panza Range. The Santa Lucia Range is in a mature stage of development. Some of the ridges appear to be remnants of an old erosion surface which has been dissected by streams cutting valleys up to 2500 feet deep. The Suez fault separates the Santa Lucia Range from the coastal strip to the west. The East Huasna and Rinconada faults are on the eastern side of the Santa Lucia Range and form the upper Salinas Basin. The La Panza Range is a result of uplifted bedrock along the La Panza Thrust fault on the west side.

Major streams that drain the westerly slopes of the Santa Lucia Range are, from north to south, the San Luis Obispo Creek, Arroyo Grande Creek and the Huasna River - Alamo Creek drainages. These drainages cut through the complex Santa Lucia Range which consists of metamorphic rocks, such as serpentine at the north end to sedimentary rocks, Monterey shale and unnamed Cretaceous sandstone to the south. The rivers in the northern part of the range have steeper gradients and narrower channels than those in the southern part of the range. Slopes range from 10 to 70 percent but usually exceed 40 percent. The soils at the northern end are moderately deep, with high and very high erosion hazard ratings; soils at the southern end are shallow with very high erosion hazard ratings. The highest elevation is Pine Mountain at 3600 feet.

The Salinas Basin is a lowland that trends northwest from the upper watershed of the La Panza and Santa

Lucia Ranges to the ocean. Elevations vary from 500 to 2,200 feet above sea level. Topography varies from nearly level terrace lands to steep hills with up to 600 feet of relief. The area has been eroded from a relatively featureless depositional plain and is now in youthful to mature stages of erosion. Most smaller streams have very thin deposits of alluvium and appear to be eroding downward at present. The ridgetops of the Salinas Basin present a fairly flat profile that slopes very gently upward toward the eastern Santa Lucia Range and western portion of the La Panza Range.

The low lying La Panza Range separates the Salinas River and Carrizo Plain. The La Panza Range is a mixture of igneous and sedimentary rocks that are moderately sloping, 20 to 50 percent, with moderately high erosion on moderately deep soils. Estrella Creek, and its principal tributary San Juan Creek, drain into the Salinas Basin. The Carrizo Plain is a narrow elongated basin east of the La Panza Range and north of the Caliente Range. The plain varies in elevation from 1900 to 2500 feet. The San Andreas fault extends along the entire northeast side of the plain.

The Santa Maria River, together with its two major tributaries, the Cuyama and Sisquoc Rivers, drain the central portion of the survey area. The Cuyama River cuts through the Cuyama Valley which is bounded on the north by the Caliente Range and south by the Sierra Madre Mountains. The Caliente Range, at about 5,500 feet, consists of sedimentary materials that are very erodible and unstable. They are steep, have rapid runoff and are highly dissected. The Morales Thrust fault forms the abrupt southern border into the Cuyama Valley. The Sierra Madre Mountains consist of hard sandstone and shale and have steep slopes, but are well vegetated and fairly stable. The Nacimiento fault dividing the Sierra Madre and San Rafael Mountains, provides the route for the Sisquoc River drainage. The San Rafael Mountains are very steep and consist of a wide variety of bedrock types. Figueroa Mountain is the highest peak near 4,700 feet. The northern portion is siltstone and shale; the southern San Rafael Mountains are serpentinitic materials that were uplifted by the Little pine fault. Their shallow soils are highly erodible. The Santa Ynez Mountains form a continuous southern border of the Forest survey area. This mountain block was elevated and tilted to the south along the Santa Ynez fault, which lies to the north. The Santa Ynez River, created by the fault, is about 70 miles long and drains the northern slopes of the Santa Ynez Mountains. The southern slopes and adjacent coastal area have several steep faults trending northwest with many short intermittent streams flowing into the Pacific Ocean. San Marcos Pass, near Santa Barbara, occupies the low saddle and Divide Peak to the east, near 4,690 feet,

is the highest mountain in the range. These rolling to steep mountains consist of sandstone, shale and siltstone with some metamorphosed materials intermixed. The topography is rough with many rock outcrops and the area is moderately erodible.

The eastern portion of the Forest survey area consists of the Mount Pinos Ranger District to the north and the Ojai Ranger District to the south. On the Mount Pinos Ranger District, prominent features are Mount Pinos, Mount Abel and Sawmill Mountain. These mountains are over 8,000 feet in elevation, lie south of the San Andreas fault, and consist of granite, gneiss and schist. The soils are moderately deep to deep and highly erodible, and are found on deep, steep walled canyons of 30 to 60 percent slopes.

Southwest of Mount Abel is San Emigdio Mesa, which slopes toward Apache Canyon. The mesa is hard sandstone and gneissic colluvial materials. The soils are moderately deep and have high erosion rates on the northern aspects and on south aspects, the soils are shallow and also highly erodible.

Ballinger, Quatal and Apache canyons provide drainage for Mount Abel, Mount Pinos, Sawmill Mountain, Grouse Mountain and San Emigdio Mesa. These canyons extend east-west for about 10 miles in length with the upper elevation at about 4,500 feet, draining into the Cuyama River basin at about 3,000 feet. The valley floors are recent stream terraces and deposits with 0 to 15 percent slopes containing very deep moderately stable soils. The northern aspects have 45 to 90 percent slopes with shallow soils that are highly erodible. The southern aspects have moderately deep to deep soils that have 30 to 60 percent slopes and are highly erodible.

Frazier Mountain is a single peak southeast of Mount Pinos. Elevation is about 8,000 feet consisting of hard granite and gneiss that was uplifted by the North Frazier Mountain Thrust fault. The northern aspects have moderately deep to deep soils with moderate erodibility. The southern aspects have moderately deep soils with moderate to high erodibility.

Lockwood Valley is in the center of the district between Mount Pinos and Frazier Mountain, at about 5,000 feet elevation. The valley is crossed by several faults of regional extent. The San Andreas is to the north, Big Pine to the west, San Guillermo to the south and Frazier Mountain Thrust fault is to the east. The Lockwood Valley area has been the site of repeated deposition. The alluvial bottomland has very deep, young soils with 0 to 10 percent slopes that are moderately erodible. Upland terraces have moderately deep soils on 10 to 60 percent slopes which are highly erodible. Mountainsides have

moderately deep soils with 30 to 60 percent slopes and are highly erodible. The Basement rock is moderately hard to soft sandstone and hard gneiss.

Lockwood Valley is drained to the east by Lockwood Creek and Piru Creek drainages, which follow the San Gabriel fault. The upper drainage has steep mountainsides and ridges with moderately deep soils which have very high erodibility. The lower drainage is steep mountainsides with shallow and moderately deep soils, 25 percent rock outcrop and very high erodibility.

Cuddy Valley is smaller and north of Lockwood Valley. The San Andreas fault forms its north border. Soil parent materials are similar to those of Lockwood Valley. Cuddy Valley is drained to the east by Cuddy Creek through Cuddy Canyon near Frazier Park. Cuddy Canyon is bounded on the north by Tecuya Mountain and Ridge and on the south by Frazier Mountain. Tecuya Ridge consists of moderately deep soils developed on granitic parent materials. Some sedimentary rock occurs at its northern end. Drainage to the east is into Cuddy Creek and into Buena Vista Lake to the west.

Pine Mountain, Reyes Peak, Alamo and Cobblestone Mountains demarcate the boundary between Mount Pinos and Ojai Ranger Districts. Pine Mountain and Reyes Peak are an east-west trending ridge at about 7,500 feet, uplifted along the Pine Mountain fault. The northern aspects are mountain ridges and side slopes of 30 to 60 percent. Soils are moderately deep, developing on hard sandstone with high erodibility. The southern aspects are mountain ridges and side slopes of 30 to 80 percent. Soils are shallow with very high erodibility and about 30 percent rock outcrop.

Alamo and Cobblestone Mountains trend northwest to southeast at about 7,000 feet elevation. These mountains include McDonald Peak and Stewart Mountain. This northwest to southeast trending ridge of mountains is the result of uplifted bedrock along the Alamo Mountain and Agua Blanca Thrust faults, which join the San Gabriel fault to the north. The north facing ridges and mountainsides are on 10 to 60 percent slopes with moderately deep soils and high to very high erodibility. The uppermost south facing slopes are 30 to 60 percent and similar in geology to the northern slopes. At lower elevations they have 40 to 70 percent slopes with shallow to moderately deep soils that are highly erodible, developed over hard sandstone.

The Sespe Creek drainage follows the Pine Mountain fault, originating near the junction of the Big Pine and Pine Mountain faults, in the northwest corner of the Ojai District and extending east about 25 miles.

The drainage then meanders south through the Sespe Condor Sanctuary, flowing through Devils Gate into the Santa Clara River. Sespe Creek provides drainage for portions of Pine Mountain, Ortega Hill, Topatopa Mountains, Chief and Whitaker Peaks. The watershed encompasses some 250 square miles. The upper drainage has moderately deep soils on broad, gently sloping terraces with 10 to 60 percent slopes that are highly erodible. The central drainage is moderately steep, 30 to 60 percent slopes, with shallow soils that are highly erodible. The lower drainage is steep ridges and valleys, 30 to 80 percent slopes, with shallow soils with 30 percent rock outcrop.

Nordhoff and Chief Peaks and Nordhoff Ridge are about 3 miles north of the town of Ojai, at about 4,700 feet. The ridges and mountainsides are formed from hard sandstone, siltstone and conglomerate, with 20 to 30 percent rock outcrop. The shallow soils are very highly erodible with mixed chaparral on 30 to 80 percent slopes. Santa Paula Creek originates in the Topatopa Mountains about 10 miles north of the city of Santa Paula and enters the Santa Clara River near Santa Paula. The creek provides drainage for portions of the Topatopa Mountains and Santa Paula Ridge. The Topatopa Mountains range up to about 6,700 feet elevation at Hines Peak and are in the northwest portion of the Sespe Condor Sanctuary. Santa Paula Ridge is about 5 miles northeast of the city of Santa Paula and ranges up to about 5,000 feet elevation at Santa Paula Peak. These mountains consist of hard fractured sandstones and shales with very highly erodible shallow soils. Slopes are 30 to 80 percent.

The Matilija Creek drainage encompasses Ortega Hill to the north, Monte Arido and Old Man Mountains to the west, White Ledge Peak to the south and Nordhoff Peak to the east. The upper drainage consists of steep mountainsides and ridges, 40 to 70 percent slopes, with shallow soils that are very highly erodible. The lower drainage has steep ridges and narrow drainages at 30 to 80 percent slope. The soils are shallow to moderately deep and very highly erodible, with 20 percent rock outcrop. The parent material is hard fractured siltstone and sandstone. Matilija Creek becomes the Ventura River near the town of Ojai.

## **Water Supply**

Providing optimum quantity and quality of water, while maintaining or enhancing the productivity of the land, is a primary goal of Los Padres National Forest Area. The maintenance of social well-being and general welfare of a large segment of the surrounding population

is dependent on the quality and quantity of water produced on Los Padres National Forest. Watershed protection and water production was the original reason for creation of this Forest; this major role has not changed and will continue to be emphasized. There are about thirty reservoirs and lakes larger than five surface acres in size within the survey boundary, and there are thirteen watersheds within the survey boundary that supply water to local municipalities.

The Forest's water is also a major recreational attraction to those living in the urbanized metropolitan area of Los Angeles, as well as many nearby smaller communities. This demand and dependency on water originating on National Forest System Lands for domestic, agricultural and recreational purposes presents increasing problems in maintenance of water quality and demands for quantity.

The Cachuma, Gibraltar and Juncal dams which are on the Santa Ynez River, supply water to the communities along the south coast - Goleta, Santa Barbara, Montecito, Carpinteria and Summerland, as well as the communities in the lower Santa Ynez Valley. The Ventura and Santa Clara River Watersheds are important in supplying the municipal, industrial and agricultural water needs of the communities of Ojai, Ventura, Santa Paula, Fillmore and Piru. Major dams which supply water to these communities are Casitas, Piru and Pyramid.

The Cuyama River supplies water for municipal as well as the ever-expanding agricultural needs of the Cuyama Valley. The river terminates at Twitchell Reservoir, where the water is released to the Santa Maria River to recharge the groundwater basin in the Santa Maria and Guadalupe area. The runoff from the Sisquoc River enters the Santa Maria River and is also used to recharge the groundwater in the Santa Maria and Guadalupe areas, where a heavy demand is being put on the groundwater to supply the needs for the municipal as well as the extensive agricultural development in that area.

Lopez Reservoir, which receives its water supply from Lopez and Arroyo Grande Creeks, supplies the water needs of the coastal communities of Arroyo Grande, Grover City and Pismo Beach. Santa Margarita Lake, which is on the upper reaches of the Salinas River, supplies water to the city of San Luis Obispo.

## Climate

The Los Padres National Forest Area, exhibits a distinct variation in climate between the coastal and inland sections. The climate in the coastal area is characterized by long, dry, cool summer seasons with frequent ocean fogs, followed by a shorter wet period with cooler temperatures.

The inland area is characterized by warm, dry summers and relatively cool, wet winters. During the winter season, temperatures below freezing are common. The long, dry summers provide an adequate growing season for a wide variety of agricultural crops, particularly in the Carrizo Plain and Cuyama Valley areas. More than 90 percent of the annual precipitation occurs between the months of November and April. Precipitation falls as rain, with some snow occurring at the higher elevations.

Much of the coastal area has average maximum temperatures in July, in the upper 60's or low 70's. Inland valley July temperatures are in the low 90's and mountain areas have July temperatures in the 80's. Inland areas show considerably more temperature variation than do coastal areas.

In January, the average low temperature is in the 40's and 50's along the coast and in the 30's for most inland valleys. In some of the higher mountain areas, the average low in January is below freezing. Daytime temperatures average in the high 50's or low 60's throughout the survey area.

Annual precipitation ranges from less than 10 inches in portions of the Cuyama Valley to more than 35 inches at the high elevations in the Santa Lucia and San Rafael mountains. Generally, annual precipitation is 20 to 30 inches in the northern and eastern mountains of the survey area, 15 to 20 inches in most of the western portion, and approximately 30 inches at higher elevations in the Santa Ynez Mountains. Thundershowers sometimes occur in the mountains during the summer, but they normally do not account for any substantial part of their annual rainfall.

Santa Ana winds can be common in the fall. These are strong, gusty northeast winds that flow over mountain peaks and passes and into the valleys below. Normally, warm temperatures and low humidity accompany these desert winds to create severe fire conditions.

## How This Survey Was Made

This Order 3 soil survey has followed the directives and guidelines in the Forest Service Manual and Handbooks. It has also followed the concepts, procedures, and guidelines of the National Cooperative Soil Survey as specified in the *Soil Survey Manual* (4), the *National Soils Handbook* (6), and the soil classification system as stated in *Soil Taxonomy* (5).

Soil scientists began the soil survey by collecting, studying and correlating all the existing data and information concerning this survey area that is related to soil genesis and morphology. This includes lithologic, geomorphic, topographic, climatic, vegetative and existing soil survey data both within and adjoining the Forest survey area. Geology of the Forest Survey Area is on unpublished maps (2) and in *The Geology of the Santa Ynez Mountains* (1).

This data and information was 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, the soil scientist made a reconnaissance study of the survey area. At this time, the delineations on the schematic map are 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 insure that later recognition by photo interpretation would be credible. Lithologic, geomorphic, soil, and vegetative characteristics were recognized and 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 scientist then delineated soil 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 ground conditions and by stereoscopic aerial photo interpretation. These aerial photos with the delineated map units and delineated symbols became the exploratory or preliminary soils map.

With the aerial photo (exploratory soils maps) and a stereoscope in hand, the soil scientist examined on the ground as many delineations of each map unit as was feasibly possible, considering the access and time allowed to complete the survey. In this way, each different map unit was examined, studied, and described by aerial photo interpretations and on-the-ground investigation.

However, because of the design of the survey, Order 3 in intensity, and the time allotted for its completion, every delineation of each different map unit was not visited and examined on the ground. Those delineations with no easy access were rarely visited other than by aerial photo interpretation. In this way, possibly one-third to one-half of the delineations on the field sheets and maps would have not been entered and examined by an on-the-ground investigation. *This is one of the main aspects of this survey that limits its reliability. It is one reason that the survey is not suitable for project planning without field verification.*

As each map unit was visited and examined, individual soils were recognized, studied, described, classified, and enough data was collected to furnish the information needed 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 usually consists of a group of soils that occupy a particular portion of the landscape which has been delineated on the aerial photo sheets. Depending on the area location and extent of the individual soils that are components of the delineated map unit, a map unit is called an association or complex of soil components. The soil scientist makes a field and aerial photo examination to estimate the soil component percentage composition for each map unit. These map units *do not* necessarily consist of similar soils. They consist of geographically associated soils that may be, and usually are, quite different in their characteristics and their suitability for use management. *These are other aspects of the survey that limit its reliability and make it not suitable for project planning without field verification.*

This field examination and study, and the associated correction and refinement of the aerial photo field sheets, produces the Order 3 intensity soil maps called for in this system of survey.

The interpretations and predictions concerning use and management found in this report are based on the soil scientist's knowledge and understanding of the conditions recognized and measured in the time allotted to this inventory. By classifying the soils, the soil scientist can also, with accepted reliability, bring information concerning use and management of a particular soil from other survey areas where this same soil occurs and has been recognized and studied. Because of the time allocation for the completion of this survey, these use and management interpretations and predictions should be considered as first or second approximations due to the relatively few examinations and measurements that have been made. *This is still another aspect of the survey that*

*limits its reliability and makes it not suitable for project planning without field verification.*

Despite the cautions that have been made in the about

paragraphs concerning the use of this survey for project level planning, it is adequate and reliable for its intended and designed purpose: a base for a Forest-wide system of land management planning.

## General Soil Map Units

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

The 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 located.

Because of the generalization of map units and the small scale of the map, the location of specific soils are not shown. The map and map unit information is not suitable for Forest or project level land management planning. They give a very general overview of soil conditions and are suitable for State or Regional planning. Each group and its map units are described below.

### Soils in the Thermic Soil Temperature Regime

These soils are at lower elevations throughout the survey area, generally from 800 feet up to 4,400 feet on the north aspects and to 6,800 feet on the south aspects. The soils in this group are the warmest in the survey area. In the thermic soil temperature regime, the mean annual soil temperature is 59 to 72 degrees F.

There are 6 map units in this group. They make up about 83.5 percent of the survey area.

#### 1. Trigo-Los Robles Families-Badlands

Shallow and moderately deep, steep to very steep, highly erodible sandy loams on sedimentary rocks.

This map unit is in the Ballinger, Quatal, Apache and Dry Canyon area. Some areas, about 20 percent, consist of badlands that are barren, on greater than 70 percent slopes, with inclusions of 10 percent soil capable of supporting plants. Soils in this map unit formed in coarse grained weathered sandstone and conglomerate from the Quatal formation.

The map unit makes up about 5 percent of the survey area. It is about 30 percent Trigo family soils, 25 percent Los Robles family soils and 20 percent Badlands. The remaining 25 percent is minor soils.

The map unit is on mountainsides and ridges. Slope is 10 to 90 percent. Elevation is 1400 to 6200 feet. Annual precipitation is 8 to 28 inches. The typical vegetation is juniper, pinyon pine, yucca, big sagebrush and annual grass.

Trigo family soils are shallow. Typically, they have a mildly alkaline sandy loam surface layer. The substratum is a mildly alkaline gravelly sandy loam. Trigo family soils occur on mountainsides with north and west aspects that generally have a western juniper, pinyon pine, and scrub oak vegetative cover.

Los Robles family soils are moderately deep. Typically, they have a moderately alkaline sandy loam surface layer over a moderately alkaline sandy clay loam subsoil. Los Robles family soils occur on ridges and mountainsides that generally have scattered western juniper, pinyon pine, or annual grass vegetative cover.

Badlands are very steep barren lands that occur on mountainsides with south aspects.

Minor soils in this map unit are Modesto and Reliz families, Vertic Xerochrepts and Orthents.

#### 2. Lodo-Millerton-Millsholm Families

Very shallow and shallow, rolling to very steep, very highly erodible sandy loams and silt loams on sedimentary rocks.

This map unit is scattered throughout the survey area, except in the northeast portion. Some areas of low, irregularly shaped rock outcroppings are in this map unit. Soils in the map unit are formed in fine and medium textured hard fractured siltstones and sandstones of the Modesto, Sespe, Matilija, Espeda, Juncal, Coldwater and Unnamed Cretaceous formations.

This map unit makes up about 45 percent of the survey area. It is about 25 percent Lodo Family soils, 25 percent Millerton Family and 20 percent Millsholm Family. The remaining 30 percent is minor soils.

This map unit is on mountainsides and ridges. Slope is 5 to 85 percent. Elevation is 900 to 7500 feet. Annual precipitation is 13 to 38 inches. Typical vegetation is chamise, manzanita, scrub oak, ceanothus, salvia, or Toyon.

Lodo family soils are shallow. Typically, they have a medium acid sandy loam surface layer over a medium acid cobbly sandy loam subsoil. Lodo family soils generally have chamise-chaparral vegetation cover.

Millerton family soils are shallow. Typically, they are slightly acid gravelly sandy loam surface layer over a slightly acid gravelly sandy loam subsoil. Millerton family soils generally have chamise-chaparral vegetation cover.

Millsholm family soils are shallow. Typically, they are slightly acid silt loam surface layer over a neutral loam subsoil. Millsholm family soils generally have scrub oak or mixed hard chaparral vegetative cover.

Minor soils in this map unit are Agua Dulce, Exchequer, Stonyford, Reliz, Lopez, Modjeska, Yorba family soils, and rock outcrop.

### **3. Agua Dulce-Modesto-Modjeska Families**

Moderately deep and very deep, rolling to very steep, highly and very highly erodible sandy loam, loam and gravelly loams on sedimentary rocks.

This map unit occurs throughout the survey area. Soils in this map unit formed in hard fractured shale and sandstone of the Juncal, Monterey, Sespe, Unnamed Cretaceous, and Cozy Dell formations.

This map unit makes up 26.5 percent of the survey area. It is about 25 percent Agua Dulce family soils, 20 percent Modesto family soils and 20 percent Modjeska family soils. The remaining 35 percent is minor soils.

This map unit is on mountainsides, ridges and hillslopes. Slope is 10 to 90 percent. Elevation is 800 to 6500 feet. Annual precipitation is 8 to 38 inches. Typical vegetation is chamise, scrub oak, manzanita, ceanothus, salvia, Toyon, annual grasses, or coast live oak vegetation cover.

Agua Dulce family soils are deep. Typically, they have a mildly alkaline gravelly loam surface layer over a slightly acid very gravelly clay loam subsoil. Agua Dulce family soils occur on mountainsides and hillslopes that generally have mixed hard chaparral vegetation cover.

Modesto family soils are moderately deep. Typically, they have a neutral loam surface layer over a moderately alkaline gravelly clay loam subsoil. The substratum is a mildly alkaline very cobbly loam. Modesto family soils occur on mountainsides and ridges that generally have annual grass, scrub oak, or coast live oak vegetative cover.

Modjeska family soils are moderately deep. Typically they have a slightly acid sandy loam surface layer over a slightly acid extremely gravelly loam subsoil. Modjeska family soils occur on mountainsides and ridges that generally have scrub oak, manzanita, ceanothus, Toyon, or coast live oak vegetation cover.

Minor soils in this map unit include Los Osos, Los Robles, Livermore, Rincon, Chualar, Yorba, Ramona and Nacimiento family soils, and rock outcrop.

### **4. Trigo-Lodo-San Andreas Families**

Shallow and moderately deep, rolling to very steep, very highly erodible coarse sandy loams and sandy loams on granitic rocks.

This map unit is in the far northeast portion of the survey area, in the northwest La Panza Range. Soils in this map unit formed in weathered granitic rocks.

This map unit makes up about 3 percent of the survey area. It is about 30 percent Trigo family soils, 30 percent Lodo family soils and 20 percent San Andreas family soils. The remaining 20 percent is minor soils.

This map unit is on mountainsides and ridges. Slope is 10 to 90 percent. Elevation is 800 to 6400 feet. Annual precipitation is 8 to 38 inches. The typical vegetation is chamise, red shank, yucca, digger pine, pinyon pine, California buckwheat, rabbit brush, or annual grass.

Trigo family soils are shallow. Typically, they have a slightly acid coarse sandy loam surface layer over weathered granite. Trigo Family soils occur on mountainsides and ridges that generally have chamise-chaparral or red shank-chaparral vegetative cover.

Lodo family soils are shallow. Typically, they have a slightly acid sandy loam surface layer over a neutral gravelly sandy loam subsoil. Lodo family soils occur on south aspects of mountainsides that typically have annual grass or big sagebrush vegetative cover.

San Andreas family soils are moderately deep. Typically, they have a neutral sandy loam surface layer over a neutral sandy loam subsoil. San Andreas family soils occur on mountainsides that generally have a mixed chaparral or digger pine vegetative cover.

Minor soils in this map unit are Chualar, Modjeska and Botella family soils.

## 5. Orthents-Fluents

Very deep, nearly level to rolling, moderately erodible sandy loams and coarse sandy loams on recent alluvium.

This map unit occurs in alluvial basins of the Salinas, Ventura, Cuyama Rivers, and Cuddy Creek including their tributaries. Soils in this map unit formed in mixed recent alluvium.

This map unit makes up 2 percent of the survey area. It is about 50 percent Orthents soils and 30 percent Fluents soils. The remaining 20 percent is minor soils and riverwash.

This map unit is on alluvial bottomland and recent stream terraces. Slope is 0 to 15 percent. Elevation is 2500 to 6200 feet. Annual precipitation is 8 to 17 inches. Typical vegetation is coast live oak, pinyon pine, big sagebrush, Mormon tea, rabbit brush, sycamore, willows, or annual grass.

Orthent soils are very deep. Typically, they have a moderately alkaline coarse sandy loam surface layer. The substratum is a moderately alkaline sandy loam. Orthent soils generally have big sagebrush, annual grass, Mormon tea, rabbit brush, California buckwheat, or juniper vegetative cover.

Fluent soils are very deep. Typically, they have a moderately alkaline sandy loam surface layer. The substratum is a moderately alkaline sandy loam. Fluent soils generally have big sagebrush, Mormon tea, rabbit brush, California buckwheat, or annual grass vegetative cover.

Inclusion in this map unit are Xerofluents, Xerorthents, and riverwash.

## 6. Cuesta-Diablo-Altamont Families

Moderately deep and deep, rolling to very steep, high and very highly erodible cobbly loam and clays on metamorphic rocks.

This map unit occurs in the west portion of the survey area, in a southeast to northwest direction, including Montecito Peak, Los Prietos, Goat Rock, Happy Canyon and Cuesta Grade. Soils in this map unit formed in serpentinitic rock, metashale and graywacke sandstone of the Franciscan formation.

This map unit makes up 2 percent of the survey area. It is about 35 percent Cuesta family soils, 20 percent Diablo family soils, and 20 percent Altamont family soils. The remaining 25 percent is minor soils.

This map unit is on mountainsides, ridges and hillslopes. Slope is 10 to 70 percent. Elevation is 900 to 4400 feet. Annual precipitation is 18 to 30 inches. Typical vegetation is annual grass, coast live oak, Sargent cypress, manzanita, chamise, or salvia.

Cuesta family soils are moderately deep. Typically, they have a neutral cobbly loam surface layer over a neutral gravelly clay loam subsoil. Cuesta family soils occur on mountainsides and ridges that generally have Sargent cypress, chamise-chaparral, or mixed hard chaparral vegetative cover.

Diablo family soils are deep. Typically, they have a mildly alkaline clay surface layer. The substratum is a moderately alkaline clay. Diablo family soils occur on mountainsides and hillslopes that generally have annual grass vegetative cover.

Altamont family soils are deep. Typically, they have a mildly alkaline clay surface layer. The substratum is a mildly alkaline clay. Altamont family soils occur on mountainsides and hillslopes that generally have annual grass and coast live oak vegetative cover.

Minor soils in this map unit are Henneke and Agua Dulce family soils and rock outcrop.

## Soils in the Mesic Temperature Regime

The soils in this group are in the eastern portion of the survey area in the middle and upper elevations. This includes Figueroa, San Rafael, Pine, Alamo, San Emigdio, Mt. Pinos, and Cobblestone Mountains, the upper Lockwood and Cuddy Valleys. Generally elevations range from 4400 feet to 7700 feet. The soils in this group are cooler than the thermic group and they are warmer and drier than the soils in the frigid group. In the mesic temperature regime, the mean annual soil temperature is 47 to 59 degrees F.

There are 3 map units in this group. They make up about 16 percent of the survey area.

## 7. Morical-Greenbluff-Skalan Families

Moderately deep and deep, rolling to very steep, highly erodible very gravelly sandy loams, sandy loams, and loams on sedimentary rocks.

This map unit is in the Figueroa, San Rafael, Pine and Alamo Mountain areas. It is generally on the north and east aspects. Soils in this map unit formed in coarse grained fractured sandstones and older alluvium/colluvium from sandstone and conglomerate rocks

of the Cretaceous Unnamed and Matilija formations and shale of the Monterey formation.

This map unit makes up about 7 percent of the survey area. It is about 35 percent Morical family soils, 20 percent Green Bluff family soils and 15 percent Skalan family soils. The remaining 30 percent is minor soils.

This map unit is on mountainsides, ridges and upland terraces. Slope is 10 to 80 percent. Elevation is 1750 to 8100 feet. Annual precipitation is 12 to 34 inches. The typical vegetation is pinyon pine, big sagebrush, Jeffrey pine, bigcone Douglas fir, Coulter pine, sugar pine, white fir, scrub oak, or canyon live oak.

Morical family soils are deep. Typically, they have a neutral loam surface layer over a neutral sandy clay loam subsoil. The substratum is a medium acid gravelly sandy loam. Morical family soils occur on upland terraces and generally have Jeffrey and pinyon pine, white fir, scrub oak, or big sagebrush vegetative cover.

Green Bluff family soils are moderately deep. Typically, they have a mildly alkaline sandy loam surface layer over a moderately alkaline sandy loam subsoil. The substratum is a moderately alkaline gravelly sandy loam. Green Bluff family soils occur on mountainsides and ridges that generally have pinyon pine, western juniper, or big sagebrush vegetative cover.

Skalan family soils are moderately deep. Typically, they have a strongly acid very gravelly sandy loam surface layer over a very strongly acid very gravelly clay loam subsoil. Skalan family soils occur on mountainsides that generally have Jeffrey pine, bigcone Douglas fir, or canyon live oak vegetative cover.

Minor soils in this map unit are Pickett, Supan, Witzel, Hohman, Konokti family soils, and rock outcrop.

## 8. Kilburn-Los Gatos-Wrentham Families

Moderately deep, rolling to very steep, high and very highly erodible coarse sandy loams, cobbly sandy loams and sandy loams on weathered granite and metamorphic rocks.

This map unit is in the east portion of the survey area, including San Emigdio, Mt. Pinos, Alamo and Cobblestone Mountains. Soils in this map unit formed in weathered granite or hard fractured gneiss.

This map unit makes up about 8 percent of the survey area. It is about 35 percent Kilburn family soils, 20 percent Los Gatos family soils, and 20 percent

Wrentham soils. The remaining 25 percent is minor soils.

This map unit is on mountainsides and ridges. Slope is 10 to 65 percent. Elevation is 1750 to 7800 feet. Annual precipitation is 14 to 35 inches. The typical vegetation is pinyon and Jeffrey pine, big sagebrush, snowberry, white fir, or perennial grass.

Kilburn family soils are moderately deep. Typically, they have a moderately acid cobbly sandy loam surface layer over a slightly acid very gravelly loam subsoil. The substratum is a slightly acid very gravelly loam. Kilburn soils generally have Jeffrey and pinyon pine, white fir, or big sagebrush vegetative cover.

Los Gatos family soils are moderately deep. Typically, they have a slightly acid sandy loam surface layer over a neutral sandy clay loam subsoil. Los Gatos soils generally have pinyon and Jeffrey pine, scrub oak, or manzanita vegetative cover.

Wrentham family soils are moderately deep. Typically, they have a slightly acid coarse sandy loam surface layer over a slightly acid very cobbly sandy loam subsoil. Wrentham family soils generally have Jeffrey and pinyon pine, white fir, or canyon live oak vegetative cover.

Minor soils in this map unit are Supan and San Andreas family soils and rock outcrop.

## 9. Oak Glen-Supan-Hagen Families

Very deep, nearly level to rolling, moderately erodible coarse sandy loam and sandy loams on recent alluvium.

This map unit occurs in alluvial bottomlands in the northeast portion of the survey area, including Lockwood and Cuddy Valleys. Soils in this map unit formed in mixed recent alluvium.

This map unit makes up one percent of the survey area. It is about 35 percent Oak Glen family soils, 25 percent Supan family and 25 percent Hagen family. The remaining 20 percent is minor soils.

This map unit is on alluvial bottomland. Slope is 0 to 10 percent. Elevation is 3100 to 6600 feet. Annual precipitation is 14 to 36 inches. Typical vegetation is big sagebrush, annual grass and pinyon pine.

Oak Glen family soils are very deep. Typically, they have a slightly acid sandy loam surface layer. The substratum is neutral gravelly sandy loam. Oak Glen family soils generally have pinyon pine, or big sagebrush vegetative cover.

Supan family soils are very deep. Typically, they have a slightly acid sandy loam surface layer over a neutral sandy clay loam subsoil. Supan family soils generally have pinyon pine, big sagebrush, or annual grass vegetative cover.

Hagen family soils are very deep. Typically, they have a mildly alkaline coarse sandy loam surface layer. The substratum is a mildly alkaline gravelly loamy coarse sand. Hagen family soils generally have annual grass, or big sagebrush vegetative cover.

Minor soils in this map unit include Orthents and Fluvents soils.

### **Soils in the Frigid Soil Temperature Regime**

The soils in this group are on the summits and upper elevations of Mt. Abel, Sawmill Mountain, Mt. Pinos and Frazier Mountain areas. Elevations generally range from 7700 feet to 8800 feet. The soils in this group differ from those in the thermic or mesic group because they are found under a colder, moist climate. In the frigid soil temperature regime, the mean annual soil temperature is 32 to 42 degrees F.

There is one map unit in this group. It makes up about 0.5 percent of the survey area.

#### **10. Hades-Ginser-Ola Family**

Moderately deep and very deep, rolling to very steep, moderate and highly erodible gravelly sandy loam and

sandy loams on hard granite, weathered gneiss, or schist.

This map unit makes up about 0.5 percent of the survey area. It is about 30 percent Hades family soils, 25 percent Ginser family soils and 25 percent Ola family soils. The remaining 20 percent is minor soils.

This map unit is on mountain sides and ridges. Slope is 10 to 65 percent. Elevation is 6100 to 8800 feet. Annual precipitation is 16 to 35 inches. Typical vegetation is Jeffrey pine, snowberry, white fir, or perennial grass.

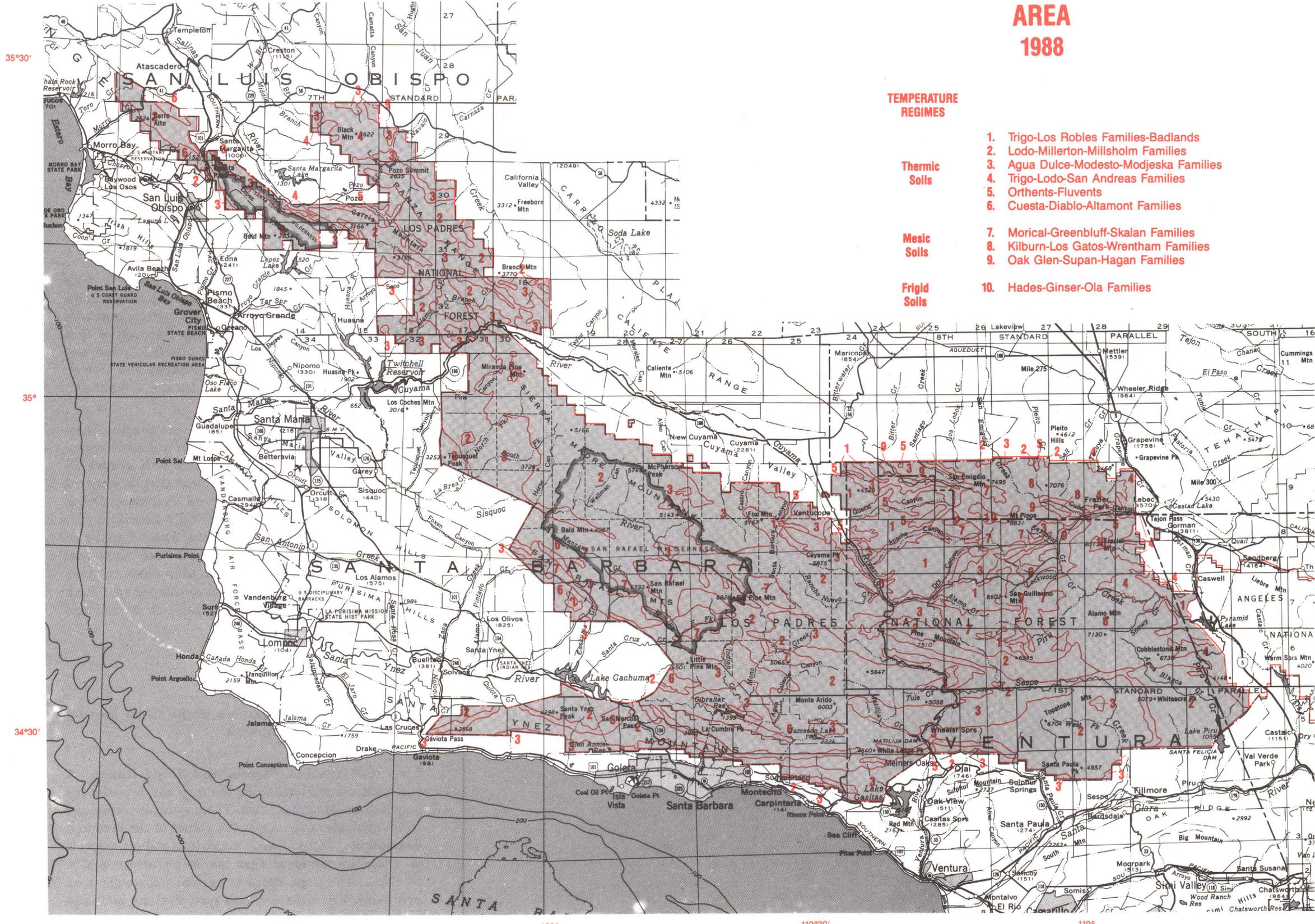
Hades family soils are very deep. Typically, they have a slightly acid gravelly sandy loam surface layer over a neutral gravelly sandy clay loam subsoil. Hades family soils generally have Jeffrey pine, or big sagebrush vegetative cover.

Ginser family soils are very deep. Typically, they have a neutral sandy loam surface layer over a slightly acid stony sandy loam subsoil. The substratum is a slightly acid very cobbly sandy loam. Ginser family soils generally have Jeffrey pine, white fir, or black oak vegetative cover.

Ola family soils are moderately deep. Typically, they have a strongly acid sandy loam surface layer over a medium acid sandy loam subsoil. Ola family soils formed in hard granite that generally have Jeffrey pine, white fir and snowberry vegetative cover.

Minor soils in this map unit are Lithic Xerochrepts and Lithic Haploxeralfs soils and rock outcrop.

# General Soils Map LOS PADRES NATIONAL FOREST AREA 1988



### TEMPERATURE REGIMES

### Thermic Soils

### Mesic Soils

### Frigid Soils

1. Trigo-Los Robles Families-Badlands
2. Lodo-Millerton-Millsholm Families
3. Agua Dulce-Modesto-Modjeska Families
4. Trigo-Lodo-San Andreas Families
5. Orthents-Fluvents
6. Cuesta-Diablo-Altamont Families
7. Morical-Greenbluff-Skalan Families
8. Kilburn-Los Gatos-Wrentham Families
9. Oak Glen-Supan-Hagan Families
10. Hades-Ginser-Ola Families

35°30'

35°

34°30'

120°30'

120°

119°30'

119°

## Detailed Soil Map Units

The map units on the soil maps located at the back of this report show the kind of soils in the survey area. The soil legend at the back of this report 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 soils for which the unit is named. The map unit descriptions are described in tabular format. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses.

In this survey, the individual soils (components of map units) were recognized and classified to the family or to the subgroup level (see "Classification of Soils"). Soils that have profiles some what 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.

Map units are made up of two or more major soils. These map units are called soil complexes or soil associations. 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. Soil association is made up of two or more geographically associated soils that are shown as one unit on the map. Because of present or anticipated uses, it was considered impractical to map the soils separately. In addition, some map units contain miscellaneous areas as components. Rock outcrop is an example and has little or no soil and supports little or no vegetation.

### Definitions and Criteria

The following are explanations of the tables used for detailed map unit descriptions.

**Map unit Symbol, Name, and Slope Range.** A numerical symbol identifying the map unit precedes the map unit name in the tables. These symbols correspond to the symbols in the upper left corner of the map unit descriptions. The soil name consists of soil components or miscellaneous areas that are in an association or complex. The slope range in percent follows the map unit name. Below the map unit symbol, name, and slope is the range in elevation for the map unit given in feet above sea level and the range in annual precipitation for the map unit given in inches.

**Soil Map Unit Components.** The soil name consists mostly of soil family names, but many include subgroups or higher category or miscellaneous area.

**Approximate Proportion.** The approximate percentage that each soil component or miscellaneous land type occupies in the map unit.

**Landscape Position.** This describes the type of land form or surface on which the components are found.

**Vegetation Series.** Each soil component was mapped under a typical vegetation series. The Vegetation Series names the dominant overstory vegetation species. Vegetation Series is part of a hierarchal system used in the Vegetation Classification system for Southern California, U.S. Forest Service and California Department of Fish and Game, April, 1978 (3).

**Slope.** This is the slope range, in percent, that each component occurs on within the map unit.

### Soil Profile Description.

*Surface Layer* - The mineral soil horizon formed at the surface and is characterized by the accumulation and mixing of organic matter, designated as the "A" horizon. This could also be the upper plow layer, designated as the "Ap" layer. It is from 3 or 4 inches to 8 or 10 inches in depth.

*Subsoil* - The soil horizon that formed below the "A" horizon and is dominated by the accumulation of clay, iron or aluminum and designated as the "B" horizons above two meters. Also includes any parts of A or C horizons between the surface and one meter or a more shallow substratum.

*Substratum* - The soil horizon or layer that is little affected by soil development and lacks the properties of the "A" and "B" horizons, designated as the "C" horizon. A layer below one meter, or beneath the solum if the lower part of the solum is between one and two meters deep. Any parts of the solum below two meters are substrata. Bedrock, hardpan, and unconsolidated geologic materials that are in contrasting particle-size classes to the surface soil or solum are substrata regardless of depth, even within one meter of the ground surface.

**Included areas.** Most map units include small minor areas other than those for which the map unit is named. These included soil families, higher categories and/or miscellaneous areas are identified by the approximate percentage that they occupy within the map unit. The

detailed description of the included area may be found by looking up the map unit symbol in parenthesis.

**Effective Rooting Depth.** The range of depth, in inches, was measured from the soil surface downward to the restrictive layer for roots. This is usually bedrock or to a maximum depth of 60 inches. Other limiting layers can include hardpans, clay pans or soft bedrock. Five depth classes are used:

very deep	more than 60 inches
deep	40 to 60 inches
moderately deep	20 to 40 inches
shallow	14 to 20 inches
very shallow	less than 14 inches

**Available Water Capacity (AWC).** The capacity of the soil to hold water available for use by most plants. Commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is expressed as the range of total inches of water per effective rooting depth or to 60 inches. Four AWC classes are used:

high	more than 8 inches
moderate	4 to 8 inches
low	2 to 4 inches
very low	less than 2 inches

**Water Retention Class.** The plant available water capacity (awc) of the upper 20 inches of soil. Three water retention classes are used. Water retention classes are used to evaluate soils for revegetation type conversion and probably of conifer seedling survival.

Class	Inches	Rating
1	more than 2.4	high
2	1.2 to 2.4	moderate
3	less than 1.2	low

**Hydrologic Soil Group.** The grouping of soils according to their runoff-producing characteristics. The chief consideration is the inherent capacity of bare soil to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms. Four hydrologic soil groups are used:

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

Group B. Moderately low runoff potential. Soils having moderate infiltration and water transmission rates when

wet. They are mostly moderately deep and deep, moderately well to well drained soils with moderately fine to moderately coarse textures and moderately slow to moderately rapid permeability.

Group C. Moderately high runoff potential. Soils having slow infiltration and water transmission rates when wet. They are mostly well to moderately well-drained soils with slowly or very slowly permeable layers (e.g., clay-pans, hardpans, massive bedrock) at moderate depth (50 to 100 cm). They generally have moderately fine or fine textures or moderately high water tables and may be somewhat poorly drained. This group also includes shallow soils over hard but highly fractured bedrock that allows a moderate transmission of water.

Group D. High runoff potential. Soils having very slow infiltration and water transmission rates when wet. They are mostly fine-textured soils with high shrink-swell potentials, soils with permanently high water tables, soils with claypans or clay layers near the surface, or shallow soil over impervious material.

**Permeability.** The quality that enables soil to transmit water or air, measured as the number of inches per hour that water moves through the soil.

Permeability	Inches per hour
very slow	less than 0.06
slow	0.06 to 0.20
moderately slow	0.2 to 0.6
moderate	0.6 to 2.0
moderately rapid	2.0 to 6.0
rapid	6.0 to 20
very rapid	more than 20

### 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 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 be-

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

0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

**Drainage Class.** 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 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, have a high soil water conductivity and low water holding capacity.

**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. They are commonly medium textured.

**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. They commonly have a slowly pervious layer within the profile, high clay content, low soil water conductivity, additions of water by seepage, or some combination of these conditions.

**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. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is saturated in layers directly below plow depth. 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. Unless the soil is artificially drained, most mesophytic crops cannot be grown. 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, as for example in "hillpeats" "climatic moors."

**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**

<b>Soil features</b>	<b>Major modifiers</b>	<b>Moderate modifiers</b>
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.

#### **Type Conversion Class**

The suitability of a soil family for type conversion from brush to grass is contingent on the soil and climatic factors as shown below.

Type Conversion Class:	1	2	3
Soil Productivity Class:	High	Moderate	Low
Factors:			
Available water capacity	6 inches	2 to 6 inches	2 inches
Rainfall	>20 inches	12 to 20 inches	<12 inches
Effective rooting depth	deep	moderately deep	shallow

**Total Production.** Total forage production is an estimate of the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. The majority of the estimates are based on professional judgement. Little if any field data or yield studies were available for this purpose. It is expressed in pounds per acre of air dry vegetation.

**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.

**1 - AGUA DULCE - BOTELLA - ARGONAUT FAMILIES ASSOCIATION**  
**20 to 60 percent slopes**

Soil Map Unit Components	Elevation: 1500 to 4600 feet      Annual Precipitation: 22 to 26 inches		
	<b>Agua Dulce family</b>	<b>Botella family</b>	<b>Argonaut family</b>
Approximate Proportion	30 percent	25 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	20 to 60 percent	20 to 60 percent	20 to 60 percent
Vegetation Series	California buckwheat and chamise	Ceanothus and mountain mahogany	Scrub oak and ceanothus

**Soil Profile Description**

Surface Layer	0 to 4 inches; dark yellowish brown sandy loam; weak granular structure; soft; 12 percent pebbles; pH 6.5	0 to 3 inches; brown coarse sandy loam; weak granular structure; soft; 10 percent pebbles; pH 7.5	0 to 8 inches; yellowish brown gravelly clay loam; moderate granular structure; soft; 15 percent pebbles; pH 7.2
Subsoil	4 to 30 inches; brown very gravelly sandy loam; moderate subangular blocky structure; hard; 45 percent pebbles; pH 6.0	3 to 25 inches; brown sandy clay loam; weak subangular blocky structure; slightly hard; 10 percent pebbles, 2 percent cobbles; pH 7.2	8 to 60 inches; pale brown gravelly clay; weak subangular blocky structure; slightly hard; 25 percent pebbles; pH 7.0
Substratum	30 inches; fractured hard gray shale	25 to 62 inches; dark brown very gravelly coarse sandy loam; weak granular structure; soft; 35 percent pebbles; 20 percent cobbles; pH 7.0 62 inches; fractured hard shale	

**Soil Properties and Management Interpretations**

Effective Rooting Depth	moderately deep	very deep	very deep
Available Water Capacity	low	moderate	moderate
Water Retention Class	2	1	1
Hydrologic Soil Group	C	B	D
Permeability	moderate	moderate	moderately slow
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.32	0.32	0.32
Drainage Class	well drained	well drained	moderately well drained
Soil Manageability Class	3Ep	3E	3E
Group	III	III	III
Type Conversion Class	2	1	1
Total Production (lb/acre)	1800	2100	2200
Forest Survey Site Class	None	None	None

Included in this unit are areas of Los Robles family (3), Modesto family (22), Ramona family (45), Livermore family (14) and Millsholm family (16) soils. Included areas make up about 25 percent of map unit area. This map unit has rock slides, dry ravel, gullies and slumps. Some areas have up to 5 percent surface rock fragments. The bedrock is moderately to strongly fractured at 2 to 10 inch intervals, with a few fine roots within the cracks.

**2 - AGUA DULCE - HENNEKE - CUESTA FAMILIES COMPLEX  
40 to 70 percent slopes**

Elevation: 1500 to 3400 feet      Annual Precipitation: 22 to 24 inches

Soil Map Unit Components	<b>Agua Dulce</b>	<b>Henneke</b>	<b>Cuesta</b>
Approximate Proportion	25 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	40 to 70 percent	40 to 70 percent	40 to 70 percent
Vegetation Series	Ceanothus or scrub oak	Chamise, scrub oak, or ceanothus	Chamise, ceanothus, or scrub oak

**Soil Profile Description**

Surface Layer	0 to 4 inches; gray gravelly coarse sandy loam; weak subangular blocky structure; very soft; 15 percent pebbles; pH 7.5	0 to 4 inches; brown cobbly clay loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles, 10 percent cobbles; pH 7.0	0 to 2 inches; dark grayish brown cobbly loam moderate granular structure; soft; 12 percent pebbles; 10 percent stones; pH 6.5
Subsoil	4 to 31 inches; gray very gravelly sandy clay loam; slightly hard; 45 percent pebbles; 5 percent cobbles; pH 8.0	4 to 7 inches; dark reddish brown very cobbly clay; moderately subangular blocky structure; slightly hard; 10 percent pebbles, 30 percent cobbles, 5 percent stones; pH 7.5	2 to 24 inches; dark reddish brown extremely stony clay; moderate subangular blocky structure; slightly hard; 15 percent pebbles, 10 percent cobbles, 60 percent stones; pH 6.9
Substratum	31 inches; fractured hard metashale	7 inches; fractured hard serpentine	24 to 34 inches; weathered serpentine 34 inches; fractured hard serpentine

**Soil Properties and Management Interpretations**

Effective Rooting Depth	moderately deep	very shallow	moderately deep
Available Water Capacity	low	very low	very low to low
Water Retention Class	2	3	3
Hydrologic Soil Group	C	D	D
Permeability	moderately slow	slow	slow
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.26	0.20	0.28
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Ep	3SDx	3SPx
Group	III	III	III
Type Conversion Class	2	3	2
Total Production (lb/acre)	1800	1400	1600
Forest Survey Site Class	None	None	None

**Included Areas & Remarks**  
Included in this unit are areas of Los Osos family (22), soils similar to Altamont family (5), and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit has some dry ravel and slumps. Some areas have up to 15 percent surface rock fragments. The bedrock is weak to strongly fractured at 2 to 7 inch intervals with many fine roots within the cracks.

**3 - AGUA DULCE - LOS ROBLES - MODJESKA FAMILIES ASSOCIATION**  
**10 to 60 percent slopes**

Soil Map Unit Components	Elevation: 2400 to 3900 feet      Annual Precipitation: 20 to 28 inches		
	<b>Agua Dulce</b>	<b>Los Robles</b>	<b>Modjeska</b>
Approximate Proportion	30 percent	30 percent	15 percent
Landscape Position	Mountainsides and stream terraces	Mountainsides	Mountainsides
Slope	10 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	or California buckwheat	buckwheat, scrub oak, buckwheat, or annual bromegrass	California buckwheat, or chamise

**Soil Profile Description**

Surface Layer	0 to 15 inches; brown sandy loam; weak granular structure; soft; 10 percent pebbles and 2 percent cobbles; pH 6.5	0 to 7 inches; pale brown sandy loam; weak granular structure; soft; 10 percent pebbles; pH 8.0	0 to 4 inches; pale brown gravelly sandy loam; weak subangublocky structure; soft; 15 percent pebbles; ph 8.0
Subsoil	15 to 47 inches; strong brown extremely gravelly sandy clay loam; moderate subangular blocky structure; very hard; 60 percent pebbles, 10 percent cobbles, 10 percent stones; pH 6.0	7 to 35 inches; light yellowish brown loam; moderate subangular blocky structure; slightly hard; 8 percent pebbles; pH 8.0	4 to 18 inches; brown gravelly sandy loam; moderate subangular blocky structure; slightly hard; 20 percent pebbles; pH 8.0
Substratum	47 inches; weathered conglomerate conglomerate	35 inches; weathered sandstone sandstone	18 to 60 inches; reddish yellow very massive; soft; 55 percent pebbles; pH 8.0

**Soil Properties and Management Interpretations**

Effective Rooting Depth	deep	moderately deep	deep
Available Water Capacity	low	moderate	low
Water Retention Class	2	1	2
Hydrologic Soil Group	C	B	C
Permeability	moderate	moderately rapid	moderately rapid
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.26	0.28	0.24
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Ep	3E	3Ep
Group	III	III	III
Type Conversion Class	1	1	2
Total Production (lb/acre)	1800	2400	1800
Forest Survey Site Class	7	None	None

Included in this unit are areas of Botella family (18), Ramona family (45), and San Andres family (47) soils. Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some dry ravel and rock slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 2 to 15 inch intervals with many fine and medium roots within the cracks.

**4 - CUESTA - HENNEKE FAMILIES COMPLEX**  
**15 to 60 percent slope**

Elevation: 1800 to 4000 feet      Annual Precipitation: 22 to 24 inches

Soil Map Unit Components	<b>Cuesta</b>	<b>Henneke</b>
Approximate Proportion	50 percent	30 percent
Landscape Position	Mountainsides	Mountainsides
Slope	15 to 60 percent	15 to 60 percent
Vegetation Series	Chamise, scrub oak, manzanita, or cypress	Annual brome grass, wild oats, cypress, chamise, or manzanita

**Soil Profile Description**

Surface Layer	0 to 2 inches; dark grayish brown cobbly loam; moderate subangular blocky structure; soft; 12 percent pebbles, 10 percent cobbles, 5 percent stones; pH 6.7	0 to 2 inches; dark brown clay loam; weak angular blocky structure; slightly hard; 5 percent pebbles; pH 7.0
Subsoil	2 to 24 inches; reddish brown very cobbly clay loam; moderate subangular blocky structure; slightly hard; 20 percent pebbles, 20 percent cobbles; pH 6.7	2 to 13 inches; dark reddish brown very gravelly clay; strong subangular blocky structure; hard; 45 percent pebbles; pH 7.5
Substratum	24 to 34 inches; weathered serpentine 34 inches; hard serpentine	13 inches; fractured hard serpentine

**Soil Properties and Management Interpretations**

Effective Rooting Depth	moderately deep	very shallow
Available Water Capacity	low to moderate	very low
Water Retention Class	3	3
Hydrologic Soil Group	D	D
Permeability	slow	slow
Max Erosion Hazard	high	high
Erosion Factor (K)	0.20	0.28
Drainage Class	well drained	excessively drained
Soil Manageability Class	3S	3SP
Soil Manageability Group	III	III
Type Conversion Class	2	3
Total Production (lb/acre)	1600	1400
Forest Survey Site Class	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Diablo family (5), Los Osos family (22), soils and soils similar to Henneke family (4). Included areas make up about 20 percent of map unit area. This map unit has some slow creeps and deep slumps. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 3 to 7 inch intervals with none to many fine roots within the cracks.

**5 - DIABLO - ALTAMONT - HENNEKE FAMILIES ASSOCIATION**  
**10 to 60 percent slopes**

Soil Map Unit Components	Elevation: 400 to 4400 feet      Annual Precipitation: 20 to 30 inches		
	<b>Diablo</b>	<b>Altamont</b>	<b>Henneke</b>
Approximate Proportion	35 percent	30 percent	15 percent
Landscape Position	Mountainsides and hillslopes	Mountainsides and hillslopes	Mountainsides
Slope	10 to 40 percent	10 to 60 percent	
Vegetation Series	Annual bromegrass, and wild oats	Annual bromegrass, wild oats, and scrub oak	Manzanita, ceanothus annual bromegrass, and wild oats
Soil Profile Description			
Surface Layer	0 to 8 inches; gray clay; moderate subangular blocky structure; slightly hard; 1 percent pebbles; pH 7.5	0 to 28 inches; brown clay; coarse subangular blocky structure; hard; 5 percent pebbles; pH 7.5	0 to 2 inches; dark grayish brown cobbly loam; moderate granular structure; soft; 10 percent pebbles, 15 percent cobbles, and 5 percent stones; pH 6.5
Subsoil	8 to 45 inches; gray clay; strong angular blocky structure; hard 2 percent pebbles; pH 8.0	28 to 40 inches; dark grayish brown clay; moderate subangular blocky structure; very hard; 5 percent pebbles; pH 7.8	2 to 13 inches; reddish brown, very gravelly clay; moderate subangular structure; slightly hard; 30 percent pebbles, 10 percent cobbles; pH 6.7
Substratum	45 inches; weathered serpentine	40 inches; hard graywacke sandstone	13 inches; fractured hard serpentine
Soil Properties and Management Interpretations			
Effective Rooting Depth	deep	deep	very shallow
Available Water Capacity	high	high	very low
Water Retention Class	1	1	3
Hydrologic Soil Group	D	D	D
Permeability	slow	slow	slow
Max Erosion Hazard	very high	very high	high
Erosion Factor (K)	0.24	0.24	0.20
Drainage Class	moderately well drained	moderately well drained	well drained
Soil Manageability Class	3S	2S	3SP
Group	III	III	III
Type Conversion Class	1	1	3
Total Production (lb/acre)	3000	2400	1400
Forest Survey Site Class	None	None	None
Included Areas & Remarks	Included in this unit are areas of Cuesta family (4), Lodo family (16), Modjeska family (3), Los Gatos family (30) soils, and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit has numerous slumps and some dry ravel and is subject to slow creeps. The soils are highly susceptible to severe gully erosion. Some areas have up to 30 percent surface rock fragments. The bedrock is fractured at 1 to 7 inch intervals with a few very fine roots within the cracks.		

**6 - HADES - GINSER - OLA FAMILIES ASSOCIATION - 10 to 30 percent slopes**

Soil Map Unit Components	Elevation: 6100 to 8600 feet      Annual Precipitation: 16 to 25 inches		
	<b>Hades</b>	<b>Ginser</b>	<b>Ola</b>
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Mountain tops	Mountain tops	Mountain tops
Slope	10 to 30 percent	10 to 30 percent	10 to 30 percent
Vegetation Series	Jeffrey pine, white fir, or sagebrush	White fir or Jeffrey pine	White fir or Jeffrey pine
Soil Profile Description			
Surface Layer	0 to 19 inches; brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 25 percent pebbles; pH 6.5	0 to 7 inches; dark grayish brown sandy loam; moderate subangular blocky structure; soft; 3 percent pebbles, 10 percent cobbles; pH 7.0	0 to 4 inches; dark grayish brown sandy loam; weak granular structure; soft; 5 percent pebbles; pH 5.5
Subsoil	19 to 60 inches; yellowish brown gravelly sandy clay loam; moderate subangular blocky structure; hard; 25 percent pebbles; pH 7.0	7 to 48 inches; light olive brown very stony sandy loam; moderate subangular blocky structure; slightly hard; 15 percent pebbles, 10 percent cobbles, 30 percent stones; pH 6.8	4 to 30 inches; brown coarse sandy loam; weak subangular blocky structure; soft; 5 percent pebbles; pH 6.0
Substratum		48 to 60 inches; yellowish brown very cobbly sandy loam; weak subangular blocky structure; slightly hard; 10 percent pebbles, 40 percent cobbles; pH 6.8	30 inches; hard granite
Soil Properties and Management Interpretations			
Effective Rooting Depth	very deep	very deep	moderately deep
Available Water Capacity	moderate	low	moderate
Water Retention Class	2	2	2
Hydrologic Soil Group	B	B	B
Permeability	moderate	moderately rapid	moderately rapid
Max Erosion Hazard	moderate	moderate	moderate
Erosion Factor (K)	0.28	0.32	0.32
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	2ex	2ex	2Ex
Soil Manageability Group	II	II	II
Type Conversion Class	2	2	2
Total Production	2600 lb/acre	1800 lb/acre	1800 lb/acre
Forest Survey Site Class	6	6	6
Included Areas & Remarks	Included in this unit are areas of soils similar to Ola family (6), soils similar to Hades family (6), and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit is mostly stable. Some areas have up to 20 percent surface rock fragments. The bedrock is fractured at 4 to 12 inch intervals with very fine to medium roots within the cracks. There are inclusions of soils with timber site class of 5.		

**7 - HADES - GINSER - OLA FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 6100 to 8600 feet      Annual Precipitation: 16 to 25 inches		
	Hades	Ginsler	Ola
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	10 to 30 percent	10 to 30 percent	10 to 30 percent
Vegetation Series	Jeffrey pine, white fir, or sagebrush	White fir or Jeffrey pine	White fir or Jeffrey pine

**Soil Profile Description**

Surface Layer	0 to 19 inches; brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 25 percent pebbles; pH 6.5	0 to 7 inches; dark grayish brown sandy loam; moderate subangular blocky structure; soft; 3 percent pebbles, 10 percent cobbles; pH 7.0	0 to 4 inches; dark grayish brown sandy loam; weak granular structure; soft; 5 percent pebbles; pH 5.5
Subsoil	19 to 60 inches; yellowish brown gravelly sandy clay loam; moderate subangular blocky structure; hard; 25 percent pebbles; pH 7.0	7 to 48 inches; light olive brown very stony sandy loam; moderate subangular blocky structure; slightly hard; 15 percent pebbles, 10 percent cobbles, 30 percent stones; pH 6.8	4 to 30 inches; brown coarse sandy loam; weak subangular blocky structure; soft; 5 percent pebbles; pH 6.0
Substratum		48 to 60 inches; yellowish brown very cobbly sandy loam; weak subangular blocky structure; slightly hard; 10 percent pebbles, 40 percent cobbles; pH 6.8	30 inches; hard granite

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very deep	very deep	moderately deep
Available Water Capacity	moderate	low	moderate
Water Retention Class	2	2	2
Hydrologic Soil Group	B	B	B
Permeability	moderate	moderately rapid	rapid
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.28	0.32	0.32
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Ex	3Ex	3Ex
Group	III	III	III
Type Conversion Class	2	2	2
Total Production	2600 lb/acre	1800 lb/acre	1800 lb/acre
Forest Survey Site Class	6	6	6

Included in this unit are areas of Ola family (6), soils similar to Hades family (6), and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit is stable with some rock slides. Some areas have up to 20 percent surface rock fragments. The bedrock is fractured at 4 to 12 inch intervals with few very fine to medium roots within the cracks. There are included soils with timber site class of 5.

**8 - HOHMANN - GREEN BLUFF - KONOCTI FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 5000 to 5700 feet      Annual Precipitation: 14 to 30 inches		
	<b>Hohmann</b>	<b>Green Bluff</b>	<b>Konocti</b>
Approximate Proportion	35 percent	25 percent	20 percent
Landscape Position	Mountainsides and hillslopes	Mountainsides and hillslopes	Mountainsides and hillslopes
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Pinyon pine and sagebrush, manzanita, or scrub oak	Annual brome grass, wild oats, sagebrush, or pinyon pine	Jeffrey pine or sagebrush
Soil Profile Description			
Surface Layer	0 to 10 inches; brown sandy loam; weak subangular blocky structure; soft; 5 percent pebbles; pH 8.0	0 to 6 inches; very dark grayish brown sandy loam; weak subangular blocky structure; slightly hard; 5 percent pebbles; pH 6.3	0 to 2 inches; pale brown loam; weak subangular structure; soft; 1 percent pebbles; pH 6.5
Subsoil	10 to 24 inches; brown loam; moderate subangular blocky structure; soft; 2 percent pebbles; pH 8.0	6 to 18 inches; light yellowish brown sandy loam; moderate subangular blocky structure; slightly hard; pH 8.0	2 to 27 inches; very pale brown extremely gravelly clay loam; moderate subangular blocky structure; hard; 65 percent pebbles; pH 6.3
Substratum	24 inches; weathered mudstone	18 to 28 inches; pale brown sandy loam; weak subangular blocky structure; slightly hard; pH 8.0 28 inches; weathered sandstone	27 inches; weathered sandstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	moderately deep	moderately deep	moderately deep
Available Water Capacity	moderate	moderate	low
Water Retention Class	1	1	2
Hydrologic Soil Group	C	B	B
Permeability	moderately rapid	moderately rapid	moderate
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.28	0.24	0.28
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3E	3E	3Ep
Soil Manageability Group	III	III	III
Type Conversion Class	2	2	2
Total Production (lb/acre)	1800	1500	1600
Forest Survey Site Class	7	7	6
Included Areas & Remarks	Included in this unit are areas of Altamont family (5), Huntmont family (44), and Morical family (52) soils. Included areas make up about 20 percent of map unit area. This map unit has a few slumps. Some areas have up to 10 percent surface rock fragments. The bedrock is moderately fractured at 2 to 4 inch intervals with many fine roots within the cracks. There are a few inclusion soils with timber site class of 5.		

**9 - INKS - LODO - AGUA DULCE FAMILIES COMPLEX - 30 to 80 percent slopes**

Elevation: 1200 to 6400 feet      Annual Precipitation: 22 to 38 inches

Soil Map Unit Components	<b>Inks</b>	<b>Lodo</b>	<b>Agua Dulce</b>
Approximate Proportion	35 percent	25 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 80 percent	30 to 80 percent	40 to 80 percent
Vegetation Series	Ceanothus, scrub oak, or wild oats	Chamise, ceanothus, or scrub oak	Scrub oak ord ceanothus

**Soil Profile Description**

Surface Layer	0 to 3 inches; yellowish brown gravelly coarse sandy loam; moderate subangular blocky structure; soft; 20 percent pebbles; pH 6.5	0 to 2 inches; dark brown sandy loam; moderate granular structure; soft; 10 percent pebbles; pH 6.5	0 to 4 inches; brown loam; weak subangular blocky structure; soft; 10 percent pebbles; pH 7.0
Subsoil	3 to 8 inches; brown extremely gravelly sandy loam; weak subangular blocky structure; soft; 70 percent pebbles; pH 6.5	2 to 14 inches; yellowish brown gravelly sandy loam; moderate subangular blocky structure; soft; 15 percent pebbles; pH 6.5	4 to 26 inches; brown very gravelly loam; moderate subangular blocky structure; slightly hard; 35 percent pebbles, 10 percent cobbles; pH 5.5
Substratum	8 inches; fractured hard siltstone	14 inches; fractured hard sandstone	26 inches; fractured hard siltstone

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	shallow	moderately deep
Available Water Capacity	very low	very low to low	low
Water Retention Class	3	2	1
Hydrologic Soil Group	D	D	C
Permeability	moderately rapid	moderately rapid	moderate
Max Erosion Hazard	very high	very high	high
Erosion Factor (K)	0.20	0.20	0.26
Drainage Class	somewhat excessively drained	somewhat excessively drained	well drained
Soil Manageability Class	3EDx	3Edx	3Ex
Group	III	III	III
Type Conversion Class	3	3	2
Total Production (lb/acre)	1200	1800	1800
Forest Survey Site Class	None	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Millsholm family (26), Yorba family (51), Los Robles family (24) soils, and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit has dry ravel slides and some slumps. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 1 to 10 inch intervals with few fine to many medium roots within the cracks.

**10 - KILBURN - WRENTHAM - SUPAN FAMILIES ASSOCIATION - 10 to 30 percent slopes**

Soil Map Unit Components	Elevation: 5000 to 7800 feet      Annual Precipitation: 14 to 22 inches		
	<b>Kilburn</b>	<b>Wrentham</b>	<b>Supan</b>
Approximate Proportion	25 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	10 to 30 percent	10 to 30 percent	10 to 30 percent
Vegetation Series	Jeffrey pine, ceanothus, mixed conifer, or pinyon pine	Jeffrey pine, mixed conifer, or pinyon pine	Jeffrey pine, scrub oak, or pinyon pine

**Soil Profile Description**

Surface Layer	0 to 7 inches; grayish brown very cobbly sandy loam; moderate granular structure; soft; 15 percent pebbles, 25 percent cobbles; pH 5.1	0 to 3 inches; yellowish; brown coarse sandy loam; weak granular structure; soft; 4 percent pebbles, 40 percent cobbles; pH 6.3	0 to 2 inches; dark grayish brown sandy loam; weak subangular soft; 5 percent pebbles; pH 5.5
Subsoil	7 to 19 inches; light olive brown very gravelly loam; moderate subangular blocky structure; soft; 35 pebbles, 10 percent cobbles; pH 6.5	3 to 29 inches; brown very cobbly sandy loam; weak subangular blocky structure; soft; 8 percent pebbles, 40 percent cobbles; pH 6.3	2 to 30 inches; dark grayish brown sandy clay loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 7.0
Substratum	19 to 36 inches; light yellowish brown extremely cobbly loam; weak subangular blocky structure; soft; 50 percent pebbles, 30 percent cobbles, 3 percent stones; pH 6.5 36 inches; fractured hard gneiss	29 to 34 inches; brown extremely cobbly sandy loam; weak subangular blocky structure; soft; 30 percent pebbles, 40 percent cobbles; pH 6.3 34 inches; fractured weathered granite rock	30 to 33 inches; fractured hard gneiss

**Soil Properties and Management Interpretations**

Effective Rooting Depth	moderately deep	moderately deep	moderately deep
Available Water Capacity	low	low	moderate
Water Retention Class	2	2	1
Hydrologic Soil Group	B	B	B
Permeability	moderately rapid	moderately rapid	moderate
Max Erosion Hazard	high	high	moderate
Erosion Factor (K)	0.20	0.24	0.28
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	2epx	2epx	2epx
Group	II	II	II
Type Conversion Class	2	2	2
Total Production (lb/acre)	1500	1600	2600
Forest Survey Site Class	6	6	7

**Included Areas & Remarks**  
 Included in this unit are areas of soils similar to Kilburn family (10), soils similar to Supan family (10), soils similar to Hambright family (16), and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit is mostly stable. Some areas have up to 20 percent surface rock fragments. The bedrock is none to moderately fractured at 6 to 12 inch intervals with few medium roots within the cracks. There are some inclusion soils with timber site class of 5.

**11 - KILBURN - WRENTHAM - SUPAN FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 5000 to 7800 feet      Annual Precipitation:		
	<b>Kilburn</b>	<b>Wrentham</b>	<b>Supan</b>
Approximate Proportion	25 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Jeffrey pine, mixed conifer, ceanothus, or pinyon pine	Jeffrey pine, mixed conifer, or pinyon pine	Jeffrey pine, scrub oak or pinyon pine

**Soil Profile Description**

Surface Layer	0 to 7 inches; grayish brown very cobbly sandy loam; moderate granular structure; soft; 15 percent pebbles, 25 percent cobbles; pH 5.1	0 to 3 inches; yellowish brown coarse sandy loam; weak granular structure soft; 4 percent pebbles; pH 6.3	0 to 2 inches; dark grayish brown sandy loam; weak subangular blocky structure; soft; 5 percent pebbles; pH 5.5
Subsoil	7 to 19 inches, light olive brown very gravelly loam; moderate subangular blocky structure; soft; 35 percent pebbles, 10 percent cobbles; pH 6.5	3 to 29 inches; brown very cobbly sandy loam; weak subangular blocky structure; soft; 8 percent pebbles, 40 percent cobbles; pH 6.3	2 to 30 inches; dark grayish brown sandy clay loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 7.0
Substratum	19 to 36 inches; light yellowish brown extremely cobbly loam; weak subangular blocky structure soft; 50 percent pebbles, 30 percent cobbles, 30 percent stones; pH 6.5 36 inches; fractured hard gneiss	29 to 34 inches; brown extremely cobbly sandy loam; weak subangular blocky structure; soft; 30 percent pebbles, 40 percent cobbles; pH 6.3 34 inches; fractured weathered granite	30 to 33 inches; fractured hard gneiss

**Soil Properties and Management Interpretations**

Effective Rooting Depth	moderately deep	moderately deep	moderately deep
Available Water Capacity	low	low	moderate
Water Retention Class	2	2	1
Hydrologic Soil Group	B	B	B
Permeability	moderately rapid	moderately rapid	moderate
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.20	0.24	0.28
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Epx	3EPX	3e
Group	III	III	III
Type Conversion Class	2	2	2
Total Production	1200 lb/acre	1800 lb/acre	1800 lb/acre
Forest Survey Site Class	6	6	6

**Included Areas & Remarks**  
 Included in this unit are areas of soils similar to Kilburn soils similar to Supan (10), soils similar to Hambright (16), and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some rock slides. Some areas have up to 20 percent surface rock fragments. The bedrock is moderately fractured at 6 to 12 inch intervals with few medium roots within the cracks. There is some inclusion of soils with moderate timber site class of 5.

## 12 - KILMER - NACIMIENTO FAMILIES ASSOCIATION - 10 to 60 percent slopes

Soil Map Unit Components	Elevation: 1300 to 3200 feet <b>Kilmer</b>	Annual Precipitation: 13 to 15 inches <b>Nacimiento</b>
Approximate Proportion	65 percent	25 percent
Landscape Position	Mountainsides and hillslopes	Mountainsides
Slope	10 to 60 percent	30 to 60 percent
Vegetation Series	Annual brome grass, and wild oats or scrub oak	Annual brome grass and wild oats

### Soil Profile Description

Surface Layer	0 to 5 inches; light brownish gray silt loam; weak subangular blocky structure; slightly hard; 3 percent pebbles; pH 8.0	0 to 17 inches; brown clay loam; weak subangular blocky structure; slightly hard; strongly effervescent; 2 percent pebbles; pH 7.9
Subsoil	5 to 29 inches; pale brown silt loam; weak subangular blocky structure; slightly hard; 2 percent pebbles; pH 8.2	17 to 35 inches; pale brown clay loam; weak subangular blocky structure; slightly hard; strongly effervescent; pH 7.7
Substratum	29 inches; weathered calcareous shale	35 inches; weathered calcareous sandstone

### Soil Properties and Management Interpretations

Effective Rooting Depth	moderately deep	moderately deep
Available Water Capacity	moderate	moderate
Water Retention Class	1	1
Hydrologic Soil Group	C	C
Permeability	moderately slow	moderately slow
Max Erosion Hazard	high	high
Erosion Factor (K)	0.32	0.32
Drainage Class	well drained	well drained
Soil Manageability Class	2E	3E
Group	II	II
Type Conversion Class	2	2
Total Production (lb/acre)	1750	2900
Forest Survey Site Class	None	7
Included Areas & Remarks	Included in this unit area areas of rock outcrop (13). Included areas make up about 10 percent of map unit area. This map unit is mostly stable. Some areas have up to 5 percent surface rock fragments. The bedrock is fractured at 3 to 7 inch intervals with few fine roots within the cracks.	

**13 - LITHIC XEROCHREPTS - LITHIC HAPLOXERALS - ROCK OUTCROP COMPLEX**  
**30 to 80 percent slopes**

	Elevation: 3600 to 6300 feet	Annual Precipitation: 20 to 28 inches	
Soil Map Unit Components	<b>Lithic Xerochrepts</b>	<b>Lithic Haploxeralfs</b>	<b>Rock Outcrop</b>
Approximate Proportion	35 percent	30 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 80 percent	30 to 80 percent	30 to 80 percent
Vegetation Series	Chamise, ceanothus, or manzanita	Chamise, ceanothus, or manzanita	Barren

**Soil Profile Description**

Surface Layer	0 to 6 inches; light yellowish brown loam; moderate subangular blocky structure; hard 10 percent pebbles; pH 6.3	0 to 2 inches; brownish yellow gravelly sandy loam; weak subangular blocky structure; soft; 20 percent pebbles; pH 6.5	Rock outcrops consists of barren exposed hard sandstone, shale or siltstone bedrock with inclusions of less than 10 percent soil capable of supporting plants
Subsoil	6 to 16 inches; light yellowish brown cobbly silt loam; moderate subangular blocky structure; hard; 8 percent pebbles and 10 percent cobbles; pH 7.1	2 to 13 inches; brownish yellow gravelly sandy loam; moderate subangular blocky structure; soft; 30 percent pebbles; pH 6.5	
Substratum	16 inches; hard fractured siltstone	13 inches; hard fractured sandstone	

**Soil Properties and Management Interpretations**

Effective Rooting Depth	shallow	very shallow
Available Water Capacity	low	low
Water Retention Class	2	2
Hydrologic Soil Group	D	D
Permeability	moderate	moderately rapid
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.43	0.43
Drainage Class	excessively drained	excessively drained
Soil Manageability Class	3EdX	3EdX
Group	III	III
Type Conversion Class	3	3
Total Production (lb/acre)	1300	1400
Forest Survey Site Class	None	None

Included in this unit are areas of deep alluvial soils within drainages (50) Exchequer family (29) soils. Included areas make up about 10 percent of map unit area. This map unit has some slumps. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 5 inch intervals with few very fine and medium roots within the cracks.

**14 - LIVERMORE - AGUA DULCE - HAMBRIGHT FAMILIES ASSOCIATION**  
**30 to 80 percent slopes**

Soil Map Unit Components	Elevation: 1200 to 1470 feet      Annual Precipitation: 20 to 28 inches		
	<b>Livermore</b>	<b>Agua Dulce</b>	<b>Hambright</b>
Approximate Proportion	40 percent	20 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 80 percent	30 to 80 percent	30 to 80 percent
Vegetation Series	Scrub oak, manzanita, chamise, or coastal sagebrush	Scrub oak, ceanothus, or mountain mahogany	California buckwheat, chamise, or coastal sagebrush

**Soil Profile Description**

Surface Layer	0 to 3 inches; brown gravelly sandy clay loam; strong granular structure; soft; 20 percent pebbles; pH 7.0	0 to 38 inches; light brownish gray gravelly loam; weak subangular blocky structure; soft; 15 percent pebbles and 5 percent cobbles; pH 7.4	0 to 11 inches; grayish brown extremely cobbly loam; moderate subangular blocky structure; soft; 30 percent pebbles and 40 percent cobbles; pH 6.8
Subsoil	3 to 17 inches; yellowish brown very gravelly sandy clay loam; moderate subangular blocky structure; slightly hard; 50 percent pebbles and 3 percent cobbles; pH 7.5	38 to 65 inches; light yellowish brown very cobbly clay loam; weak angular blocky structure; soft; 35 percent pebbles and 20 percent cobbles; pH 6.5	
Substratum	17 to 60 inches; yellowish brown extremely gravelly sandy clay loam; weak subangular blocky structure; slightly hard; 60 percent pebbles and 2 percent cobbles; pH 7.5	65 inches; fractured hard shale	11 inches; fractured hard shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very deep	very deep	very shallow
Available Water Capacity	low to moderate	moderate to high	very low
Water Retention Class	2	1	3
Hydrologic Soil Group	C	C	D
Permeability	moderately slow	moderate	moderately rapid
Max Erosion Hazard	high	high	very high
Erosion Factor (K)	0.24	0.20	0.17
Drainage Class	well drained	well drained	excessively drained
Soil Manageability Class Group	3Epx III	3Epx III	3EPx III
Type Conversion Class	2	1	3
Total Production	1850 lb/acre	1800 lb/acre	1200 lb/acre
Forest Survey Site Class	None	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Rincon family (41), Inks family (9), Lopez family (19), Lodo family (15) and Chular family (22) soils and soils similar to Witzel family (49). Included areas make up about 20 percent of map unit area. This map unit has some dry ravel. Some areas have up to 30 percent rock fragments. The bedrock is fractured at 1 to 5 inch intervals with common very fine roots within the cracks.

**15 - LODO - BOTELLA FAMILIES ROCK OUTCROP ASSOCIATION**  
**30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 1200 to 5000 feet		Annual Precipitation: 18 to 24 inches
	<b>Lodo</b>	<b>Botella</b>	<b>Rock Outcrop</b>
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 TO 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Chamise, California buckwheat, or scrub oak	Annual brome grass, wild oats, or coast live oak	Barren
Soil Profile Description			
Surface Layer	0 to 6 inches; reddish brown sandy loam; weak subangular block structure slightly hard; 2 percent pebbles; pH 5.5	0 to 9 inches; reddish brown gravelly loam; moderate granular structure; slightly hard; 20 percent pebbles; pH 6.5	Rock outcrop consists of barren exposed hard sandstone or shale bedrock w/ less than 10 percent inclusions of soils which are capable of supporting plant life
Subsoil	6 to 17 inches; reddish brown very cobbly sandy loam; weak subangular blocky structure; slightly hard; 10 percent cobbles; pH 5.8	9 to 40 inches; reddish brown gravelly loam; weak subangular blocky structure slightly hard; 30 percent pebbles; pH 6.3	
Substratum	17 inches; fractured hard shale	40 inches; fractured hard shale	
Soil Properties and Management Interpretations			
Effective Rooting Depth	shallow	deep	
Available Water Capacity	Low	moderate to high	
Water Retention Class	2	1	
Hydrologic Soil Group	D	B	
Permeability	rapid	moderately rapid	
Max Erosion Hazard	very high	high	
Erosion Factor (K)	0.24	0.32	
Drainage Class	well drained	well drained	
Soil Manageability Class	3EdX	3EX	
Group	III	III	
Type Conversion Class	3	2	
Total Production (lb/acre)	1800	2100	
Forest Survey Site Class	None	None	
Included Areas & Remarks	Included in this unit are areas of Chular family (22), Modesto family (22), Ramona family (45), and Trigo family (46) soils. Included areas make up about 20 percent of map unit area. This map unit has some dry ravel slides, slumps and gullies. Some areas have up to 15 percent rock fragments. The bedrock is fractured at 1 to 8 inch intervals with few fine roots within the cracks.		

**16 - LODO - HAMBRIGHT - MILLSHOLM FAMILIES ASSOCIATION**  
**30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 800 to 3100 feet      Annual Precipitation: 18 to 28 inches		
	<b>Lodo</b>	<b>Hambright</b>	<b>Millsholm</b>
Approximate Proportion	60 percent	15 percent	15 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Manzanita, chamise, ceanothus, or California buckwheat	Ceanothus or chamise	Scrub oak, ceanothus, or chamise

**Soil Profile Description**

Surface Layer	0 to 7 inches; brown sandy loam; weak granular structure; soft; 7 percent pebbles; pH 7.0	0 to 7 inches; dark brown very gravelly sandy loam; weak granular structure; soft; 40 percent pebbles; pH 6.5	0 to 3 inches; brown gravelly sandy loam; weak granular structure; soft; 20 percent
Subsoil			3 to 13 inches; yellowish brown gravelly sandy loam; moderate subangular blocky structure; soft; 30 percent pebbles; pH 6.5
Substratum	7 inches; fractured hard shale	7 inches; highly fractured hard shale	13 inches; fractured hard shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	very shallow	very shallow
Available Water Capacity	very low to low	very low	low
Water Retention Class	3	3	2
Hydrologic Soil Group	D	D	C
Permeability	rapid	rapid	rapid
Max Erosion Hazard	very high	very high	very high
Erosion Factor (K)	0.24	0.24	0.28
Drainage Class	excessively drained	excessively drained	well drained
Soil Manageability Class	3EDx	3EDx	3Edx
Group	III	III	III
Type Conversion Class	3	3	3
Total Production (lb/acre)	1800	1200	1350
Forest Survey Site Class	None	None	None

**Included Areas & Remarks**

Included in this unit are areas of Los Robles family (3), Los Osos family (25), Botella family (15) soils, and rock outcrop (13). Included areas make up about 10 percent of map unit area. This map unit has numerous dry ravel slides and some slumps. Some areas have up to 30 percent surface rock fragments. The bedrock is fractured at 1 to 12 inch intervals with common very fine and many fine roots within the cracks.

**17 - LODO - LIVERMORE - CHUALAR FAMILIES ASSOCIATION**  
**30 to 60 percent slope**

Soil Map Unit Components	Elevation: 800 to 4200 feet      Annual Precipitation: 22 to 34 inches		
	<b>Lodo</b>	<b>Livermore</b>	<b>Chualar</b>
Approximate Proportion	30 percent	30 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	40 to 60 percent	40 to 60 percent
Vegetation Series	Ceanothus or scrub oak	Ceanothus or chamise	Ceanothus or chamise

**Soil Profile Description**

Surface Layer	0 to 10 inches; brown sandy loam; weak granular structure; soft; 7 percent pebbles; pH 7.0	0 to 6 inches; brown very gravelly sandy loam; weak subangular blocky structure; soft; 38 percent pebbles; pH 7.0	0 to 3 inches; dark gray silt loam; weak subangular blocky structure; soft 10 percent pebbles; pH 7.6
Subsoil		6 to 7 inches; grayish brown very gravelly loam; weak subangular blocky structure; soft; 38 percent pebbles; pH 6.5	3 to 48 inches; brown gravelly loam; weak subangular blocky structure; hard; 30 percent pebbles; pH 7.8
Substratum	10 inches; hard fractured shale	17 to 44 inches; light brownish gray very gravelly loam; weak subangular blocky structure; soft; 38 percent pebbles; pH 6.0 44 inches; hard fractured shale	48 inches; hard fractured shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	deep	deep
Available Water Capacity	low	moderate	moderate
Water Retention Class	2	2	1
Hydrologic Soil Group	D	B	B
Permeability	rapid	moderately rapid	moderately rapid
Max Erosion Hazard	very high	high	high
Erosion Factor (K)	0.24	0.24	0.32
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Edp	3E	3E
Group	III	III	III
Type Conversion Class	3	1	1
Total Production (lb/acre)	1800	1850	2000
Forest Survey Site Class	None	None	None

Included Areas & Remarks: Included in this unit are areas of Botella family (1), Modesto family (42), family (45), and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit has some dry ravel slides and slumps. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 1 to 10 inch intervals with few to many fine roots within the cracks.

**18 - LODO - MODJESKA - BOTELLA FAMILIES ASSOCIATION**  
**10 to 70 percent slopes**

Elevation: 1300 to 5800 feet      Annual Precipitation: 14 to 22 inches

Soil Map Unit Components	<b>Lodo</b>	<b>Modjeska</b>	<b>Botella</b>
Approximate Proportion	30 percent	30 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Alluvial fans and mountainsides
Slope	30 to 70 percent	30 to 60 percent	10 to 60 percent
Vegetation Series	Annual bromegrass and wild oats	Annual bromegrass and wild oats	Annual bromegrass and wild oats

**Soil Profile Description**

Surface Layer	0 to 7 inches; brown sandy loam; moderate granular structure; soft; 10 percent pebbles; pH 6.5	0 to 13 inches; pale brown sandy loam; weak granular structure; soft; 8 percent pebbles; pH 7.5	0 to 9 inches; brown sandy loam; weak granular structure; slightly hard; pH 7.0
Subsoil	7 to 16 inches; yellowish brown gravelly sandy loam; moderate subangular blocky structure; slightly hard; 12 percent pebbles and 5 percent cobbles; pH 7.0	13 to 27 inches; light yellowish brown extremely gravelly sandy loam; moderate subangular blocky structure; soft; 40 percent pebbles and 20 percent cobbles; pH 7.8	9 to 40 inches; brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 20 percent pebbles and 5 percent cobbles; pH 6.5
Substratum	16 inches; hard sandstone	27 inches; fractured hard granite rock	40 inches; hard sandstone

**Soil Properties and Management Interpretations**

Effective Rooting Depth	shallow	moderately deep	deep
Available Water Capacity	very low to low	low	high
Water Retention Class	2	2	1
Hydrologic Soil Group	D	C	B
Permeability	rapid	rapid	rapid
Max Erosion Hazard	very high	very high	high
Erosion Factor (K)	0.24	0.24	0.30
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Ep	3Ep	3E
Group	III	III	III
Type Conversion Class	3	2	2
Included Areas & Remarks	Included in this unit are areas of Chular family (47), Oak Glen family (37), and rock outcrop (13). Included areas make up about 20 percent of map unit area.		

**19 - LOPEZ - SANTA LUCIA FAMILIES ASSOCIATION - 10 to 70 percent slope**

Soil Map Unit Components	<b>Lopez</b>	<b>Santa Lucia</b>
Approximate Proportion	50 percent	30 percent
Landscape Position	Mountainsides	Mountainsides
Slope	10 to 70 percent	10 to 70 percent
Vegetation Series	Chamise, manzanita, coast live oak, and Coulter pine	Annual bromegrass and wild oats

**Soil Profile Description**

Surface Layer	0 to 11 inches; grayish brown very gravelly clay loam; weak granular structure; slightly hard; 40 percent pebbles; pH 4.7	0 to 10 inches; dark grayish brown clay loam; weak granular structure; slightly hard; 2 percent pebbles; pH 5.5
Subsoil		10 to 24 inches; brown very cobbly clay; moderate subangular blocky structure slightly hard; 2 percent pebbles and 42 percent cobbles; pH 5.5
Substratum	11 inches; fractured hard shale	24 inches; fractured hard shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	moderately deep
Available Water Capacity	very low to low	low to moderate
Water Retention Class	2	1
Hydrologic Soil Group	D	C
Permeability	moderate	moderately slow
Max Erosion Hazard	high	high
Erosion Factor (K)	0.15	0.20
Drainage Class	well drained	well drained
Soil Manageability Class	3Epx	3E
Soil Manageability Group	III	III
Type Conversion Class	3	2
Total Production (lb/acre)	1800	2100
Forest Survey Site Class	None	None

**Included Areas & Remarks**

Included in this unit are areas of soils similar to Livermore family (14), and soils similar to Wrentham family (10). Included areas make up about 20 percent of map unit area. This map unit has a few slumps and dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 6 inch intervals with few fine roots within the cracks.

**20 - LOS GATOS - KILBURN - PANAMINT FAMILIES ASSOCIATION - 10 to 30 percent slopes**

Soil Map Unit Components	Elevation: 5200 to 7500 feet      Annual Precipitation: 18 to 22 inches		
	<b>Los Gatos</b>	<b>Kilburn</b>	<b>Panamint</b>
Approximate Proportion	25 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides mostly south and west aspects
Slope	10 to 30 percent	10 to 30 percent	10 to 30 percent
Vegetation Series	Jeffrey pine or pinyon pine	Jeffrey pine, pinyon pine, or scrub oak	Annual brome grass, wild oats, Jeffrey pine, or scrub oak

**Soil Profile Description**

Surface Layer	0 to 3 inches; brown sandy loam; weak subangular blocky structure; soft; 3 percent pebbles; pH 6.4	0 to 7 inches; grayish brown very cobbly sandy loam; moderate granular structure; soft; 15 percent pebbles and 25 percent cobbles; pH 5.7	0 to 15 inches; brown coarse sandy loam; weak subangular blocky blocky structure; soft; 10 percent pebbles; pH 6.5
Subsoil	3 to 21 inches; brown sandy clay loam; moderate subangular blocky structure; hard; 8 percent pebbles; pH 6.6	7 to 19 inches; light olive brown very gravelly loam; moderate subangular blocky structure; soft; 35 percent pebbles and 10 percent cobbles; pH 6.2	15 to 39 inches; yellowish brown coarse sandy loam; moderate subangular blocky structure; soft; 10 percent pebbles; pH 6.5
Substratum	21 inches; hard fractured gneiss	19 to 36 inches; light yellowish brown extremely cobbly sandy loam; weak subangular blocky structure; soft; 50 percent pebbles, 30 percent cobbles and 3 percent stones; pH 6.5 36 inches; hard fractured gneiss	39 inches; hard granitic rock

**Soil Properties and Management Interpretations**

Rooting Depth	moderately deep	moderately deep	Moderately deep
Avail. Water Capacity	low to moderate	low to moderate	moderate
Water Retention Class	1	2	2
Hydrologic Soil Group	C	B	B
Permeability	moderate	moderately rapid	moderately rapid
Max Erosion Hazard	moderate	moderate	high
Erosion Factor (K)	0.28	0.24	0.24
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	2e	2ep	2E
Group	II	II	II
Type Conversion Class	2	2	2
Total Production	2500 lb/acre	1500 lb/acre	1800 lb/acre
Forest Survey Site Class	6	6	6

Included Areas & Remarks

Included in this unit are areas of Morical family (35), rock outcrop (13) and similar to Kilburn family (20), and soils similar to Los Gatos family (10). Included areas make up about 25 percent of map unit area. This map unit is mostly stable. Some areas have up to 10 percent surface rock fragmenmts. The bedrock is none to moderately fractured at 0 to 3 inch intervals with few fine roots in the cracks. Some inclusion soils have timber site class 5.

**21 - LOS GATOS - KILBURN - PANAMINT FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 5200 to 7500 feet      Annual Precipitation: 18 to 22 inches		
	Los Gatos	Kilburn	Panamint
Approximate Proportion	25 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides, mostly south and west aspects
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Jeffrey pine or pinyon pine	Jeffrey pine, scrub oak, or pinyon pine	Annual brome grass, wild oats, Jeffrey pine, or scrub oak

**Soil Profile Description**

Surface Layer	0 to 3 inches; brown sandy loam; weak subangular blocky structure; soft; 3 percent pebbles; pH 6.4	0 to 17 inches; grayish brown very cobbly sandy loam; moderate granular structure; soft; 15 percent pebbles and 25 percent cobbles; pH 5.7	0 to 15 inches; brown coarse sandy loam; weak subangular blocky structure; soft 10 percent pebbles; pH 6.5
Subsoil	3 to 21 inches; brown sandy clay loam; moderate subangular blocky structure; hard; 8 percent pebbles; pH 6.6	7 to 19 inches; light olive brown very gravelly loam; moderate subangular blocky structure; soft; 35 percent pebbles and 10 percent cobbles; pH 6.2	15 to 39 inches; yellowish brown coarse sandy loam; moderate subangular blocky structure; soft; 10 percent pebbles; pH 6.5
Substratum	21 inches; hard fractured gneiss	19 to 36 inches; light yellowish brown extremely cobbly sandy loam; weak subangular blocky structure; soft; 50 percent pebbles, 30 percent cobbles and 3 stones; pH 6.5 36 inches; hard fractured gneiss	39 inches; hard granitic rock

**Soil Properties and Management Interpretations**

Rooting Depth	moderately deep	moderately deep	moderately deep
Avail. Water Capacity	low to moderate	low to moderate	moderate
Water Retention Class	1	2	2
Hydrologic Soil Group	C	B	B
Permeability	moderate	moderately rapid	moderately rapid
Max Erosion Hazard	high	high	very high
Erosion Factor (K)	0.28	0.24	0.24
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3E	3E	3E
Group	III	III	III
Type Conversion Class	2	2	2
Total Production	2500 lb/acre	1500 lb/acre	1800 lb/acre
Forest Survey Site Class	6	6	6
Included Areas & Remarks	Included in this unit are areas of Morical family (35), Supan family (13), soils similar to Kilburn family (37), and soils similar to Los Gatos family (10). Included areas make up about 25 percent of map unit area. This map unit has some rock slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 0 to 3 inch intervals with few fine roots within the cracks. Some inclusion soils have timber site classes of 5.		

**22 - LOS OSOS - MODESTO - CHUALAR FAMILIES ASSOCIATION - 20 to 70 percent slopes**

Soil Map Unit Components	Elevation: 800 to 3700 feet      Annual Precipitation: 22 to 25 inches		
	<b>Los Osos</b>	<b>Modesto</b>	<b>Chualar</b>
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	20 to 70 percent	20 to 70 percent	20 to 70 percent
Vegetation Series	Coast live oak and bromegrass or ceanothus	Coast live oak or annual bromegrass	Ceanothus, manzanita, or scrub oak
Soil Profile Description			
Surface Layer	0 to 7 inches; brown clay loam; moderate subangular blocky structure; slightly hard; 2 percent pebbles and 2 percent cobbles; pH 6.5	0 to 5 inches; brown cobbly clay loam; moderate subangular blocky structure; hard; 10 percent pebbles and 10 percent cobbles; pH 6.5	0 to 6 inches; brown loam; weak granular structure; slightly hard; 5 percent pebbles; pH 7.3
Subsoil	7 to 47 inches; brown clay; moderate subangular blocky structure; hard; 10 percent pebbles; pH 6.5	5 to 35 inches; very pale brown clay loam; moderate subangular blocky structure very hard; 5 percent pebbles and 5 percent cobbles; pH 6.5	6 to 40 inches; brown clay loam; moderate subangular blocky structure; slightly hard; 5 percent pebbles and 2 percent cobbles; pH 7.6
Substratum	47 to 60 inches; brown silty clay; massive very hard; 5 percent pebbles; pH 6.5	35 inches; hard sandstone	40 inches; fractured hard sandstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	very deep	moderately deep	deep
Available Water Capacity	moderate to high	moderate	moderate to high
Water Retention Class	1	1	1
Hydrologic Soil Group	C	C	B
Permeability	moderately slow	moderately slow	moderate
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.32	0.37	0.28
Drainage Class	moderately well drained	well drained	well drained
Soil Manageability Class	3E	3E	3E
Soil Manageability Group	III	III	III
Type Conversion Class	1	2	2
Total Production (lb/acre)	3800	2000	2000
Forest Survey Site Class	7	7	7
Included Areas & Remarks	Included in this unit are areas of Livermore family (41), Modjeska family (25), and Hambright family (16). Included areas make up about 20 percent of map unit area. This map unit has a few slumps. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 10 inch intervals with few very fine roots within the cracks.		

## 23 - LOS OSOS - NACIMIENTO FAMILIES ASSOCIATION - 15 to 45 percent slopes

Soil Map Unit Components	Elevation: 1500 to 2200 feet <b>Los Osos</b>	Annual Precipitation: 13 to 20 inches <b>Nacimiento</b>
Approximate Proportion	50 percent	45 percent
Landscape Position	Mountainsides and hillslopes	Mountainsides and hillslopes
Slope	15 to 45 percent	15 to 45 percent
Vegetation Series	oats, blue oak, scrub oak, or chamise	oats, or blue oak
Soil Profile Description		
Surface Layer	0 to 12 inches; dark gray clay loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 7.0	0 to 35 inches; brown clay loam; weak subangular blocky structure; slightly hard; 2 percent pebbles; pH 7.9
Subsoil	12 to 35 inches; pale brown clay loam; strong angular blocky structure; hard; 10 percent pebbles; pH 8.0	
Substratum	35 inches; weathered sandstone	35 inches; weathered sandstone
Soil Properties and Management Interpretations		
Effective Rooting Depth	moderately deep	moderately deep
Available Water Capacity	moderate	moderate
Water Retention Class	1	1
Hydrologic Soil Group	C	C
Permeability	moderately slow	moderately slow
Max Erosion Hazard	high	high
Erosion Factor (K)	0.32	0.32
Drainage Class	well drained	well drained
Soil Manageability Class	2E	2E
Soil Manageability Group	II	II
Type Conversion Class	2	2
Total Production (lb/acre)	3800	3900
Forest Survey Site Class	None	7
Included Areas & Remarks	<p>Included in this unit area areas of rock outcrop (13), and soils similar to Nacimiento family (23). Included areas make up about 5 percent of map unit area. This map unit has a few slumps. Some areas have up to 5 percent surface rock fragments. The bedrock is fractured at 3 to 7 inch intervals with few fine roots within the cracks.</p>	

**24 - LOS ROBLES - TRIGO FAMILIES - ORTHENTS ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 2500 to 6200 feet    Annual Precipitation: 8 to 14 inches		
	<b>Los Robles</b>	<b>Trigo</b>	<b>Orthents</b>
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Mountainsides	Mountainsides, north and west aspects	Mountainsides, south & east aspects
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Annual brome grass or scrub oak	Annual brome grass or lupine	Annual brome grass or California buckwheat

**Soil Profile Description**

Surface Layer	0 to 4 inches; light yellowish brown sandy loam; moderate subangular blocky structure; soft; 10 percent pebbles; pH 8.0	0 to 10 inches; light yellowish brown gravelly sandy loam; weak subangular blocky structure; soft; 20 percent pebbles; pH 8.0	0 to 4 inches; light yellowish brown sandy loam; weak subangular blocky structure; soft; 10 percent pebbles; pH 8.0
Subsoil	4 to 21 inches; light yellowish brown loam; strong subangular blocky structure; slightly hard; pH 8.0	10 to 17 inches; very pale brown gravelly sandy loam; single grain; soft; 15 percent pebbles and 2 percent cobbles; pH 8.0	4 to 12 inches; very pale brown sandy loam; weak subangular blocky structure; soft; 25 percent pebbles; pH 8.0
Substratum	21 inches; weathered conglomerate	17 inches; soft conglomerate and sandstone	12 inches; soft weathered sandstone and conglomerate

**Soil Properties and Management Interpretations**

Effective Rooting Depth	moderately deep	shallow	very shallow
Available Water Capacity	moderate	very low to low	very low to low
Water Retention Class	1	2	2
Hydrologic Soil Group	C	D	D
Permeability	moderately rapid	rapid	rapid
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.28	0.37	0.37
Drainage Class	well drained	excessive drained	well drained
Soil Manageability Class	3E	3Edx	3Edx
Group	III	III	III
Type Conversion Class	2	3	3
Total Production (lb/acre)	2400	1000	1400
Forest Survey Site Class	None	None	None

Included in this unit are areas of Fluvents family (38), Modesto family (46), and Ramona family (45). Included areas make up about 20 percent of map unit area. This map unit is mostly stable with a few dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 4 to 15 inch intervals with few fine and many medium roots within the cracks.

**25 - MILLERTON - MILLSHOLM - AGUA DULCE FAMILIES ASSOCIATION**  
**30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 800 to 5700 feet		Annual Precipitation: 14 to 24 inches
	Millerton	Millsholm	Agua Dulce
Approximate Proportion	30 percent	30 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Ceanothus or chamise	Annual brome grass, blue oak, chamise, or manzanita	Chamise or manzanita

**Soil Profile Description**

Surface Layer	0 to 4 inches; pale brown sandy loam; weak subangular blocky structure; soft; 5 percent pebbles; pH 6.5	0 to 6 inches; light yellowish brown silt loam; subangular blocky structure; hard; 10 percent pebbles; pH 6.3	0 to 15 inches; brown sandy loam; weak granular structure; soft; 10 percent pebbles and 2 percent cobbles; pH 6.5
Subsoil	4 to 14 inches; yellowish brown sandy loam; moderate subangular blocky structure; soft; 5 percent pebbles and 2 percent cobbles; pH 6.5	6 to 16 inches; light yellowish brown cobbly silt loam; moderate subangular blocky structure; hard; 8 percent pebbles and 10 percent cobbles; pH 7.1	15 to 47 inches; strong brown extremely gravelly sandy clay loam; moderate subangular blocky structure; very hard; 50 percent pebbles, 10 percent cobbles, 20 percent stones; pH 7.5
Substratum	14 to 18 inches; brownish yellow sandy loam; weak subangular blocky structure; slightly hard; 5 percent pebbles 5 percent cobbles; pH 6.5 18 inches; fractured hard sandstone	16 inches; hard siltstone	47 inches; weathered conglomerate

**Soil Properties and Management Interpretations**

Effective Rooting Depth	shallow	shallow	deep
Available Water Capacity	low	low	moderate
Water Retention Class	2	1	1
Hydrologic Soil Group	D	D	C
Permeability	rapid	moderately rapid	moderate
Max Erosion Hazard	very high	very high	high
Erosion Factor (K)	0.28	0.37	0.30
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Edx	3Edx	3E
Group	III	III	III
Type Conversion Class	3	3	2
Total Production (lb/acre)	2000	1350	1800
Forest Survey Site Class	None	None	None

Included in this unit are areas of Los Osos family (23), Exchequer family (29), Modesto family (31), and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit has some dry ravel slides and slumps. Some areas have up to 15 percent rock fragments. The bedrock is weakly to strongly fractured at 2 to 20 inch intervals with many fine roots within the cracks.

**26 - MILLERTON - MILLSHOLM FAMILIES - ROCK OUTCROP COMPLEX**  
**30 to 80 percent slopes**

Soil Map Unit Components	Elevation: 400 to 7500 feet      Annual Precipitation: 17 to 34 inches		
	<b>Millerton</b>	<b>Millsholm</b>	<b>Rock Outcrop</b>
Approximate Proportion	30 percent	30 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 80 percent	30 to 80 percent	30 to 80 percent
Vegetation Series	Chamise, ceanothus, annual bromegrass, or manzanita	Scrub oak, manzanita, chamise, or ceanothus	Barren

**Soil Profile Description**

Surface Layer	0 to 3 inches; brown sandy loam; weak subangular blocky structure; slightly hard; 5 percent pebbles; pH 6.0	0 to 6 inches; brown sandy loam; weak subangular blocky structure; slightly hard; 5 percent pebbles; pH 6.0	Rock outcrop consists of barren hard exposed sandstone bedrock with less than 10 percent inclusions of soils which are capable of supporting plant life
Subsoil	3 to 16 inches; reddish yellow gravelly sandy loam; moderate subangular blocky structure; pH 5.5	6 to 16 inches; reddish yellow gravelly sandy loam; moderate subangular blocky structure; slightly hard; 25 percent pebbles; pH 5.5	
Substratum	16 inches; fractured hard sandstone	16 inches; hard sandstone	

**Soil Properties and Management Interpretations**

Effective Rooting Depth	shallow	shallow
Available Water Capacity	very low to low	low
Water Retention Class	2	2
Hydrologic Soil Group	D	D
Permeability	rapid	rapid
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.28	0.28
Drainage Class	well drained	well drained
Soil Manageability Class	3Edx	3Edx
Group	III	III
Type Conversion Class	3	3
Total Production (lb/acre)	2000	1350
Forest Survey Site Class	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Stoneyford family (29), Yorba family (52), Livermore family (17), soils similar to Los Gatos family (22). Included areas make up about 20 percent of map unit area. This map unit is mostly stable with a few dry ravel slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 6 to 20 inch intervals with few fine roots within the cracks.

**27 - MILLERTON - MODJESKA FAMILIES ASSOCIATION - 30 to 80 percent slopes**

Elevation: 2800 to 4900 feet      Annual Precipitation: 20 to 26 inches

Soil Map Unit Components

**Millerton**

**Modjeska**

Approximate Proportion

45 percent

30 percent

Landscape Position

Mountainsides

Mountainsides

Slope

30 to 80 percent

30 to 80 percent

Vegetation Series

Chamise or manzanita

Chamise or scrub oak

**Soil Profile Description**

Surface Layer

0 to 2 inches; dark yellowish brown gravelly sandy loam; weak subangular blocky structure; soft; 20 percent pebbles; pH 6.5

0 to 5 inches; light yellowish brown gravelly loam; weak subangular blocky structure; slightly hard; 30 percent pebbles; pH 5.8

Subsoil

2 to 13 inches; brownish yellow gravelly sandy loam; moderate subangular blocky structure; soft; 30 percent pebbles; pH 6.5

5 to 26 inches; brownish yellowish very gravelly clay loam; moderate subangular blocky structure; slightly hard; 45 percent pebbles; pH 5.5

Substratum

13 to 17 inches; fractured weathered sandstone  
17 inches; fractured hard sandstone

26 inches; highly fractured hard shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth

shallow

moderately deep

Available Water Capacity

very low to low

low

Water Retention Class

2

2

Hydrologic Soil Group

D

C

Permeability

rapid

moderate

Max Erosion Hazard

very high

very high

Erosion Factor (K)

0.24

0.20

Drainage Class

well drained

well drained

Soil Manageability

Class

3Edx

3Epx

Group

III

III

Type Conversion Class

3

2

Total Production (lb/acre)

2000

1800

Forest Survey Site Class

None

None

Included Areas & Remarks

Included in this unit are areas of Los Robles family (24) and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with a few dry ravel slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 4 to 20 inch intervals with many fine roots within the cracks.

**28 - MILLERTON - RELIZ - MODJESKA FAMILIES ASSOCIATION - 40 to 70 percent slopes**

	Elevation: 760 to 5800 feet	Annual Precipitation: 20 to 34 inches	
Soil Map Unit Components	<b>Millerton</b>	<b>Reliz</b>	<b>Modjeska</b>
Approximate Proportion	35 percent	25 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	40 to 70 percent	40 to 70 percent	
Vegetation Series	Manzanita or chamise	Ceanothus, scrub oak, or chamise	Manzanita or ceanothus

**Soil Profile Description**

Surface Layer	0 to 2 inches; dark yellowish brown gravelly sandy loam; weak subangular blocky structure; soft; 20 percent pebbles; pH 6.5	0 to 4 inches; pale brown sandy loam; weak subangular blocky structure; soft; 10 percent pebbles; pH 7.5	0 to 3 inches; brown cobbly sandy loam; weak granular structure; soft; 10 percent pebbles and 10 percent cobbles; pH 6.5
Subsoil	2 to 13 inches; brownish yellow gravelly sandy loam; moderate subangular blocky structure; soft; 30 percent pebbles; pH 6.5	4 to 10 inches; pale brown very gravelly coarse sandy loam; weak subangular blocky structure; soft; 40 percent pebbles and 10 percent cobbles; pH 6.5	3 to 22 inches; brown very cobbly sandy loam; moderate subangular blocky structure; slightly hard; 5 percent pebbles and 50 percent cobbles; pH 6.0
Substratum	13 to 17 inches; fractured weathered sandstone	10 to 14 inches; fractured weathered sandstone 14 inches; fractured hard sandstone	22 inches; fractured hard sandstone

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	very shallow	moderately deep
Available Water Capacity	very low to low	very low	low
Water Retention Class	2	3	2
Hydrologic Soil Group	D	D	C
Permeability	rapid	rapid	rapid
Max Erosion Hazard	very high	very high	high
Erosion Factor (K)	0.28	0.24	0.24
Drainage Class	well drained	excessively drained	well drained
Soil Manageability Class	3Edx	3EPx	3Ep
Group	III	III	III
Type Conversion Class	3	3	2
Total Production (lb/acre)	2000	1200	1800
Forest Survey Site Class	None	None	None

Included in this unit are areas of Yorba family (32), Agua Dulce family (9), San Andres family (47) and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit is mostly stable with a few dry ravel slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 2 to 20 inch intervals with few medium roots within the cracks.

**29 - MILLSHOLM - EXCHEQUER - STONYFORD FAMILIES ASSOCIATION**  
**30 to 75 percent slopes**

Soil Map Unit Components	Elevation: 2100 to 5000 feet      Annual Precipitation: 14 to 25 inches		
	<b>Millsholm</b>	<b>Exchequer</b>	<b>Stonyford</b>
Approximate Proportion	35 percent	20 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 75 percent	30 to 75 percent	30 to 75 percent
Vegetation Series	Chamise, annual brome-grass, manzanita, or scrub oak	Manzanita, chamise, toyon or annual brome-grass	Chamise, manzanita, scrub oak, or annual brome-grass

**Soil Profile Description**

Surface Layer	0 to 2 inches; pale brown gravelly loam; weak subangular blocky structure; slightly hard; 20 percent pebbles; pH 7.1	0 to 2 inches; brown sandy loam; moderate subangular blocky structure; slightly hard; 5 percent pebbles; pH 6.5	0 to 4 inches; grayish brown sandy loam; weak granular structure; soft; 2 percent cobbles; pH 6.0
Subsoil	2 to 14 inches; brown gravelly loam; moderate subangular blocky structure; slightly hard; 20 percent pebbles and 5 percent cobbles; pH 7.0	2 to 12 inches; light brownish yellow sandy loam massive; slightly hard; 5 percent pebbles; pH 6.5	4 to 12 inches; brownish yellow sandy clay loam; weak subangular blocky structure; soft; 5 percent pebbles and 5 percent cobbles; pH 5.5
Substratum	14 inches; fractured hard siltstone	12 inches; hard sandstone	12 inches; fractured hard sandstone

**Soil Properties and Management Interpretations**

Effective Rooting Depth	shallow	very shallow	very shallow
Available Water Capacity	low to moderate	very low to low	low
Water Retention Class	1	2	1
Hydrologic Soil Group	D	D	D
Permeability	moderately rapid	rapid	moderate
Max Erosion Hazard	very high	very high	very high
Erosion Factor (K)	0.28	0.28	0.32
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Edx	3Edx	3Edx
Group	III	III	III
Type Conversion Class	3	3	3
Total Production (lb/acre)	1350	1300	1600
Forest Survey Site Class	None	None	None

Included in this unit are areas of Reliz family (28), Agua Dulce family (3), Los Robles family (3), Supan family (10), and soils similar to Millerton family (25). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with a few dry ravel slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 1 to 15 inch intervals with many very fine to few medium roots within the cracks.

**30 - MILLSHOLM - RELIZ FAMILIES ROCK OUTCROP ASSOCIATION - 40 to 65 percent slopes**

	Elevation: 1200 to 7200 feet		Annual Precipitation: 18 to 36 inches	
Soil Map Unit Components	<b>Millsholm</b>	<b>Reliz</b>	<b>Rock Outcrop</b>	
Approximate Proportion	30 percent	25 percent	20 percent	
Landscape Position	Mountainsides	Mountainsides	Mountainsides	
Slope	40 to 65 percent	40 to 65 percent	40 to 65 percent	
Vegetation Series	Manzanita or chamise	Manzanita or chamise	Barren	

**Soil Profile Description**

Surface Layer	0 to 4 inches; brownish yellow gravelly sandy loam; weak subangular blocky structure; soft; 20 percent pebbles; pH 4.8	0 to 4 inches; pale brown gravelly sandy loam; weak subangular blocky structure; soft; 30 percent pebbles; pH 7.5	Rock outcrop consists of barren exposed fractured hard sandstone and siltstone bedrock with inclusions of less than 10 percent soil capable of supporting plants
Subsoil	4 to 7 inches; yellow sandy loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 5.4	4 to 10 inches; pale brown very gravelly sandy loam; weak subangular blocky structure; soft; 40 percent pebbles and 10 percent cobbles; pH 6.5	
Substratum	7 to 13 inches; light yellowish brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 20 percent pebbles; pH 5.8	10 to 14 inches; fractured soft sandstone 14 inches; fractured hard sandstone	

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	very shallow
Available Water Capacity	low to moderate	very low
Water Retention Class	3	3
Hydrologic Soil Group	D	D
Permeability	rapid	rapid
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.28	0.28
Drainage Class	well drained	excessively drained
Soil Manageability Class	3EdX	3EPX
Group	III	III
Type Conversion Class	3	3
Total Production (lb/acre)	1350	1200
Forest Survey Site Class	None	None

**Included Areas & Remarks**  
 Included in this unit area areas of Millerton family (27), Modjeska family (28), Exchequer family (29), and Morical family (52). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with a few dry ravel slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 2 to 12 inch intervals with few fine and medium roots within the cracks.

**31 - MODESTO - RINCON - MILLSHOLM FAMILIES ASSOCIATION - 20 to 50 percent slopes**

Soil Map Unit Components	Elevation: 800 to 3400 feet      Annual Precipitation: 14 to 24 inches		
	<b>Modesto</b>	<b>Rincon</b>	<b>Millsholm</b>
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Mountainsides and hillslopes	Mountainsides and hillslopes	Mountainsides and hillslopes
Slope	20 to 50 percent	20 to 50 percent	20 to 40 percent
Vegetation Series	Annual brome grass, wild oats, or blue oak	Annual brome grass, wild oats, or blue oak	annual brome grass, wild oats, blue oak, or digger pine
Soil Profile Description			
Surface Layer	0 to 14 inches; light yellowish brown loam; moderate subangular blocky structure; hard 2 percent cobbles; pH 6.5	0 to 12 inches; pale brown loam; weak subangular blocky structure; hard; pH 6.6	0 to 6 inches; light yellowish brown loam; moderate subangular blocky structure; hard; 10 percent pebbles; pH 6.3
Subsoil	14 to 38 inches; light yellowish brown loam; moderate subangular blocky structure; hard;	12 to 60 percent; light yellowish brown gravelly clay loam; 30 percent pebbles; pH 6.0	6 to 16 inches; light yellowish brown cobbly loam; moderate subangular blocky structure; hard; 10 percent pebbles and 10 percent cobbles; 7.1
Substratum	38 inches; fractured hard sandstone		16 inches; fractured hard siltstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	moderately deep	very deep	shallow
Available Water Capacity	moderate to high	moderate to high	low to moderate
Water Retention Class	1	1	2
Hydrologic Soil Group	C	C	C
Permeability	moderately rapid	moderate	moderately rapid
Max Erosion Hazard	high	moderate	high
Erosion Factor (K)	0.37	0.37	0.37
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3E	3g	3Ed
Group	III	III	III
Type Conversion Class	1	1	3
Total Production (lb/acre)	2000	5500	1350
Forest Survey Site Class	7	7	None
Included Areas & Remarks	Included in this unit are areas of Los Osos family (23), and soils similar to Rincon family (31). Included areas make up about 20 percent of map unit area. This map unit has some slumps. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 12 inch intervals with few very fine and fine roots within the cracks.		

**32 - MODESTO - YORBA - AGUA DULCE FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 1200 to 3000 feet      Annual Precipitation: 14 to 24 inches		
	<b>Modesto</b>	<b>Yorba</b>	<b>Agua Dulce</b>
Approximate Proportion	30 percent	30 percent	25 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Redshank or chamise	Chamise	Chamise

**Soil Profile Description**

Surface Layer	0 to 7 inches; grayish brown coarse sandy loam; weak granular structure; soft; 10 percent pebbles; pH 6.5	0 to 2 inches; light olive brown loam; weak platy structure; slightly hard; 10 percent pebbles; pH 7.0	0 to 15 inches; brown sandy loam; weak granular structure; soft; 10 percent pebbles and 2 percent cobbles; pH 6.5
Subsoil	7 to 23 inches; brown gravelly sandy clay loam; moderate subangular blocky structure; very hard; 10 percent pebbles and 5 percent	2 to 30 inches; reddish yellow very gravelly clay loam; moderate subangular blocky structure; hard; 40 percent pebbles and 5 percent cobbles; pH 7.0	15 to 47 inches; strong brown extremely gravelly sandy clay loam; moderate subangular blocky structure; 50 percent pebbles, 10 percent cobbles and 20 percent stones; pH 6.0
Substratum	23 to 56 inches; light very gravelly brown sandy loam; weak subangular blocky structure; hard; 30 percent pebbles and 10 percent cobbles; pH 5.5 56 inches; weathered conglomerate	30 inches; weathered conglomerate	47 inches; weathered conglomerate

**Soil Properties and Management Interpretations**

Effective Rooting Depth	deep	moderately deep	deep
Available Water Capacity	high	low	moderate
Water Retention Class	1	2	2
Hydrologic Soil Group	C	C	C
Permeability	moderate	moderate	moderate
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.37	0.28	0.26
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3E	3Ep	3Ep
Group	III	III	III
Type Conversion Class	1	2	2
Total Production (lb/acre)	2000	1500	1800
Forest Survey Site Class	None	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Chular family (22), Los Osos family (23), and rock outcrop (13). Included areas make up about 15 percent of map unit area. This map unit has some dry ravel slides and slumps. Some areas have up to 20 percent surface rock fragments. The bedrock is fractured at 1 to 4 inch intervals with many fine and few medium roots within the cracks.

### 33 - MODJESKA - LODO FAMILIES ASSOCIATION - 40 to 80 percent slopes

Elevation: 1700 to 5300 feet      Annual Precipitation: 32 to 34 inches

Soil Map Unit Components	<b>Modjeska</b>	<b>Lodo</b>
Approximate Proportion	40 percent	35 percent
Landscape Position	Mountainsides	Mountainsides
Slope	40 to 80 percent	40 to 80 percent
Vegetation Series	Manzanita, chamise, ceanothus, or scrub oak	Scrub oak, chamise, or manzanita

#### Soil Profile Description

Surface Layer	0 to 3 inches; brown sandy loam; weak granular structure; soft; 10 percent pebbles; pH 6.0	0 to 7 inches; brown sandy loam; weak granular structure; soft; 10 percent pebbles; pH 6.5
Subsoil	3 to 11 inches; light yellowish brown very cobbly sandy loam; moderate subangular blocky structure; soft; 15 percent pebbles and 25 percent cobbles; pH 5.5	7 to 16 inches; brown gravelly sandy loam; moderate subangular structure; slightly hard; 12 percent pebbles and 5 percent cobbles; pH 7.0
Substratum	11 to 32 inches; very pale brown extremely cobbly sandy loam; weak granular structure; soft; 25 percent pebbles and 50 percent cobbles; pH 5.5 32 inches; fractured hard sandstone and conglomerate	16 inches; fractured hard sandstone

#### Soil Properties and Management Interpretations

Effective Rooting Depth	moderately deep	shallow
Available Water Capacity	low	low
Water Retention Class	2	2
Hydrologic Soil Group	C	D
Permeability	rapid	moderately rapid
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.24	0.24
Drainage Class	well drained	well drained
Soil Manageability Class	3Epx	3Edx
Group	III	III
Total Production (lb/acre)	1800	1800
Included Areas & Remarks	Included in this unit are areas of Chular family (17), Livermore family (17), Lithic Haploxerafs (13), and rock outcrop (13). Included areas make up about 25 percent of map unit area.	

### 34 - MODJESKA - MODESTO FAMILIES ASSOCIATION - 30 to 60 percent slopes

	Elevation: 4250 to 6500 feet	Annual Precipitation: 20 to 24 inches
Soil Map Unit Components	<b>Modjeska</b>	<b>Modesto</b>
Approximate Proportion	50 percent	30 percent
Landscape Position	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent
Vegetation Series	Pinyon pine, scrub oak, or annual brome grass	Scrub oak, annual brome grass, or pinyon pine

#### Soil Profile Description

Surface Layer	0 to 4 inches; brown sandy loam; weak granular structure; soft; 10 percent pebbles; pH 7.0	0 to 5 inches; brown sandy loam; weak granular structure; soft; 3 percent pebbles and 2 percent cobbles; pH 6.5
Subsoil	4 to 12 inches; dark yellowish brown very gravelly sandy loam; moderate subangular blocky structure; soft; 45 percent pebbles and 5 percent cobbles; pH 7.2	5 to 21 inches; dark yellowish brown gravelly sandy clay loam; weak subangular blocky structure; slightly hard; 15 percent pebbles ' and 5 percent cobbles; pH 6.9
Substratum	12 to 30 inches; yellowish brown very gravelly sandy loam; single grain; soft; 40 percent pebbles and 5 percent cobbles; pH 7.6 30 inches; fractured hard sandstone and conglomerate	21 inches; weathered conglomerate

#### Soil Properties and Management Interpretations

Effective Rooting Depth	moderately deep	moderately deep
Available Water Capacity	moderate	moderate
Water Retention Class	2	2
Hydrologic Soil Group	C	C
Permeability	rapid	moderate
Max Erosion Hazard	high	high
Erosion Factor (K)	0.24	0.34
Drainage Class	well drained	well drained
Soil Manageability Class	3Ep	3E
Group	III	III
Type Conversion Class	2	2
Total Production (lb/acre)	1800	2000
Forest Survey Site Class	7	7
Included Areas & Remarks	Included in this area are areas of soils similar to Botella family (18), and rock outcrop (13). Included areas make up about 20 percent of map unit area. This map unit has some dry ravel slides and slumps. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 1 to 9 inch intervals with many fine roots within the cracks.	

**35 - MORICAL - SUPAN - GREEN BLUFF FAMILIES ASSOCIATION - 10 to 60 percent slopes**

Soil Map Unit Components	Elevation: 4700 to 8100 feet      Annual Precipitation: 14 to 20 inches		
	<b>Morical</b>	<b>Supan</b>	<b>Green Bluff</b>
Approximate Proportion	40 percent	20 percent	20 percent
Landscape Position	Mountain slopes, terraces, or alluvial fans	Mountain slopes, terraces, or alluvial fans	Mountain slopes, or hillslopes
Slope	10 to 60 percent	10 to 60 percent	10 to 60 percent
Vegetation Series	Pinyon pine, scrub oak, sagebrush, or Jeffrey pine	Sagebrush or annual brome-grass	Sagebrush or pinyon pine
Soil Profile Description			
Surface Layer	0 to 2 inches; dark brown loam; weak granular structure; slightly hard; 3 percent pebbles; pH 7.0	0 to 7 inches; dark grayish brown gravelly loam; weak subangular blocky structure; slightly hard; 20 percent pebbles and 5 percent cobbles; pH 7.2	0 to 6 inches; very dark grayish brown sandy loam; weak subangular blocky structure; slightly hard; 5 percent pebbles; pH 7.4
Subsoil	2 to 28 inches; yellowish brown sandy clay loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 7.0	7 to 32 inches; dark grayish brown gravelly clay loam; moderate subangular blocky structure; slightly hard; 20 percent pebbles and 5 percent cobbles; pH 7.1	6 to 18 inches; yellowish brown sandy loam; moderate subangular blocky structure; slightly hard; 5 percent gravels; pH 8.0
Substratum	28 to 60 inches; strong brown gravelly sandy loam; massive; slightly hard; 12 percent pebbles and 5 percent cobbles; pH 6.0	32 to 60 inches; dark brown gravelly loam; moderate subangular blocky structure; hard; 20 percent gravels and 10 percent cobbles; pH 7.2	18 to 28 inches; pale brown sandy loam; massive; slightly hard; 5 percent pebbles and 2 percent cobbles; pH 8.0 28 inches; weathered sandstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	very deep	very deep	moderately deep
Available Water Capacity	moderate to high	moderate	moderate
Water Retention Class	1	1	1
Hydrologic Soil Group	B	B	B
Permeability	moderate	moderate	rapid
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.32	0.28	0.24
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3E	3E	3E
Soil Manageability Group	III	III	III
Type Conversion Class	2	2	2
Total Production	2200 lb/acre	2600 lb/acre	1500 lb/acre
Forest Survey Site Class	6	7	7
Included Areas & Remarks	Included in this unit are areas of Los Gatos family (20), Millerton family (25), soils similar to Morical family (35), and soils similar to Supan family (35). Included areas make up about 20 percent of map unit area. This map unit is mostly stable with a few dry ravel slides and rock slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 4 inch intervals with no roots within the cracks.		

### 36 - OAK GLEN - SUPAN - HAGAN FAMILIES COMPLEX - 0 to 10 percent slopes

Soil Map Unit Components	Elevation: 4250 to 6600 feet      Annual Precipitation: 19 to 25 inches		
	Oak Glen	Supan	Hagan
Approximate Proportion	30 percent	25 percent	25 percent
Landscape Position	Valley floor	Valley Floor	Valley Floor
Slope	0 to 10 percent	0 to 10 percent	0 to 10 percent
Vegetation Series	Annual bromegrass or scrub oak	Sagebrush, annual bromegrass, or pinyon pine	Annual bromegrass or sagebrush

#### Soil Profile Description

Surface Layer	0 to 16 inches; grayish brown gravelly sandy loam; moderate granular structure; soft; 20 percent pebbles; pH 7.2	0 to 11 inches; grayish brown sandy loam; moderate subangular blocky structure; soft; 2 percent pebbles; pH 6.4	0 to 3 inches; pale brown coarse sandy loam; moderate platy structure; soft; 10 percent pebbles; pH 7.7
Subsoil	16 to 90 inches; brown gravelly sandy loam; massive; soft; 20 percent pebbles and 5 percent cobbles; pH 7.2	11 to 50 inches; dark grayish brown sandy clay loam; moderate subangular blocky structure; very hard; 10 percent pebbles; pH 7.3	3 to 40 inches; light yellowish brown sandy loam; massive; soft; 5 percent pebbles and 5 percent cobbles; pH 7.8
Substratum	40 to 60 inches; brown gravelly sandy loam; massive; soft; 20 percent pebbles and 5 percent cobbles; pH 7.2	50 to 60 inches; yellowish brown gravelly sandy loam; moderate subangular blocky structure; very hard; 10 percent pebbles; pH 7.3	40 to 60 inches; light yellowish brown coarse sand; massive; 20 percent pebbles, 5 percent cobbles; pH 8.0

#### Soil Properties and Management Interpretations

Effective Rooting Depth	very deep	very deep	very deep
Available Water Capacity	moderate	moderate to high	moderate
Water Retention Class	2	1	2
Hydrologic Soil Group	B	B	B
Permeability	rapid	moderately rapid	rapid
Max Erosion Hazard	moderate	moderate	moderate
Erosion Factor (K)	0.20	0.28	0.20
Drainage Class	well drained	well drained	excessively drained
Soil Manageability Class	2e	2e	2eP
Group	II	II	II
Type Conversion Class	2	1	2
Total Production (lb/acre)	1800	2600	1600
Forest Survey Site Class	7	7	None

Included in this unit are areas of Orthents (39), Fluvents (39), and soils similar to Oak Glen family (36). Included areas make up about 20 percent of map unit area. This map unit is susceptible to gullyng. Some areas have up to 5 percent surface rock fragments. There is no bedrock within 60 inches.

**37 - OAK GLEN - WRENTHAM - KILBURN FAMILIES COMPLEX - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 4000 to 7300 feet      Annual Precipitation: 20 to 35 inches		
	Oak Glen	Wrentham	Kilburn
Approximate Proportion	30 percent	25 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Mixed conifer	Jeffrey pine	Jeffrey pine
Soil Profile Description			
Surface Layer	0 to 13 inches; dark brown sandy loam; weak subangular blocky structure; soft; 3 percent pebbles; pH 6.5	0 to 3 inches; reddish brown sandy loam; weak subangular blocky structure; soft; 4 percent pebbles; pH 5.5	0 to 14 inches; brown sandy loam; moderate subangular blocky structure; soft; 4 percent pebbles; pH 5.7
Subsoil	13 to 24 inches; brown sandy loam; moderate subangular blocky structure; soft; 3 percent pebbles; pH 6.2	3 to 29 inches; brown extremely cobbly sandy loam; weak subangular blocky structure; soft; 20 percent pebbles, 30 percent cobbles & 10 percent stones; pH 6.6	14 to 24 inches; brown extremely cobbly sandy loam; weak subangular blocky structure; soft; 15 percent pebbles, 40 percent cobbles and 5 percent stones; pH 6.3
Substratum	24 inches; fractured hard sandstone	29 inches; hard sandstone sandstone	24 inches; hard sandstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	moderately deep	moderately deep	moderately deep
Available Water Capacity	moderate	low	low
Water Retention Class	2	2	2
Hydrologic Soil Group	B	B	B
Permeability	rapid	rapid	rapid
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.24	0.28	0.24
Drainage Class	well drained	well drained	well drained
Soil Manageability Class Group	3Ex III	3Epx III	3Epx III
Type Conversion Class	2	2	2
Total Production (lb/acre)	1800	1600	1500
Forest Survey Site Class	6	6	6
Included Areas & Remarks	Included in this unit are areas of Morical family (52), Millsholm family (30), and soils similar to Oak Glen family (37). Included areas make up about 25 percent of map unit area. This map unit has a few rock slides. some areas have up to 20 percent surface rock fragments. The bedrock is fractured at 1 to 12 inch intervals with many very fine and medium roots within the cracks.		

### 38 - ORTHENTS - FLUVENTS COMPLEX, DRY, 0 to 15 percent slopes

Elevation: 2700 to 4400 feet

Annual Precipitation: 8 to 12 inches

#### Soil Map Unit Components

#### Orthents

#### Fluents

Approximate Proportion

60 percent

30 percent

Landscape Position

stream terraces

stream terraces

Slope

0 to 15 percent

0 to 15 percent

Vegetation Series

annual brome grass, pinyon pine, or juniper

Sagebrush, rabbit brush, or annual brome grass

#### Soil Profile Description

Surface Layer

0 to 5 inches; light yellowish brown coarse sandy loam; weak platy structure; soft; 8 percent pebbles; pH 8.0

0 to 14 inches; pale brown sandy loam; weak granular structure; soft; 2 percent pebbles; pH 8.0

Subsoil

5 to 40 inches; very pale brown sandy loam; massive; slightly hard; 4 percent pebbles; pH 8.0

14 to 40 inches; pale brown sandy loam; massive; slightly hard; 2 percent pebbles; pH 8.0

Substratum

40 to 60 inches; very pale brown sandy loam; massive; slightly hard; 4 percent pebbles; pH 8.0

40 to 60 inches; pale brown sandy loam; massive; slightly hard; 2 percent pebbles; pH 8.0

#### Soil Properties and Management Interpretations

Effective Rooting Depth

very deep

very deep

Available Water Capacity

moderate

moderate

Water Retention Class

2

2

Hydrologic Soil Group

B

B

Permeability

rapid

rapid

Max Erosion Hazard

moderate

moderate

Erosion Factor (K)

0.24

0.20

Drainage Class

well drained

well drained

Soil Manageability Class Group

2e

2e

II

II

Type Conversion Class

2

2

Total Production (lb/acre)

1750

1800

Forest Survey Site Class

None

None

Included Areas & Remarks

Included in this unit are areas of Modesto family (46), and riverwash (50). Included areas make up about 10 percent of map unit area. This map unit is subject to gully erosion. Some areas have up to 25 percent rock fragments. There is no bedrock within 60 inches. This map unit is subject of flash floods from concentrated runoff on adjacent steeper mountain slopes.

### 39 - ORTHENTS - FLUVENTS COMPLEX - 0 to 15 percent slopes

Elevation: 3500 to 4800 feet      Annual Precipitation: 12 to 16 inches

Soil Map Unit Components

**Orthents**

**Fluvents**

Approximate Proportion

60 percent

30 percent

Landscape Position

stream terraces

stream terraces

Slope

0 to 15 percent

0 to 15 percent

Vegetation Series

Annual bromegrass or pinyon pine

Sagebrush or annual bromegrass

#### Soil Profile Description

Surface Layer

0 to 5 inches; light yellowish brown coarse sandy loam; weak platy structure; soft; 8 percent pebbles; pH 8.0

0 to 14 inches; pale brown sandy loam; weak granular structure; soft; 2 percent pebbles; pH 8.0

Subsoil

5 to 60 inches; very pale brown sandy loam; massive; slightly hard; 4 percent pebbles; pH 8.0

14 to 40 inches; pale brown sandy loam; massive; slightly hard; 2 percent pebbles; pH 8.0

Substratum

5 to 60 inches; very pale brown sandy loam; massive; slightly hard; 4 percent pebbles; pH 8.0

14 to 60 inches; pale brown sandy loam; massive; slightly hard; 2 percent pebbles; pH 8.0

#### Soil Properties and Management Interpretations

Effective Rooting Depth

very deep

very deep

Available Water Capacity

moderate

moderate

Water Retention Class

2

2

Hydrologic Soil Group

B

B

Permeability

rapid

rapid

Max Erosion Hazard

moderate

moderate

Erosion Factor (K)

0.20

0.24

Drainage Class

well drained

well drained

Soil Manageability Class Group

2e  
II

2e  
II

Type Conversion Class

2

2

Total Production (lb/acre)

1750

1800

Forest Survey Site Class

7

7

Included Areas & Remarks

Included in this unit are areas of Modesto family (46), and riverwash (50). Included areas make up about 10 percent of map unit area. This map unit is subject to gully erosion. Some areas have up to 50 percent surface rock fragments. There is no bedrock within 60 inches. This map unit is subject to flash floods from concentrated runoff on adjacent steeper mountain slopes.

**40 - RELIZ - TRIGO FAMILIES - BADLANDS ASSOCIATION - 40 to 90 percent slopes**

Soil Map Unit Components	Elevation: 3400 to 5500 feet	Annual Precipitation: 20 to 25 inches	
	<b>Reliz family</b>	<b>Trigo family</b>	<b>Badlands</b>
Approximate Proportion	35 percent	20 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	40 to 70 percent	40 to 70 percent	70 to 90 percent
Vegetation Series	Manzanita, scrub oak, pinyon pine, or bare ground	Manzanita or scrub oak	Barren

**Soil Profile Description**

Surface Layer	0 to 11 inches; light gray very gravelly loam; weak subangular blocky structure; slightly hard; 50 percent pebbles; pH 7.5	0 to 5 inches; pink sandy loam; strong platy structure breaking to moderate subangular blocky structure; soft; 5 percent pebbles; pH 7.5	Badlands consist of barren slopes of exposed weakly consolidated conglomerate and sandstone greater than 70 percent with inclusions of less than 10 percent soil capable of supporting plants
Subsoil		5 to 12 inches; reddish yellow gravelly sandy loam; weak subangular blocky structure; soft; 30 percent pebbles; pH 7.5	
Substratum	11 inches; fractured hard sandstone	12 inches; weathered conglomerate	

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	very shallow
Available Water Capacity	very low	very low to low
Water Retention Class	3	3
Hydrologic Soil Group	D	D
Permeability	moderately rapid	moderate
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.24	0.37
Drainage Class	excessively drained	excessively drained
Soil Manageability Class	3EPx	3EPx
Group	III	III
Type Conversion Class	3	3
Total Production (lb/acre)	1200	1000
Forest Survey Site Class	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Modjeska family (27), Ramona family (45), and soils similar to Ramona family (45). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractures at 2 to 10 inch intervals with few fine and medium roots within the cracks.

**41 - RINCON - LIVERMORE - MODESTO FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 1650 to 5300 feet    Annual Precipitation: 20 to 26 inches		
	<b>Rincon</b>	<b>Livermore</b>	<b>Modesto</b>
Approximate Proportion	50 percent	20 percent	15 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Annual brome grass, wild oats, or ceanothus	Mountain mahogany or ceanothus	Annual brome grass or wild oats

**Soil Profile Description**

Surface Layer	0 to 4 inches; light brownish gray gravelly loam; strong granular structure; slightly hard; 15 percent pebbles; pH 8.0	0 to 3 inches; brown gravelly sandy clay loam; strong granular structure; slightly hard; 20 percent pebbles; pH 7.0	0 to 6 inches; grayish brown silt loam; moderate subangular blocky structure; soft; 10 percent pebbles; pH 8.5
Subsoil	4 to 32 inches; pale brown gravelly clay loam; moderate subangular blocky structure; slightly hard; 15 percent pebbles; pH 8.0	3 to 25 inches; yellowish brown very gravelly sandy clay loam; moderate subangular blocky structure; slightly hard; 50 percent pebbles and 5 percent cobbles; pH 7.5	6 to 18 inches; pale brown gravelly silty clay loam; moderate subangular blocky structure; slightly hard; 20 percent pebbles; pH 8.0
Substratum	32 to 60 inches; light gray extremely gravelly clay loam; moderate subangular blocky structure slightly hard; 50 percent pebbles and 10 percent cobbles; pH 8.0	25 inches; fractured hard shale	18 to 28 inches; brown extremely cobbly silt loam; weak subangular blocky structure; soft; 15 percent pebbles and 70 percent cobbles; pH 7.8 28 inches; fractured hard shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very deep	moderately deep	moderately deep
Available Water Capacity	moderate to high	moderate	low to moderate
Water Retention Class	1	2	1
Hydrologic Soil Group	C	C	C
Permeability	moderately slow	moderately slow	moderately slow
Max Erosion Hazard	high	very high	very high
Erosion Factor (K)	0.28	0.32	0.37
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3S	3Sp	3S
Group	III	III	III
Type Conversion Class	1	2	1
Total Production	5500 lb/acre	1850 lb/acre	2000 lb/acre
Forest Survey Site Class	None	None	None

**Included Areas & Remarks**  
 Included in this unit are areas of Millsholm family (16), and soils similar to Rincon family (41). Included areas make up about 15 percent of map unit area. This map unit has slumps and a few dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is weakly to moderately fractured at 1 to 6 inch intervals with a few very fine roots within the cracks.

**42 - RINCON - MODESTO - LOS OSOS FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 250 to 3000 feet      Annual Precipitation: 20 to 26 inches		
	<b>Rincon</b>	<b>Modesto</b>	<b>Los Osos</b>
Approximate Proportion	30 percent	30 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Annual bromegrass, wild oats, or chamise	Scrub oak, annual bromegrass, or wild oats	Annual bromegrass, wild oats, chamise, or scrub oak
Soil Profile Description			
Surface Layer	0 to 3 inches; very dark grayish brown sandy loam; strong subangular blocky structure; slightly hard; 5 percent pebbles; pH 6.5	0 to 2 inches; reddish gray gravelly loam; strong subangular blocky structure; soft; 20 percent pebbles; pH 7.2	0 to 13 inches; brown silt loam; moderate subangular blocky structure; soft; 5 percent pebbles; pH 7.0
Subsoil	3 to 23 inches; brown gravelly clay loam; strong subangular blocky structure; very hard; 15 percent pebbles; pH 7.0	2 to 60 inches; reddish gray gravelly clay loam; strong subangular blocky structure; slightly hard; 25 percent pebbles and 5 percent cobbles; pH 7.5	13 to 31 inches; reddish gray clay loam; strong subangular blocky structure; very hard; 10 percent pebbles; pH 8.0
Substratum	23 to 32 inches; pale brown gravelly sandy clay loam; weak subangular blocky structure; hard; 20 percent pebbles and 15 percent cobbles; pH 7.5 32 inches; weathered conglomerate		31 inches; weathered sandstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	moderately deep	very deep	moderately deep
Available Water Capacity	moderate	moderate to high	moderate
Water Retention Class	1	1	1
Hydrologic Soil Group	C	C	C
Permeability	moderately slow	moderately slow	moderately slow
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.28	0.30	0.37
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3S	3Sx	3Sx
Group	III	III	III
Type Conversion Class	1	1	1
Total Production (lb/acre)	5500	2000	3800
Forest Survey Site Class	None	None	None
Included Areas & Remarks	Included in this unit are areas of Inks family (9), Trigo family (40), Oak Glen (37), and rock outcrop. Included areas make up about 20 percent of map unit area. This map unit has slumps and dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 6 inch intervals with a few very fine roots within the cracks.		

**43 - ROCK OUTCROP - LITHIC XEROCREPTS - LITHIC HAPLOXERALFS COMPLEX**  
**30 to 90 percent slopes**

Soil Map Unit Components	Elevation: 3200 to 6500 feet		Annual Precipitation: 20 to 22 inches	
	<b>Rock Outcrop</b>	<b>Lithic Xerocrepts</b>	<b>Lithic Haploxeralfs</b>	
Approximate Proportion	40 percent	35 percent	25 percent	
Landscape Position	Mountain slopes	Mountain slopes	Mountain slopes	
Slope	30 to 90 percent	30 to 90 percent	30 to 90 percent	
Vegetation Series	Barren	Chamise or ceanothus	Chamise or ceanothus	

**Soil Profile Description**

Surface Layer	Rock outcrop consists of barren exposed hard sandstone, shale and siltstone bedrock, which is unable to support plant life, except where roots may penetrate fractures	0 to 2 inches; yellowish brown sandy clay loam; weak subangular blocky structure; slightly hard; 3 percent pebbles; pH 8.0	0 to 3 inches; light gray gravelly sandy clay loam; weak subangular blocky structure; slightly hard; 30 percent pebbles; pH 6.5
Subsoil		2 to 7 inches; light yellowish brown sandy clay loam; moderate subangular blocky structure; soft; 3 percent pebbles; pH 8.0	3 to 12 inches; light gray extremely gravelly sandy clay loam; moderate subangular blocky structure; slightly hard; 60 percent pebbles and 10 percent cobbles; pH 5.5
Substratum		7 to 10 inches; weathered sandstone 10 inches; fractured hard sandstone	12 to 17 inches; weathered shale 17 inches; fractured hard shale

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	very shallow
Available Water Capacity	very low to low	very low to low
Water Retention Class	3	3
Hydrologic Soil Group	D	D
Permeability	moderately slow	moderately slow
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.43	0.43
Drainage Class	excessively drained	excessively drained
Soil Manageability Class	4GDx	4GPx
Group	IV	IV
Type Conversion Class	3	3
Total Production (lb/acre)	1000	1100
Forest Survey Site Class	None	None

This map unit has dry ravel slides and a few slumps. Some areas have up to 20 percent surface rock fragments. The bedrock is fractured at 1 to 5 inch intervals with few very fine and medium roots within the cracks.

## 44 - SKALAN - HUNTMOUNT FAMILIES ASSOCIATION - 30 to 70 percent slopes

Soil Map Unit Components	Elevation: 900 to 6600 feet      Annual Precipitation: 20 to 32 inches	
	<b>Skalan</b>	<b>Huntmount</b>
Approximate Proportion	45 percent	30 percent
Landscape Position	Mountainsides	Mountainsides
Slope	30 to 70 percent	30 to 70 percent
Vegetation Series	Jeffrey pine or canyon live oak	Jeffrey pine, canyon live oak, or manzanita
<b>Soil Profile Description</b>		
Surface Layer	0 to 16 inches; yellowish brown very gravelly sandy loam; weak subangular blocky structure; soft; 40 percent pebbles; pH 5.1	0 to 5 inches; brown sandy loam; weak subangular blocky structure; soft; 5 percent pebbles; pH 5.5
Subsoil	16 to 40 inches; yellowish brown very gravelly clay loam; moderate subangular blocky structure; slightly hard; 40 percent pebbles and 5 percent cobbles; pH 4.7	5 to 60 inches; brown sandy clay loam; weak subangular blocky structure; slightly hard; 5 percent pebbles; pH 6.5
Substratum	40 inches; fractured hard sandstone	
<b>Soil Properties and Management Interpretations</b>		
Effective Rooting Depth	moderately deep	very deep
Available Water Capacity	moderate	high
Water Retention Class	2	1
Hydrologic Soil Group	C	B
Permeability	moderately slow	moderate
Max Erosion Hazard	high	high
Erosion Factor (K)	0.15	0.20
Drainage Class	well drained	well drained
Soil Manageability Class	3Epx	3Ex
Soil Manageability Group	III	III
Type Conversion Class	2	1
Total Production (lb/acre)	1750	2000
Forest Survey Site Class	5	5
Included Areas & Remarks	<p>Included in this unit are areas of Lithic Xerocepts (13), Millerton family (25), rock outcrop (13), and soils similar to Reliz family (28). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some rock slides and dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 4 inch intervals with few medium roots within the cracks.</p>	

## 45 - STONYFORD - RAMONA ASSOCIATION - 30 to 60 percent slopes

Soil Map Unit Components	Elevation: 1400 to 2500 feet	Annual Precipitation: 20 to 29 inches
	<b>Stonyford</b>	<b>Ramona</b>
Approximate Proportion	45 percent	35 percent
Landscape Position	Mountainsides	Mountainsides
Slope	30 to 65 percent	30 to 65 percent
Vegetation Series	Annual brome-grass, wild oats, or chamise	Chamise
<b>Soil Profile Description</b>		
Surface Layer	0 to 1 inch; pale brown loam; strong granular structure; soft; 3 percent pebbles; pH 6.0	0 to 2 inches; brown loam; moderate granular structure; soft; 5 percent pebbles; pH 6.5
Subsoil	1 to 18 inches; pale brown gravelly sandy clay loam; strong subangular blocky structure; slightly hard; 15 percent pebbles; pH 6.0	2 to 22 inches; pale brown clay loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 6.0
Substratum	18 inches; highly fractured hard shale	22 inches; fractured hard sandstone
<b>Soil Properties and Management Interpretations</b>		
Effective Rooting Depth	very shallow	moderately deep
Available Water Capacity	low	moderate
Water Retention Class	2	2
Hydrologic Soil Group	D	B
Permeability	moderate	moderate
Max Erosion Hazard	high	high
Erosion Factor (K)	0.32	0.37
Drainage Class	excessively drained	well drained
Soil Manageability Class	3Edx	3Ex
Group	III	III
Type Conversion Class	3	2
Total Production (lb/acre)	1600	1800
Forest Survey Site Class	None	None
Included Areas & Remarks	<p>Included in this unit are areas of Oak Glen family (37), on north facing slopes, Lithic Haploxerafals (13), rock outcrop (13), and soils similar to Green Bluff family (35). Included areas make up about 20 percent of map unit area. This map unit is mostly stable with some dry ravel slides. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 1 to 4 inch intervals with many very fine roots within the cracks.</p>	

**46 - TRIGO - MODESTO FAMILIES - BADLANDS ASSOCIATION - 45 to 90 percent slopes**

Soil Map Unit Components	Elevation: 4000 to 6000 feet	Annual Precipitation: 8 to 12 inches	
	<b>Trigo</b>	<b>Modesto</b>	<b>Badlands</b>
Approximate Proportion	40 percent	20 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	45 to 70 percent	45 to 70 percent	70 to 90 percent
Vegetation Series	California buckwheat or needle grass	Scrub oak or pinyon pine	Barren

**Soil Profile Description**

Surface Layer	0 to 5 inches; pink sandy loam; strong platy breaking to moderate subangular blocky structure; soft; 5 percent pebbles; pH 7.5	0 to 7 inches; grayish brown coarse sandy loam; weak granular structure; soft; 10 percent pebbles; pH 6.5	Badlands consist of barren slopes of unconsolidated conglomerate and sandstone greater than 70 percent inclusions of less than 10 percent soil capable of supporting plants
Subsoil	5 to 12 inches; reddish yellow gravelly sandy loam; weak sugangular blocky structure; soft; 30 percent pebbles; pH 7.5	7 to 23 inches; brown gravelly sandy clay loam; moderate subangular blocky structure; very hard; 15 percent pebbles and 5 percent cobbles; pH 6.0	
Substratum	12 inches; weathered conglomerate	23 to 56 inches; light brown very gravelly sandy loam; weak subangular blocky structure; hard; 31 percent pebbles and 5 percent cobbles 56 inches; weathered conglomerate	

**Soil Properties and Management Interpretations**

Effective Rooting Depth	very shallow	deep
Available Water Capacity	very low to low	moderate to high
Water Retention Class	3	1
Hydrologic Soil Group	D	C
Permeability	moderately rapid	moderate
Max Erosion Hazard	very high	very high
Erosion Factor (K)	0.37	0.32
Drainage Class	well drained	well drained
Soil Manageability Class	4GdX	4GX
Group	IV	IV
Type Conversion Class	3	2
Total Production	1000 lb/acre	2000 lb/acre
Forest Survey Site Class	None	7
Included Areas & Remarks	Included in this unit are areas of Ramona family (45), and Lithic Xerocepts (13). Included areas make up about 20 percent of map unit area. This map unit has some dry ravel slides and a few slumps. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 10 inch intervals with none to few fine roots within the cracks.	

**47 - TRIGO - SAN ANDREAS - CHUALAR FAMILIES ASSOCIATION - 10 to 50 percent slopes**

Soil Map Unit Components	Elevation: 1400 to 3400 feet      Annual Precipitation: 14 to 20 inches		
	<b>Trigo</b>	<b>San Andreas</b>	<b>Chualar</b>
Approximate Proportion	30 percent	25 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	10 to 50 percent	20 to 50 percent	20 to 50 percent
Vegetation Series	Chamise or red shank	Scrub oak, chamise, or ceanothus	Annual brome grass, wild oats, or blue oak
Soil Profile Description			
Surface Layer	0 to 9 inches; yellowish brown coarse sandy loam; weak granular structure; soft; 13 percent pebbles; pH 6.4	0 to 11 inches; grayish brown coarse sandy loam; weak granular structure; soft; 2 percent pebbles; pH 6.6	0 to 13 inches; brown sandy loam; moderate subangular blocky structure; slightly hard; 10 percent pebbles; pH 6.5
Subsoil		11 to 30 inches; yellowish brown sandy loam; weak subangular blocky structure; soft; 2 percent pebbles; pH 7.2	13 to 50 inches; brown gravelly sandy clay loam; moderate subangular blocky structure; slightly hard; 15 percent pebbles; pH 6.5
Substratum	9 inches; weathered granite	30 inches; weathered granite	50 inches; weathered granite
Soil Properties and Management Interpretations			
Effective Rooting Depth	shallow	moderately deep	deep
Available Water Capacity	very low	moderate	moderate
Water Retention Class	3	2	1
Hydrologic Soil Group	D	B	B
Permeability	rapid	rapid	moderate
Max Erosion Hazard	very high	high	high
Erosion Factor (K)	0.32	0.28	0.28
Drainage Class	excessively drained	well drained	well drained
Soil Manageability Class	3ED	3Ep	3E
Group	III	III	III
Type Conversion Class	3	2	2
Total Production (lb/acre)	shallow coarse loamy	coarse loamy	fine loamy
Forest Survey Site Class	None	None	None
Included Areas & Remarks	Included in this unit area areas of Los Osos family (23), Millsholm family (30), and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit has some dry ravel slides and is subject to gully erosion. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 4 to 10 inch intervals with few fine roots within the cracks.		

## 48 - VERTIC XEROCHREPTS - LOS ROBLES FAMILY ASSOCIATION - 10 to 60 percent slopes

Soil Map Unit Components	Elevation: 3200 to 4700 feet	Annual Precipitation: 8 to 12 inches
	<b>Vertic Xerochrepts</b>	<b>Los Robles</b>
Approximate Proportion	40 percent	35 percent
Landscape Position	Mountainsides and hillslopes	Mountainsides
Slope	10 to 40 percent	30 to 60 percent
Vegetation Series	Annual brome grass	California buckwheat
<b>Soil Profile Description</b>		
Surface Layer	0 to 5 inches; light yellowish brown silty clay; strong prismatic structure; hard; pH 8.0	0 to 7 inches; pale brown sandy clay loam; weak granular structure; soft; 5 percent pebbles; pH 8.0
Subsoil	5 to 60 inches; light yellowish brown clay; moderate columnar structure; extremely hard; pH 8.0	7 to 60 inches; light yellowish brown silty clay loam; moderate subangular blocky structure; slightly hard; 5 percent pebbles; pH 8.0
Substratum		
<b>Soil Properties and Management Interpretations</b>		
Effective Rooting Depth	very deep	moderately deep
Available Water Capacity	moderate to high	moderate
Water Retention Class	1	1
Hydrologic Soil Group	D	B
Permeability	slow	moderately slow
Max Erosion Hazard	high	high
Erosion Factor (K)	0.32	0.28
Drainage Class	somewhat poorly drained	somewhat poorly drained
Soil Manageability Class	3E	3Ex
Soil Manageability Group	III	III
Type Conversion Class	2	2
Total Production (lb/acre)	2100	
Forest Survey Site Class	None	None
Included Areas & Remarks	Included in this unit are areas of Exchequer family (29), Badlands (46), and soils similar to Trigo family (24). Included areas make up about 25 percent of map unit area. This map unit is subject to severe soil piping and gully erosion, particularly Vertic Xerochrepts. Some areas have up to 15 percent surface rock fragments. The bedrock is fractured at 8 to 15 inch intervals with many medium roots within the cracks.	

## 49 - WITZEL - SKALAN FAMILIES COMPLEX - 30 to 70 percent slopes

Soil Map Unit Components	Elevation: 2000 to 4300 feet	Annual Precipitation: 22 to 26 inches
	<b>Witzel</b>	<b>Skalan</b>
Approximate Proportion	45 percent	30 percent
Landscape Position	Mountainsides with north facing aspects	Mountainsides with north facing aspects
Slope	30 to 70 percent	30 to 70 percent
Vegetation Series	Canyon live oak, white fir or ponderosa pine	Canyon live oak, white fir, or ponderosa pine

### Soil Profile Description

Surface Layer	0 to 3 inches; dark grayish brown gravelly sandy clay loam; weak granular structure; slightly hard; 40 percent pebbles and 2 percent cobbles; pH 6.0	0 to 6 inches; light brown gravelly sandy loam; weak subangular blocky structure; slightly hard; 30 percent pebbles and 20 percent cobbles; pH 4.5
Subsoil	3 to 17 inches; brown very gravelly sandy clay loam; weak granular structure; slightly hard; 40 percent pebbles and 2 percent cobbles; pH 6.0	6 to 22 inches; light brown very cobbly loam; weak subangular block structure; slightly hard; 30 percent pebbles and 20 percent cobbles; pH 4.5
Substratum	17 inches; fractured tured hard shale	22 inches; fractured hard shale

### Soil Properties and Management Interpretations

Effective Rooting Depth	shallow	moderately deep
Available Water Capacity	moderate	moderate
Water Retention Class	2	2
Hydrologic Soil Group	C	C
Permeability	moderately slow	moderate
Max Erosion Hazard	high	high
Erosion Factor (K)	0.28	0.24
Drainage Class	well drained	well drained
Soil Manageability Class	3EdX	3Ep
Group	III	III
Type Conversion Class	2	2
Total Production (lb/acre)	1600	1750
Forest Survey Site Class	6	6

**Included Areas & Remarks**  
 Included in this unit are areas of Lopez family (19), soils similar to Hambright family (14), soils similar to Skalan family (49), and soils similar to Supan family (35). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some dry ravel slides. Some areas have up to 10 percent surface rock fragments. The bedrock is fractured at 1 to 4 inch intervals with many fine roots within the cracks.

## 50 - XEROFLUVENTS - XERORTHENTS - RIVERWASH COMPLEX - 25 to 35 inches

Soil Map Unit Components	Elevation: 1400 to 1600 feet    Annual Precipitation: 25 to 35 inches		
	<b>Xerofluvents</b>	<b>Xerorthents</b>	<b>Riverwash</b>
Approximate Proportion	50 percent	30 percent	20 percent
Landscape Position	Stream terraces	Stream terraces	Drainage ways
Slope	0 to 15 percent	0 to 15 percent	0 to 15 percent
Vegetation Series	Annual bromegrass and wild oats	Annual bromegrass and wild oats	Scattered trees and willows
Soil Profile Description			
Surface Layer	0 to 3 inches; brown fine sandy loam; weak granular structure; soft; 1 percent cobbles; pH 6.5	0 to 22 inches; brown sandy loam; weak granular structure; soft; 5 percent pebbles; pH 7.8	Recent deposits of sand, pebbles, cobbles, and stones, which are subject to flooding; constant reworking by water restricts plant growth to scattered trees and willows
Subsoil	3 to 40 inches; brown gravelly sandy loam; weak subangular blocky structure; slightly hard 18 percent pebbles and 10 percent cobbles; pH 6.5	22 to 40 inches; pale brown sandy loam; weak subangular blocky structure; soft; 10 percent pebbles; pH 7.8	
Substratum	40 to 60 inches; brown cobbly coarse sandy loam; weak subangular blocky structure; slightly hard; 8 percent pebbles and 10 percent cobbles; pH 6.5	22 to 60 inches; yellowish red cobbly sandy loam; weak subangular blocky structure; soft; 1 percent pebbles and 20 percent cobbles; pH 8.2	
Soil Properties and Management Interpretations			
Effective Rooting Depth	very deep	very deep	
Available Water Capacity	moderate	moderate	
Water Retention Class	1	1	
Hydrologic Soil Group	B	B	
Permeability	moderately rapid	moderately rapid	
Max Erosion Hazard	high	high	
Erosion Factor (K)	0.20	0.20	
Drainage Class	well drained	well drained	
Soil Manageability Class	2E	2E	
Soil Manageability Group	II	II	
Type Conversion Class	1	1	
Total Production (lb/acre)	2100	2100	
Forest Survey Site Class	None	None	
Included Areas & Remarks	Included in this unit are areas of soils similar to Oak Glen family (36) and soils similar to Supan family (36). Included areas make up about 20 percent of map unit area. This map unit is subject to gully erosion. Some areas have up to 50 percent surface rock fragments. There is no bedrock within 60 inches.		

**51 - YORBA - MILLSHOLM - STONYFORD FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 1000 to 5900 feet      Annual Precipitation: 15 to 30 inches		
	Yorba	Millsholm	Stonyford
Approximate Proportion	30 percent	25 percent	20 percent
Landscape Position	Mountainsides	Mountainsides	Mountainsides
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Chamise, manzanita, scrub or, and ceanothus	Chamise or manzanita	Chamise or ceanothus
Soil Profile Description			
Surface Layer	0 to 2 inches; brown sandy loam; weak subangular blocky structure; soft; 10 percent pebbles; pH 6.0	0 to 6 inches, light yellowish brown silt loam; moderate subangular blocky structure; hard; 10% percent pebbles; pH 6.3	0 to 1 inch; pale brown loam; strong granular structure; soft; 3 percent pebbles; pH 6.0
Subsoil	2 to 23 inches; yellowish brown extremely gravelly sandy clay loam; slightly hard; 60 percent pebbles and 10 percent cobbles; pH 6.0	6 to 16 inches; light yellowish brown loam; moderate subangular blocky structure; hard; 12 percent pebbles; pH 7.1	1 to 18 inches; pale brown gravelly sandy clay loam; strong subangular blocky structure; slightly hard; 15 percent pebbles; pH 6.0
Substratum	23 inches; fractured hard siltstone	16 inches; fractured hard siltstone	18 inches; fractured hard shale
Soil Properties and Management Interpretations			
Effective Rooting Depth	moderately deep	shallow	shallow
Available Water Capacity	low to moderate	low	very low to low
Water Retention Class	2	2	2
Hydrologic Soil Group	C	C	D
Permeability	moderately slow	moderate	moderately slow
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.28	0.43	0.32
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Ep	3Ed	3Ed
Group	III	III	III
Type Conversion Class	2	3	3
Total Production (lb/acre)	1500	1350	1600
Forest Survey Site Class	None	None	None
Included Areas & Remarks	Included in this unit are areas of Millerton family (25), Reliz family (28), Livermore family (17), Morical family (52), Konocti family (8), and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some dry ravel slides. Some areas have up to 15 percent rock fragments. The bedrock is fractured at 1 to 12 inch intervals with few fine to medium roots within the cracks.		

**52 - YORBA - MODJESKA - MORICAL FAMILIES ASSOCIATION - 30 to 60 percent slopes**

Soil Map Unit Components	Elevation: 1750 to 6500 feet      Annual Precipitation: 12 to 34 inches		
	<b>Yorba</b>	<b>Modjeska</b>	<b>Morical</b>
Approximate Proportion	30 percent	30 percent	15 percent
Landscape Position	Mountain slopes	Mountain slopes	Mountain slopes with north facing aspects
Slope	30 to 60 percent	30 to 60 percent	30 to 60 percent
Vegetation Series	Chamise or ceanothus	Ceanothus or chamise	Pinyon pine or canyon live oak
Soil Profile Description			
Surface Layer	0 to 3 inches; yellowish brown loam; weak granular structure; soft; 10 percent pebbles; pH 6.5	0 to 6 inches; brown sandy loam; weak granular structure; soft; 12 percent pebbles; pH 6.5	0 to 4 inches; brown loam; weak subangular blocky structure; slightly hard; 10 percent pebbles; pH 6.7
Subsoil	3 to 24 inches; very pale brown extremely gravelly clay loam; weak subangular blocky structure; slightly hard; 60 percent pebbles 5 percent cobbles; pH 6.5	6 to 23 inches; yellowish brown extremely gravelly loam; moderate subangular blocky structure; soft; 60 percent pebbles; pH 6.5	4 to 25 inches; brownish yellow cobbly loam; moderate subangular blocky structure; slightly hard; 8 percent pebbles and 10 percent cobbles; pH 6.3
Substratum	24 inches; hard fractured siltstone	23 inches; hard fractured sandstone	25 inches; hard fractured sandstone
Soil Properties and Management Interpretations			
Effective Rooting Depth	moderately deep	moderately deep	moderately deep
Available Water Capacity	low	low	moderate
Water Retention Class	2	2	1
Hydrologic Soil Group	C	C	B
Permeability	moderately slow	moderate	moderate
Max Erosion Hazard	high	high	high
Erosion Factor (K)	0.28	0.24	0.32
Drainage Class	well drained	well drained	well drained
Soil Manageability Class	3Ep	3Ep	3Ex
Group	III	III	III
Type Conversion Class	2	2	1
Total Production (lb/acre)	1500	1800	2200
Forest Survey Site Class	None	None	7
Included Areas & Remarks	Included in this unit are areas of Livermore family (17), Agua Dulce family (1), Chular family (22), Hambright family (16), Millsholm family (16), Reliz family (40), and rock outcrop (13). Included areas make up about 25 percent of map unit area. This map unit is mostly stable with some dry ravel slides. Some areas have up to 20 percent surface rock fragments. The bedrock is fractured at 1 to 9 inch intervals with many fine and few medium roots within the cracks.		

**Table 2. - Acreage and Proportionate Extent of Map Units**

<b>Map Symbol</b>	<b>Mapping Unit Name</b>	<b>Acres</b>	<b>Percent</b>
1	<b>Agua Dulce-Botella Argonaut Families Association, 20 to 60 percent slopes</b>	16,927	1.03
2	<b>Agua Dulce-Henneke-Cuesta Families Complex, 40 to 70 percent slopes</b>	4,884	0.30
3	<b>Agua Dulce-Los Robles-Modjeska Families, 10 to 60 percent slopes</b>	45,879	2.80
4	<b>Cuesta-Henneke Families Complex, 15 to 60 percent slopes</b>	4,338	0.30
5	<b>Diablo-Altamont-Henneke Families Association, 10 to 60 percent slopes</b>	8,355	0.51
6	<b>Hades-Ginser-Ola Families Association, 10 to 30 percent slopes</b>	15,535	0.94
7	<b>Hades-Ginser-Ola Families Association, 30 to 60 percent slopes</b>	2,690	0.20
8	<b>Hohmann-Green Bluff-Konocti Families Association, 30 to 60 percent slopes</b>	60,855	3.70
9	<b>Inks-Lodo-Agua Dulce Families Complex, 30 to 60 percent slopes</b>	21,157	1.30
10	<b>Kilburn-Wrentham-Supan Families Association, 10 to 30 percent slopes</b>	2,646	0.20
11	<b>Kilburn-Wentham-Supan Families Association, 30 to 60 percent slopes</b>	3,294	0.20
12	<b>Kilmer-Nacimiento Families Association, 10 to 60 percent slopes</b>	16,195	0.98
13	<b>Lithic Xerochrepts-Lithic Haploxerals-Rock Outcrop Complex, 30 to 80 percent slopes</b>	50,641	3.07
14	<b>Livermore-Agua Dulce-Hambright Families Association, 30 to 80 percent</b>	27,213	1.70
15	<b>Lodo-Botella Families Rock Outcrop Association, 30 to 60 percent</b>	58,822	3.57
16	<b>Lodo-Hambright-Millsholm Families Association, 30 to 60 percent slopes</b>	38,429	2.33
17	<b>Lodo-Livermore-Chualar Families Association, 30 to 60 percent</b>	15,666	1.00
18	<b>Lodo-Modjeska-Botella Families Association, 10 to 70 percent slopes</b>	37,315	2.30
19	<b>Lopez-Santa Lucia Families Association, 10 to 70 percent slopes</b>	31,223	1.90
20	<b>Los Gatos-Kilburn-Panamint Families Association, 10 to 30 percent slopes</b>	31,277	1.90
21	<b>Los Gatos-Kilburn-Panamint Association, 30 to 60 percent slopes</b>	45,169	2.74
22	<b>Los Osos-Modesto-Chular Families Association, 20 to 70 percent slopes</b>	23,164	1.41

Map Symbol	Mapping Unit Name	Acres	Percent
23	Los Osos-Nacimiento Families Association, 15 to 45 percent slopes	27,612	1.70
24	Los Robles-Trigo Families-Orthents Association, 30 to 60 percent slopes	12,487	0.80
25	Millerton-Millsholm-Agua Dulce Families Association, 30 to 60 percent slopes	34,983	2.13
26	Millerton-Millsholm Families-Rock Outcrop Complex, 30 to 80 percent slopes	51,670	3.14
27	Millerton-Modjeska Families Association, 30 to 80 percent slopes	4,388	0.27
28	Millerton-Reliz-Modjeska Families Association, 40 to 70 percent slopes	41,120	2.50
29	Millsholm-Exchequer-Stonyford Families Association, 30 to 75 percent	122,681	7.50
30	Millsholm-Reliz Families Rock Outcrop Association, 40 to 65 percent	55,937	3.40
31	Modesto-Rincon-Millsholm Families Association, 20 to 50 percent slopes	11,645	0.71
32	Modesto-Yorba-Agua Dulce Families Association, 30 to 60 percent slopes	168,786	10.30
33	Modjeska-Lodo Families Association, 40 to 80 percent slopes	33,361	2.03
34	Modjeska-Modesto Families Association, 30 to 60 percent slopes	38,946	2.36
35	Morical-Supan-Green Bluff Families, 10 to 60 percent slopes	27,327	1.66
36	Oak Glen-Supan-Hagan Families Complex, 0 to 10 percent slopes	6,221	0.38
37	Oak Glen-Wrentham-Kilburn Families Complex, 30 to 60 percent slopes	15,198	0.92
38	Orthents-Fluents Complex, Dry, 0 to 15 percent slopes	33,560	2.04
39	Orthents-Fluents Complex, 0 to 15 percent slopes	14,110	0.90
40	Reliz-Trigo Families-Badlands Association, 40 to 90 percent slopes	21,590	1.31
41	Rincon-Livermore-Modesto Families Association, 30 to 60 percent slopes	42,889	2.06
42	Rincon-Modesto-Los Osos Family Association, 30 to 60 percent slopes	22,680	1.40
43	Rock Outcrop-Lithic Xerocepts-Lithic Haploxeralfs, 30 to 90 percent slopes	31,346	1.90
44	Skalan-Huntamont Families Association, 30 to 70 percent slopes	28,972	1.76
45	Stoneyford-Ramona Association, 30 to 60 percent slopes	14,086	0.86

Map Symbol	Mapping Unit Name	Acres	Percent
46	<b>Trigo-Modesto Families-Badlands Association,</b> 45 to 90 percent slopes	14,348	0.87
47	<b>Trigo-San Andreas-Chualar Families Association,</b> 10 to 50 percent slopes	13,115	0.80
48	<b>Vertic Xerochrepts-Los Robles Family Association,</b> 10 to 60 percent slopes	29,396	1.78
49	<b>Witzel-Skalan Families Complex,</b> 30 to 70 percent slopes	5,954	0.36
50	<b>Xerofluvents-Xerothents-Riverwash Complex,</b> 0 to 15 percent slopes	2,661	0.16
51	<b>Yorba-Millsholm-Stonyford Families Association,</b> 30 to 60 percent slopes	92,652	5.62
52	<b>Yorba-Modjeska-Morical Families Association,</b> 30 to 60 percent slopes	65,934	4.00

## 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 with fewer or less severe limitations, and for determining areas where more detailed or site specific soil surveys information is needed.

Additional information about each soil and its use and management is given under "Detailed Soil Map Unit Descriptions". In that section under Management Interpretations, individual soils are evaluated for their productivity, manageability limitation and their potential for production of forage and timber.

### Watershed

Many groundwater basins are adjacent to the forest boundary. The survey area produces the majority of surface water to meet the demand of developed areas of San Luis Obispo, Santa Barbara, Santa Maria and Ventura. Because of the tremendous amount of fracturing throughout the rock mass of the mountain ranges within the survey area, these rocks have considerable capacity for reception and temporary storage of water. This degree of fracturing and associated deep weathering in the underlying rock mantles are important factors in determining the hydrologic response of these watersheds.

The total annual surface water production of the survey area is estimated to be about 357,000 thousand acre feet. Additional water percolates through the thin soil mantles to become part of the groundwater system. At the beginning of the rainy season, when soils are dry and undisturbed, they normally have high infiltration rates. Recently burned soils, however, may be initially hydrophobic. Because of the degree of fracturing and deep weathering in the underlying bedrock, some shallow soils have more permeable substratums compared to other shallow soils. For watershed planning purposes these soils were assigned a Hydrologic Soil Group rating of moderately high runoff or high runoff potential, depending on the fracturing of the underlying rock.

Soils on the forest are managed for watershed protection by reducing soil erosion and maintaining on-site productivity. Overland flow or runoff on these forest soils can increase tremendously as a result of wildfires in chaparral lands and the formation of water repellent soil layers.

Prevention of large wildfire through more intensive vegetative management is an important soil management objective. The use of prescribed burning in chaparral to develop age class mosaics along with fuel break maintenance are important management activities for reducing soil erosion and sedimentation rates.

### Range Production

In recent years the demand for use of forest soils for grass production has increased substantially. Currently there are about 177,000 acres of suitable rangeland under grazing permit producing about 42,500 animal unit months (AMU) of grazing on the Los Padres National Forest Area. These lands are in need of prescribed fire treatments and water development before they would be suitable to commercial grazing. The majority of forage production and livestock use will primarily in annual grasses, forbs and resprouting chaparral species. Maximum production of annual grasses occurs in the winter and spring seasons.

Soil properties that affect moisture supply and plant nutrients have the greatest influence on productivity of range plants. The most productive range soils are usually those that have high available waterholding capacities and are located in higher rainfall zones. The deep upland valley soils like Hagen and Oak Glen are included in this category. In general the least productive soils are those shallow coarse textured soils that occur below 4,000 feet elevation and particularly on south or west facing slopes. Deeper soils on north facing slopes have moisture regimes that favor the build-up of organic matter and hence, better fertility. However, slope is a major limitation of these 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. Soil information can be used in planning wildlife refuges,

nature study areas, habitat improvement projects and other developments for wildlife.

The fish and wildlife resources are important to the Forest for many reasons, two of which are: 1) urban developments surround much of the survey area, turning forest lands into "habitat islands". In the future, most breeding activities of native animals may be confined to forest lands, like the Cooper's Hawk is today, and 2) residents of urban areas enjoy fishing and hunting, primarily for trout, deer, quail, dove, and pigeons, as well as enjoy observing wildlife and fish when camping, picnicking, and hiking.

Fish, wildlife and botanical resources occur forest-wide. As with most natural systems, they are not usually uniform in distribution. The riparian woodlands, oak woodlands, and conifer forest types provide more opportunities for wildlife and plants to diversify. Thus, these types of vegetation are rich in species variety and sometimes density. Other habitat types, such as chamise chaparral provide less of a variety of species or density.

Some animal species, such as deer and coyote, are cosmopolitan in their requirements and occur in all vegetation types during some time of the year. Specific wildlife species, like the Least Bell's Verio, Willow Flycatcher and Yellow Warbler, require riparian woodland and are very sensitive to changes within their habitat.

Many forest visitors appreciate the opportunity to observe animals and plant that they can identify (deer, bighorn sheep, squirrels, jays, sparrows, pine and oak trees). It gives them a sense of satisfaction to know that there is a forest nearby where they can utilize the fish, wildlife, and botanical resources in a consumptive and non-consumptive manner. The Los Padres National Forest is responsible for managing the land habitats in which these resources are considered dependent and forest management of the land is crucial to their survival.

## Recreation

There are 123 National Forests. The Los Padres National Forest is the 16th most heavily used national forest in the nation. An estimated four million recreation visitor days are made each year. The heavy use is a result of geographic location of less than an hour to nearby cities of San Luis Obispo, Santa Barbara, Ventura and Santa Maria and the relatively close proximity to the 7.5 million people in the Los Angeles metropolitan area. Population in the area is expected to grow each year, thereby putting additional demand on both dispersed and developed sites. Recreational off-road vehicle use (trail bikes, 4-wheel jeeps etc.) on the forest can cause major impacts on soil resources. Overuse and heavy

foot traffic may cause such severe soil compaction and reduced infiltration that it becomes necessary to close campgrounds for reforestation.

Soils of the survey area are rated in the Map Unit Descriptions for their manageability. This rating system contains general information about soil properties useful for recreation planning. For site specific planning purposes, more detailed soil investigation and interpretation may be required. The following is a general discussion of soil parameters important for some kinds of recreation sites.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and area 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, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

## Woodland

There are about 69,000 acres of forest land physically capable of producing wood products in excess of 20 cubic feet per acre per year. With the exception of about 9770 acres, the vast majority of this acreage is economically unsuitable because of low volume or extremely difficult terrain for access. Most of the timber sold from the

forest is used for firewood. The forest should be able to produce two to six thousand cords of wood annually as a by-product of managing the timber stands for their in-place value. Most of the material sold is down dead wood. Demands for fuelwood rather than saw-timber 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 brush species. Future demand for fuelwood is expected to continue to increase.

The demand for conifer and oak trees is in especially high in Recreation sites. Management of native stands is very intensive in these heavily used areas. Tree plantations have been established with emphasis on converting brush stands in suitable locations to trees. The best sites for mixed conifer are generally above 4,000 feet elevation and which receive rainfall in excess of 25 inches. Deep soils occurring on north aspects in these

higher elevations are the most suitable sites. As with forage production, moisture stress is the major limiting factor for tree growth. The following provides more specifics on the soils, their properties and limitations for land uses.

### **Physical and Chemical Analysis of Selected Soils**

The results of physical and chemical analysis are given in Table 1. 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 and their morphology. Soil samples were analyzed by the U.S. Department of Agriculture, Soil Conservation Service, National Soil Laboratory Lincoln, Nebraska. Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis.

**Table 3. - Physical and Chemical Properties of Selected Soils**

Absence of an entry indicates that data were not available or were not estimated

Soil Family and Sample No.	Horizon	Depth in Inches	<2 mm Particle Size			Sand					Water Content, 15-bar tension	
			Clay	Silt	Sand	Very Coarse	Coarse	Medium	Fine	Very Fine	Ratio to Total Clay	Organic Carbon pct. of <2mm
						2-1mm	1-0.5mm	0.5-0.10mm	0.25-0.10mm	0.10-0.05mm		
<b>Hades Family</b> S79CA-111-001	A11	0-10	13.3	39.1	47.6	8.6	11.2	9.8	6.3	11.7	.52	1.66
	A12	10-19	13.2	39.3	47.5	8.6	10.4	9.8	6.9	11.8	.53	1.37
	B1T	19-33	14.8	36.2	49.0	9.2	10.1	10.0	7.0	12.7	.53	0.61
	B21T	33-49	21.0	34.0	45.0	6.8	10.7	10.6	6.4	10.5	.47	0.42
	B22T	49-60	21.1	40.0	38.9	5.7	8.4	8.1	5.6	11.1	.50	0.39
<b>Kilburn Family</b> S79CA-C29-001	A1	0-7	8.6	15.3	76.1	15.3	16.7	16.7	12.0	15.4	.94	3.72
	B2T	7-19	10.7	19.4	69.9	10.5	13.8	17.4	12.9	15.3	.53	1.05
<b>Vertic Xerochrept</b> S79CA-C83-001	A1	0-5	51.3	40.7	8.0	0.2	0.1	0.2	0.6	6.9	.45	0.49
	B1T	5-18	52.8	39.6	7.6	Tr	0.1	0.2	0.5	6.6	.45	0.41
	B21T	18-29	47.7	41.0	11.3	Tr	0.1	0.6	1.6	9.0	.53	0.32
	B22T	29-43	29.0	55.2	15.8	0.1	0.1	1.6	3.5	10.5	.75	0.22
	C1Cs	43-60										0.14
<b>Altamont Family</b> S79CA-083-002	A11	0-6	42.3	26.4	31.3	7.5	7.7	6.0	3.6	6.5	.48	1.07
	A12*	6-20										
	B2	20-28	36.2	32.8	31.0	3.5	5.0	4.2	4.8	13.5	.44	0.54
	B3	28-40	37.2	40.7	22.3	1.7	2.4	3.2	3.9	11.1	.43	0.47
<b>Diablo Family</b> S79CA-083-003	A11	0-11	50.2	30.4	19.4	1.9	2.7	3.3	3.1	8.4	.33	1.26
	A12	11-19	49.1	31.7	19.2	1.8	2.8	3.5	3.2	7.9	.32	1.05
	C1Ca	19-30	47.7	33.2	19.1	2.6	2.6	3.1	3.0	7.8	.33	0.90
	C2Ca	30-36	46.4	33.2	20.4	2.4	2.6	3.3	3.2	8.9	.35	0.76
	C3Ca	36-45	43.8	35.2	21.0	3.2	3.0	3.2	3.1	8.5	.35	0.57
<b>Cuesta Family</b> S79CA-079-001	A1	0-2	26.6	32.5	40.9	7.6	10.2	9.3	6.4	7.4	.94	4.51
	A3	2-6	34.7	30.9	34.4	8.7	8.3	7.1	4.0	6.3	.82	2.92
	B21T	6-11	39.8	26.2	34.0	6.6	9.1	7.9	3.9	6.5	.75	2.07
	B22T	11-24	36.3	19.5	44.2	7.5	10.4	10.7	5.7	9.9	.77	1.20

\*No bulk sample.

Tr means trace

Table 3. - Physical and Chemical Properties of Selected Soils - Continued

Soil Family and Sample no.	Horizon	Depth in Inches	NH40Ac Extractable Bases meq 100/grams					Ratio Ca to Mg	Carbonate	CEC NH40Ac	% Base Saturation NH40Ac	pH H2O	pH CaCL2
			Ca	Mg	Na	K	Sum						
<b>Hades Family</b> S79CA-111-001	All	0-10	10.6	1.7		0.7	13.0	6.2		15.5	84	6.3	5.5
	A12	10-19	10.6	2.0		0.5	13.1	5.3		15.6	84	6.4	5.6
	B1T	19-33	10.0	3.6		0.3	13.9	2.8		15.8	88	6.6	5.8
	B21T	33-49	12.0	5.0	Tr	0.2	17.2	2.4		18.5	93	6.6	5.7
	B22T	49-60	12.6	5.9	Tr	0.2	18.7	2.1		19.5	96	6.5	5.6
<b>Kilburn Family</b> S79CA-C29-001	A1	0-7	8.5	1.9		0.5	10.9	4.5		14.0	78	5.7	5.0
	B2T	7-19	6.4	2.0		0.4	8.8	3.2		9.8	90	5.8	5.2
<b>Vertic Xerochrept</b> S79VCCA-C83-001	A1	0-5		6.9	0.4	2.2			4	43.2	100	8.2	7.7
	B1T	5-18		7.3	3.3	1.9			4	43.2	100	8.6	7.9
	B21T	18-29		12.4	13.0	1.8			4	39.9	100	8.0	7.9
	B22T	29-43		18.3	18.2	1.5			3	36.8	100	8.1	8.0
	C1Cs	43-60		16.8	16.2	0.8			1	31.6	100	8.2	8.0
<b>Altamont Family</b> S79CA-083-0023	A11	0-6	11.6	37.8	0.1	0.8	50.3	0.3		42.4	100	7.6	6.9
	A12*	6-20											
	B2	20-28	7.9	30.0	0.1	0.5	38.5	0.3		36.1	100	7.3	6.7
	B3	28-40	8.0	31.4	0.1	0.4	39.9	0.3		37.0	100	7.9	7.0
<b>Diablo Family</b> S79CA-083-003	A11	0-11	22.2	19.6	0.2	0.7	42.7	1.1	Tr	37.6	100	7.6	7.2
	A12	11-19		20.8	0.4	0.6			2	33.4	100	8.2	7.6
	C1Ca	19-30		24.6	1.1	0.5			2	33.0	100	8.5	7.9
	C2Ca	30-36		25.6	2.6	0.4			3	30.1	100	8.5	8.0
	C3Ca	36-45		31.9	5.0	0.5			2	28.5	100	7.8	7.8
<b>Cuesta Family</b> S79CA-079-001	A1	0-2	8.8	26.8	0.1	0.5	36.2	0.3		37.6	96	6.9	6.5
	A3	2-6	5.2	30.8	Tr	0.4	36.4	0.2		35.2	100	7.0	6.7
	B21T	6-11	1.1	33.6	Tr	0.2	34.9	0.03		33.6	100	7.0	6.7
	B22T	11-24	0.1	31.7	Tr	0.1	31.9	0.003		28.4	100	7.3	6.9

\*No bulk sample.  
Tr means trace.

## Soil Components in Map Units

The map units consist mostly of soil family names, but may include subgroups, higher soil taxa or miscellaneous land types. Table 4 lists each soil component and the map unit(s) in which they are included.

TABLE 4. - Soil Components in Map Units

Components	Map Unit	Components	Map Unit
Agua Dulce family	1, 2, 3, 9 14, 25, 32	Los Robles family	3, 24, 48
Altamont family	5	Millerton family	25, 26, 27, 28
Argonaut family	1	Millsholm family	16, 25, 26, 29 30, 31, 51
Botella family	1, 15, 18	Modesto family	22, 31, 32, 34 41, 42, 46
Chular family	17, 22, 47	Modjeska family	3, 18, 27, 28 33, 34, 52
Cuesta family	2, 4	Morical family	35, 52
Diablo family	5	Nacimiento family	12, 23
Exchequer family	29	Oak Glen family	36, 37
Fluvents	38, 39	Ola family	6, 7
Ginser family	6, 7	Orthents	24, 38, 39
Green Bluff family	8, 35	Panamint family	20, 21
Hades family	6, 7	Ramona family	45
Hagen family	36	Reliz family	28, 30, 40
Hambright family	14, 16	Rincon family	31, 41, 42
Henneke family	2, 4, 5	San Andres family	47
Hohmann family	8	Santa Lucia family	19
Huntmount family	44	Skalan family	44, 49
Inks family	9	Stonyford family	29, 45, 51
Kilburn family	10, 11, 20 21, 37	Supan family	10, 11, 35, 36
Kilmer family	12	Trigo family	24, 40, 46, 47
Konocti family	8	Vertic Xerochrepts	48
Lithic Haploxeralfs	13, 43	Witzel family	49
Lithic Xerochrepts	13, 43	Wrentham family	10, 11, 37
Livermore family	14, 17, 41	Xerofluvents	50
Lodo family	9, 15, 16, 17 18, 33	Xerorthents	50
Lopez family	19	Yorba family	32, 51, 52
Los Gatos family	20, 21		
Los Osos family	22, 23, 42		

## 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 2, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

**ORDER.** Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in sol. An example is 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 Haploxeralfs (Hapl, meaning minimal horizonation, plus xeralf, the suborder of the Alfisols that have an 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 Typic identifies the subgroup that typifies the great group. An example is Typic 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 fine-loamy, mixed, thermic Typic 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.

Five soil orders are represented in the survey area: Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols. The soils have a xeric moisture regime. There are a few areas where the moisture regime boards on aridic. The xeric moisture regime is that typified in Mediterranean climate, where winters are moist and cool and summers are warm and dry. Therefore the 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 in the lower elevations and particularly on southern slopes. The thermic temperature regime is one in which the soil temperature at a depth of 20 inches ranges from 59 degrees F. to 72 degrees F. Generally in the higher elevations the temperature regime is mesic. The mesic temperature regime is one in which the soil temperature at a depth of 20 inches ranges from 47 degrees F. to 59 degrees F. Frigid temperature regimes occur above 6,100 feet, particularly on north aspects. Soil temperatures range between 32 and 47 degrees F. at a depth of 20 inches.

Alfisols are soils that have a massive and hard A horizon when dry 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 survey area have been placed in the Xeralfs suborder. They have a xeric moisture regime. The Xeralfs of the survey area fall into the Haploxeralfs great group. Haploxeralfs are the relatively thin, reddish to brownish soils. They do not have a duripan. They formed mostly on sedimentary conglomerate and shale formations. Their parent materials may be either acidic or basic, but are rarely as basic as limestone or basalt.

Entisols are soils in this survey area that have little or no evidence of development of pedogenic horizons. All

of these do not have a B horizon and generally are less than 1 percent organic matter.

The Entisols in this area are in the Orthent and Fluvent suborders.

The Orthents have a particle-size class that is loamy or finer in some horizon below the surface layer and have slope of greater 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.

Fluvents are like Orthents except organic matter content decreases irregularly to at least 1.25 m. These soils are on alluvial fans and are very deep.

Except for soils mapped at the suborder level, the Orthents and Fluvents have been placed in the Xerorthent to Xerofluent great groups since they have a xeric moisture regime.

Inceptisols are soils in which altered horizons have lost bases or 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 this 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 color, organic matter, or structure are lacking. The cambic horizon increases in clay by 1 to 2 percent and has structure. The texture is loamy fine sand or finer. Since these soils have a Xeric moisture regime, they have been placed in Xerochrepts great group.

Mollisols are soils that typically have a dark colored surface layer which is more than 25 cm thick, which is more than 1 percent organic matter, and which 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.

The 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 lack strong calcium carbonate layers have been placed in the Argixeroll great group.

Vertisols are soils that are fine textured throughout and consist in part of clays that swell and shrink significantly on wetting and drying. Unless irrigated, these soils dry in summer and crack open from the surface downward to a depth of at least 50 centimeters. Because of negligible rainfall in the summer, the cracks remain open for more than 60 consecutive days each year. These soils typically have an A horizon that is firm and massive when moist but becomes granular or blocky and hard or very hard when dry. Surface soil falls into cracks in these soils when they are dry and causes internal displacement. Because of the internal churning that takes place in these soils, development of a B horizon is not possible. Another result of this internal churning is intersecting slickenside faces in the clayey substratum. Vertisols in this area have been placed in the Xerert suborder, which has a xeric moisture regime.

The Xererts are divided into two great groups: Chromoxererts and Pelloxererts. Chromoxererts are the Xererts that have some subhorizons in the upper 30 cm that have dominant moist chroma of 1.5 or more in the matrix in more than half of each pedon. Pelloxererts are the Xererts in which all subhorizons in the upper 30 cm have a moist chroma of less than 1.5 which is dominant in the matrix and which is in more than half of each pedon.

Table 5, which follows, gives the soil classification for each of the soil families described in the survey.

TABLE 5. - Classification of the Soils

Soil Name	Family or Higher Taxonomic Class
Agua Dulce	Loamy-skeletal, mixed, thermic Mollic Haploxeralfs
Altamont	Fine, montmorillonitic, thermic Typic Chromoxererts
Argonaut	Fine, mixed, thermic Mollic Haploxeralfs
Botella	Fine-loamy, mixed, thermic Pachic Argixerolls
Chualar	Fine-loamy, mixed, thermic Typic Argixerolls
Cuesta	Clayey-skeletal, serpentinitic, thermic Typic Argixerolls
Diablo	Fine, montmorillonitic, thermic Chromic Pelloxererts
Exchequer	Loamy, mixed, nonacid, thermic Lithic Xerorthents
Fluvents	Fluvents
Ginser	Loamy-skeletal, mixed, frigid Pachic Haploxerolls
Green Bluff	Coarse-loamy, mixed, mesic Typic Xerochrepts
Hades	Fine-loamy, mixed, frigid Pachic Argixerolls
Hagen	Sandy, mixed, mesic Typic Xerorthents
Hambright	Loamy-skeletal, mixed, thermic Lithic Haploxerolls
Henneke	Clayey-skeletal, serpentinitic, thermic Lithic Argixerolls
Hohmann	Fine-loamy, mixed, mesic Typic Xerochrepts
Huntmount	Fine-loamy, mixed, mesic Typic Haploxeralfs
Inks	Loamy-skeletal, mixed, thermic Lithic Argixerolls
Kilburn	Loamy-skeletal, mixed, mesic Typic Haploxerolls
Kilmer	Fine-loamy, mixed (calcareous) thermic Typic Xerorthents
Konocti	Loamy-skeletal, mixed, mesic Typic Haploxeralfs
Lithic Haploxeralfs	Lithic Haploxeralfs
Lithic Xerochrepts	Lithic Xerochrepts
Livermore	Loamy-skeletal, mixed, thermic Typic Haploxerolls
Lodo	Loamy, mixed, thermic Lithic Haploxerolls
Lopez	Loamy-skeletal, mixed, thermic Lithic Ultic Haploxerolls
Los Gatos	Fine-loamy, mixed mesic Typic Argixerolls
Los Osos	Fine-montmorillonitic, thermic Typic Argixerolls
Los Robles	Fine-loamy mixed, thermic Typic Xerochrepts
Millerton	Loamy, mixed, thermic Lithic Haploxeralfs
Millsholm	Loamy, mixed, thermic Lithic Xerochrepts
Modesto	Fine-loamy, mixed, thermic Mollic Haploxeralfs
Modjeska	Loamy-skeletal, mixed, thermic Typic Xerochrepts
Morical	Fine-loamy, mixed, mesic Mollic Haploxeralfs
Nacimiento	Fine-loamy, mixed, thermic Calcic Haploxerolls

Soil Name	Family or Higher Taxonomic Class
Oak Glen	Coarse-loamy, mixed, mesic Pachic Haploxerolls
Ola	Coarse-loamy, mixed, frigid Pachic Haploxerolls
Orthents	Orthents
Panamint	Coarse-loamy, mixed, mesic Typic Haploxerolls
Ramona	Fine-loamy, mixed, thermic Typic Haploxeralfs
Reliz	Loamy-skeletal, mixed, nonacid, thermic Lithic Xerorthent
Rincon	Fine, montmorillonitic, thermic Mollic Haploxeralfs
San Andreas	Coarse-loamy, mixed, thermic Typic Haploxerolls
Santa Lucia	Clayey-skeletal, mixed, thermic Pachic Ultic Haploxerolls
Skalan	Loamy-skeletal, mixed, mesic Ultic Haploxeralfs
Stonyford	Loamy, mixed, thermic Lithic Mollic Haploxeralfs
Supan	Fine-loamy, mixed, mesic Pachic Argixerolls
Trigo	Loamy, mixed, nonacid, thermic, shallow Typic Xerorthents
Vertic Xerochrepts	Vertic Xerochrepts
Witzel	Loamy-skeletal, mixed, mesic Lithic Ultic Haploxerolls
Wrentham	Loamy-skeletal, mixed, mesic Pachic Haploxerolls
Xerofluvents	Xerofluvents
Xerorthents	Xerorthents
Yorba	Loamy-skeletal, mixed, thermic Typic Haploxeralfs

## 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) the biological forces; (4) the 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 from which the soils in the south part of the Los Padres National Forest have formed is both residual and transported materials. The parent material is the weathered rock or unconsolidated material from which soils are formed. The hardness, grain size, and porosity of the parent material and its content of weatherable minerals greatly influence the formation of soils.

### Soils Formed Over Sedimentary Rocks

Soils formed over sandstone of the Coldwater, Unnamed Cretaceous and Matilija formations are typically shallow (less than 20 inches) with a sandy loam texture. Millsholm, Millerton and Reliz families are examples. Soils formed over continental conglomerate deposits (Sespe and Quatal Formations), are deep with texture ranging from sandy loam to clay. Los Robles, Modesto and Rincon families represent some of these deeper upland soils.

Soils developed over shale vary in both depth and texture as functions of resistance to weathering of the bed rock, angle of dip of the beds, and extent of sandstone interbedding. Shallow coarse textured (sandy-loam to loamy-sand) soils such as Inks and Lodo families are common to shales of the Cozy Dell, Juncal and Toro Formations. Shales of the Monterey and Espada Formations develop both shallow coarse textured soils, Hambright family, and deep finer textured soils like Santa Lucia and Livermore families. The deeper soils

may be associated with considerable slumping and mass movement.

### Soils Formed Over Metamorphic Rocks

Soils developed over gneiss and schist are deep with sandy loam to loam surface textures and very gravelly or very cobbly loams in the subsoil. The skeletal subsoil (more than 35 percent rock fragments) begins at about 6 to 12 inches depth. Examples of skeletal soils are Ginser and Kilburn families.

Soils formed over serpentine rocks of the Franciscan Formation have serpentinitic mineralogy with moderate amounts of montmorillinite clay. These soils range from shallow Henneke family to moderately deep Cuesta family. The surface soil has medium to fine textures and the subsoil has clayey-skeletal textures.

Other soils associated with the Franciscan Formation are Vertisols. Vertisols develop over the Metashale and graywacke sandstone. Altamont and Diablo families are Vertisols. All soils developed over the Franciscan Formation are very unstable, and are associated with extensive slumping, slides, severe gullying or piping erosion.

### Soils Formed Over Igneous Rocks

Soils developed over granitic rocks are shallow to moderately deep with sandy loam textures throughout the profile. These soils are very erosive, and are associated with extensive gully and rill erosion following disturbance. Trigo, San Andreas, and Chualar soils are common to the granitics. At higher elevations in the Mt. Pinos area, cooler, mesic and frigid soils such as Wrentham, Panamint, and Ola families have developed.

### Soils Formed Over Alluvium

Soils formed in alluvium are found adjacent to major stream channels on terraces, alluvial fans, flood plains, and valleys. The Hagen family soils in Cuddy Valley and Lockwood Valley are developed in deep Alluvium. Alluvial soils are generally deep with sandy loam and or loamy-sand textures throughout their profile. Some of the soils developed on older terraces have sandy clay loam or clay loam textures in their subsoil. River terrace soils are Xerofluvents and Xerorthents. Alluvial soils are very erosive following disturbance and may develop deep gullies.

## Climate

The effect of climate on different soils varies as a result of the complex interaction among the soil-forming factors. Some properties, however, are common to many soils because of the similarity in climate.

The survey area has mildly warm, dry summers and moderately cool, rainy winters. The average annual rainfall for most of the survey area is 18 to 20 inches but ranges from 8 to 40 inches. Almost all precipitation falls during November through April, although some summer thunderstorms occur, mostly on the Mt. Pinos Ranger District. Some winter snow falls at higher elevations, again mostly on the Mt. Pinos Ranger District.

During the rainy period the soils become saturated, and they lose moisture through runoff or deep percolation. They seldom freeze. In most years, soil moisture in the upper 20 inches goes beyond the wilting point late in May or in June. Biological and chemical processes are retarded after late spring. Moisture persists longest on the north-facing subsoils such as Los Robles or Modesto.

The small amounts of moisture of the present climate preclude active leaching. The rates of redistribution of carbonates and the translocation of clays by this process are generally slow. Most of the soils have a good supply of bases, and many lack prominent argillic horizons. The alternate wet and dry periods cause soils that are high in montmorillonitic clays to shrink and swell. Wide cracks form during the dry summer and close during the moist winter in such soils as the Diablo or Altamont families. Some of the surface soil falls or washes into the cracks and mixes with the other horizons and prevents textural differentiation in the profiles.

The warm temperature, when the soils are moist, provides a suitable environment for rapid decomposition of organic matter and soil minerals. Surface layers are not generally well granulated, others are structureless and are crusted and hard when dry but becomes friable when moist.

Generally, differences in climate mean differences in soil properties. Increases in precipitation mean increases in organic matter, more leaching, and deeper soil profiles. The main difference in this area, however, seems to be caused by micro-climatic variations.

## Biological Activity

Living organisms, such as vegetation, burrowing animals, insects, earthworms, bacteria, fungi, other micro-organisms, and man affect the formation of soils. Plants

generally have a greater influence than other living organisms on soil formation in the survey area. They provide shade, cover, and litter, thus reducing runoff and erosion, and they contribute organic matter to the soil, improving its structure, aeration, and other physical and chemical conditions. A sparse vegetative cover adds little organic matter to soils. Millsholm soils, for example, under only a scattered brush cover, are low in content of organic matter and have a light colored surface layer. Rincon soils, in contrast, developed under grasses and forbs, have a dark colored surface layer, and are high in content of organic matter.

The effects of burrowing animals are apparent in some soils. Scattered bits of parent material are on the surface, and the soils are loose and mixed as a result of the collapsing of the burrows. Earthworms loosen, aerate, and mix soils and with other micro-organisms help break down plant nutrients.

Recently, man has changed the natural processes of soil formation through cultivation, irrigation, burning, and drainage.

## Time

Soil formation or development relates more to the length of time for weathering by the other four interacting forces than to age in terms of years. The geologic age of the parent material has little to do with the age of most soils.

The oldest soils in this area developed in old alluvium of terraces. These soils are on stable landscapes and have been in place longer than the other soils of the survey area. They are redder in color, finer in texture, and have stronger structure and more acid reactions than the surrounding younger soils.

The young soils, which lack development, generally formed in recent alluvium or on upland slopes where erosion is active and new soil material is removed almost as it is weathered. Hagen soils and Xerofluvents are formed in recent alluvium. Millsholm, Millerton and Trigo are examples of young upland soils. Soils having few or indistinct horizons are considered intermediate in age.

## Relief

Relief, or the shape of the landscape, influences soil formation, mainly through its effects on erosion, drainage or movement of water, and climate. Elevation, slope and exposure to the sun, wind, air, and drainage affect soil development.

Soils on north-facing slopes receive less direct sunlight, have cooler soil temperatures, and retain moisture longer than those on south-facing slopes. They therefore tend to have a dark colored surface layer and are deeper, have less active erosion, and tend to develop a denser vegetative cover than soils on south-facing slopes. For example, Agua Dulce soils, many of which are on northfacing slopes, have a deeper, darker surface layer than Millsholm soils, which commonly are on adjacent south-facing slopes.

On steep and very steep slopes, relief is a major factor in soil formation. In these areas the soil material is removed by erosion almost as fast as it forms. Thus, a deep soil profile seldom develops. Examples of shallow, steep to very steep soils are Millsholm, Millerton and Trigo families.

Relief also influences soil formation by its effect upon drainage, runoff and water erosion. The Transverse and Coast Ranges represent mature topography with well-developed drainage pattern. The land slopes are steep, the ridges are sharp, and the valleys are narrow. Earth quake faulting is continuing to build or uplift the main mountain masses to the point where it exceeds the natural angle of repose for these geologic materials. Soils

on very steep slopes, especially if not densely covered with vegetation, tend to have more erosion than soils on gentle slopes. In very steep forest areas, the soil material may be removed as fast as it forms.

Very steep soils generally have rapid runoff and are shallow. The characteristics of Lodo family soils have been determined in part by their steep slopes. Associations with these shallow residual soils is dry ravel. Dry ravel is noncohesive, unstable, and contains a high percentage of coarse fragments. Once the protective vegetation holding dry ravel materials in place is removed, only minor disturbance is needed to cause these materials to move farther down slope into stream channels.

Because of the east-west orientation of the Transverse Range, north-south facing slopes have a pronounced influence on soil development and vegetation composition. Direction and slope of the soil affect the soil temperature. Mesic soils occur mostly on north-facing slopes, which are cooler and support more dense vegetation. More vegetation generally results on darker colored surface soils. On broad ridgetops at higher elevation, soils are generally deeper. This is characteristic of the Ola soils.

## Taxonomic Unit Descriptions

In this section, each soil family or higher categories recognized in the survey area is described. The descriptions are arranged in alphabetical order. Characteristics of the soil and the material in which it is 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 the soil taxonomy. The soil moisture condition 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 Unit".

## AGUA DULCE FAMILY

Agua Dulce family consist of moderately deep to deep, well-drained soils formed in material weathered from conglomerate, sandstone, shale, and siltstone. They are on mountain uplands at elevations of 800 to 6400 feet. Slopes range from 10 to 90 percent. Annual precipitation is 14 to 38 inches.

**Taxonomic Class:** Loamy-skeletal, mixed, thermic Mollic Haploxeralfs.

**Typical Pedon:** Typical pedon of Agua Dulce family is in a unit of Modesto-Yorba-Agua Dulce families association, 30 to 60 percent slopes under Chamise at an elevation of 2,600 feet.

01-1/2 inch to 0; undecomposed leaves and twigs.

A1-0 to 10 inches; brown (10 YR 5/3) sandy loam, dark brown (7.5YR 3/4) moist; weak, fine granular structure; soft, friable, nonsticky and nonplastic; common medium roots; common fine tubular pores; 10 percent gravel, 2 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

A3-10 to 15 inches; yellowish brown (10YR 5/4) very cobbly sandy loam, dark yellowish brown (10YR 3/6) moist; weak, fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common medium roots; few medium tubular pores; 10 percent pebbles, 30 percent cobbles; slightly acid (pH 6.1); clear smooth boundary.

B21t-15 to 30 inches; yellowish brown (10YR 5/6) very cobbly sandy clay loam, strong brown (7.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common medium roots; few fine tubular pores; few thin clay films lining pores and channels; 15 percent pebbles

25 percent cobbles; slightly acid (pH 6.1); clear smooth boundary.

B22t-30 to 47 inches; strong brown (7.5YR 5/6) very gravelly sandy clay loam, strong brown (7.5YR 4/6) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few coarse roots; common medium tubular pores; common moderately thick clay films in pores and on ped faces; 50 percent pebbles, 10 percent cobbles, 20 percent stones; slightly acid (pH 6.0); gradual wavy boundary.

Cr-47 to 54 inches; soft weathered conglomerate rock.

**Type location:** 100 feet north of Pozo Road turnout at the summit in the NW 1/4, NE 1/4, Sec. 6, T. 30S., R. 16 E., M.D.B.M., Pozo Summit Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 60 or more inches. The soil is usually dry from June to October. Surface rock fragments range from 5 to 35 percent.

The A horizon is brown, grayish brown or light yellowish brown (10YR 4/3, 5/2, 5/3, 5/6, 6/1). It is gravelly sandy loam, sandy loam, loam or clay loam. Rock fragments range from 5 to 50 percent. It is medium acid to moderately alkaline.

The B2t horizon is brown, gray, brownish yellow, yellowish red or very pale brown (10YR 4/3, 5/1, 5/6, 6/2, 6/6, 7/3; 5YR 5/6). It is a very gravelly sandy loam, very gravelly sandy clay loam, or very gravelly clay loam. Rock fragments range from 35 to 85 percent. It is strongly acid to moderately alkaline.

**Vegetation:** California Buckwheat, chamise, ceanothus, scrub oak, mountain mahogany, or manzanita.

## ALTAMONT FAMILY

Altamont family consist of moderately deep to deep, well drained soils formed in material weathered from siltstone, sandstone, shale or colluvial deposit of serpentine. They are on mountainsides, hillslopes, or toe slopes at elevations of 400 to 4,400 feet. Slopes range from 10 to 60 percent. Annual precipitation is 18 to 30 inches.

**Taxonomic Class:** Fine, montmorillonitic, thermic Typic Chromoxererts.

**Typical pedon:** A typical pedon of Altamont family is in a unit of Diablo-Altamont-Henneke families association, 10 to 65 percent slopes under bromegrass/wild oats and oaks at an elevation of 2,400 feet.

01-2 inch to 0; undecomposed oak-grass leaves.

A11-0 to 6 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong medium to coarse subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; few very fine tubular pores; 5 percent pebbles; cracks are 6 to 10 inches apart and 1 to 2 inches wide; mildly alkaline (pH 7.5); gradual smooth boundary.

A12-6 to 20 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong coarse subangular blocky structure; very hard, friable, sticky and plastic; common very fine and medium roots; few very fine tubular pores; many intersecting slickensides; 10 percent pebbles; cracks are 6 to 10 inches apart and 1 to 2 inches wide; mildly alkaline (pH 7.5); gradual smooth boundary.

A13-20 to 28 inches; dark brown (10YR 3/3) and greenish gray (5GY 6/1) clay with common red stains (5YR 8/8) very dark grayish brown (10 YR 3/2) and (2.5Y 3/2) moist; weak very coarse columnar structure parting to strong coarse subangular blocky structure; very hard, very friable, sticky and plas-

tic; common very fine, medium and coarse roots; few very fine and fine tubular pores; many intersecting slickensides; cracks are 6 to 8 inches apart and 1/2 to 1 inch wide; 10 percent pebbles; mildly alkaline (pH 7.6); gradual smooth boundary.

C1-28 to 40 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure; very hard, very friable, slightly sticky and slightly plastic; few very fine, fine and common medium roots; few fine tubular pores; many intersecting slickensides; cracks are 6 to 8 inches apart and 1/2 to 1 inch wide; 5 percent pebbles; mildly alkaline (pH 7.8); clear smooth boundary.

R-40 to 45 inches; fractured hard graywacke sandstone.

**Type Location:** Approximately 800 feet west of Happy Canyon Road on the Ranger Peak trail in the NW 1/4, SE 1/4, Sec. 15, T. 7 N., R. 29 W., S.B.B.M., Figueroa Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 21 to 60 or more. The soil is usually dry from June to November. Some pedons contain gypsum in the substratum and have a gilgai topography.

The A horizon is olive gray, dark grayish brown, dark brown or dark reddish brown (5Y 5/2; 10YR 4/2; 7.5YR 3/2; 5YR 3/3). It is gravelly clay loam, clay loam or clay. Rock fragment range from 0 to 50 percent. It is mildly alkaline to moderately alkaline.

The C horizon is dark grayish brown, very dark grayish brown, yellowish brown, olive gray or light gray (10YR 4/2, 5/3, 5/4; 5Y 4/2, 7/2). It is clay loam, gravelly clay or clay. Rock fragments range from 5 to 30 percent. It is mildly alkaline to moderately alkaline.

**Vegetation:** Annual bromegrass, wild oats, scrub oak or coastal live oak.

## ARGONAUT FAMILY

Argonaut family consist of very deep, moderately well drained soils formed in material from shale. They are on mountain slopes at elevations of 1,500 to 4,600 feet. Slopes range from 20 to 60 percent. Annual precipitation is 22 to 26 inches.

**Taxonomic Class:** Fine, mixed, thermic Mollic Haploxeralfs.

**Typical pedon:** Typical pedon of Argonaut family is in a unit of Agua Dulce-Botella-Argonaut family association, 20 to 60 percent slopes under scrub oak and ceanothus at an elevation of 2,100 feet.

01-1 inch to 0; undecomposed grass and twigs.

A11-0 to 3 inches; yellowish brown (10YR 5/4) gravelly clay loam, dark brown (10YR 3/3) moist; moderate granular structure; soft, friable, slightly sticky and non-plastic; many very fine and common fine roots; many very fine discontinuous interstitial pores; 15 percent pebbles; neutral (pH 7.2); abrupt smooth boundary.

A12-3 to 8 inches; pale brown (10YR 6/3) gravelly clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and non-plastic; many very fine and common medium roots; common fine continuous interstitial pores; 15 percent pebbles; neutral (pH 7.2); clear wavy boundary.

B21t-8 to 18 inches; pale brown (10YR 6/3) gravelly clay, dark yellowish brown (10YR 4/4) moist; weak, fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and few medium roots; few fine interstitial pores; common, moderately thick clay films on ped faces and in pores; 25 percent pebbles; neutral (pH 7.0); gradual wavy boundary.

B22t-18 to 34 inches; light yellowish brown (10YR 6/4)

very gravelly clay, yellowish brown (10YR 5/4) moist; weak very fine subangular blocky structure; slightly hard, firm, sticky and plastic; many fine and few medium roots; few fine interstitial pores; many moderately thick clay films on ped faces and in pores; 35 percent pebbles; neutral (pH 6.8); gradual wavy boundary.

B23t-34 to 62 inches; yellowish brown (10YR 5/4) very gravelly clay, dark yellowish brown (10YR 4/4) moist; weak very fine subangular blocky structure; slightly hard, firm, sticky and plastic; common fine and few medium roots; few fine interstitial pores; common moderately thick clay films on ped faces and in pores; 35 percent pebbles, 15 percent cobbles; slightly acid (pH 6.5); gradual smooth boundary.

R-62 to 65 inches; hard fractured bluegray shale.

**Type location:** Approximately 0.4 miles east of Mono Creek on the south side cut bank of the Hildreth Peak Jeep Trail in the SE 1/4, SE 1/4, Sec. 26, T. 6 N., R. 26 W., S.B.B.M., Hildreth Peak Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 60 or more inches. The subsoil is usually dry from June to October.

The A horizon is dark grayish brown or pale brown (10 YR 4/2, 6/3). It is loam, gravelly clay loam, or clay loam. Rock fragments range from 5 to 20 percent. It is strongly acid to neutral.

The B2t horizon is light olive brown, pale brown, yellowish brown or light yellowish brown (2.5YR 5/4; 10YR 5/4, 6/3, 6/4). It is very gravelly clay or clay. Rock fragments range from 10 to 40 percent. It is medium acid to neutral. Some pedons have a C horizon.

**Vegetation:** Scrub oak, annual brome grass, wild oats or ceanothus.

## BOTELLA FAMILY

Botella family consist of deep to very deep, well drained soils formed in material weathered from sandstone, shale, granite, or mixed alluvium. They are on mountain sides, and alluvial fans, at elevations of 1,200 to 5,800 feet. Slopes range from 10 to 80 percent. Annual precipitation is 14 to 26 inches.

**Taxonomic Class:** Fine-loamy, mixed, thermic Pachic Argixerolls.

**Typical pedon:** Typical pedon for the Botella family is in the unit of Lodo-Botella families-Rock outcrop association, 30 to 60 percent slopes under chamise and scrub oak at an elevation of 2,400 feet.

O1-1 inch to 0; undecomposed leaves and twigs.

A1-0 to 2 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/2) moist; moderate, fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; few very fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

A3-2 to 9 inches; reddish brown (5 YR 4/3) loam, dark reddish brown (5YR 3/2) moist; weak, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, medium and few coarse roots; few very fine interstitial pores; few thin and moderately thick clay films in pores; 10 percent pebbles; medium acid (pH 5.6); clear smooth boundary.

B21t-9 to 18 inches; reddish brown (5 YR 4/3) gravelly loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many

fine, medium and few coarse roots; few very fine interstitial pores; many moderately thick clay films in pores; 25 percent pebbles; slightly acid (pH 6.3); gradual smooth boundary.

B22t-18 to 40 inches; reddish brown (5YR 4/3) gravelly loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; few fine interstitial pores; few moderately thick clay films on ped faces and in pores; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

R-40 to 43 inches; hard fractured shale.

**Type location:** Approximately 0.3 miles northeast of B.M. 2503 on the Squaw Flat Road, north of Fillmore in the NW 1/4, NW 1/4, Sec. 31, T. 5 N., R. 19 W., S.B.B.M., Fillmore Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact ranges from 40 to 60 or more inches. The soil is usually dry from June to November.

The A horizon is dark grayish brown, brown or reddish brown (10YR 4/2, 5/3; 5YR 4/3). It is sandy loam, loam or silty clay loam. Rock fragments range from 5 to 30 percent. It is medium acid to moderately alkaline.

The B2t is dark grayish brown, reddish brown or brown (10YR 4/2, 5/3). It is gravelly sandy loam, gravelly loam, loam or silty clay loam. Rock fragments range from 5 to 30 percent. It is medium acid to mildly alkaline. Some pedons contain a C horizon which contains up to 80 percent rock fragments.

**Vegetation:** Ceanothus, chamise, mountain mahogany, annual brome grass, wild oats, or coastal live oak.

## CHUALAR FAMILY

Chualar family consist of deep, well drained soils formed in material weathered from granite, sandstone, shale, or conglomerate rocks. They are on mountain uplands at elevations of 800 to 4,200 feet. Slopes range from 20 to 70 percent. Annual precipitation is 14 to 34 inches.

**Taxonomic Class:** Fine-loamy, mixed, thermic Typic Argixerolls.

**Typical pedon:** Typical pedon of Chualar family is in a unit of Trigo-San Andres-Chualar families association, 10 to 50 percent slopes under annual bromegrass and wild oats at an elevation of 2,400 feet.

0l-1 inch to 0; undecomposed grass.

A1-0 to 13 inches; brown (10 YR 5/3) sandy loam, dark brown (7.5 YR 3/2) moist; moderate, medium granular structure; slightly hard, friable, slightly sticky and non-plastic; common fine roots; few medium tubular pores; 10 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B1t-13 to 20 inches; brown (7.5 YR 5/4) sandy clay loam, dark brown (7.5 YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine and few medium roots; few medium interstitial pores; few thin clay films in bridges between mineral grains; 12 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B21t-20-32 inches; brown (7.5 YR 5/4) gravelly sandy clay loam, reddish brown (5 YR 4/4) moist; moderate, medium subangular blocky structure; slightly hard, firm, sticky and plastic; few medium roots and few medium interstitial pores; common moderately thick clay films on ped faces; 15 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B22t-32 to 50 inches; yellowish brown (10YR 5/6) gravelly sandy clay loam, dark reddish brown (5 YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few medium tubular pores; common moderately thick clay films on ped faces; 15 percent pebbles; slightly acid (pH 6.5); gradual smooth boundary.

Cr-50 to 55 inches; light yellowish brown weathered granitic rock.

**Type location:** Approximately 2.3 miles on Black Mountain Road from the intersection with Pozo Parkfield Road and 50 feet up on the east slope in the SE 1/4, SW 1/4, Sec. 26, T. 29 S., R. 15 E., M.D.B.M., Pozo Summit Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 40 to 50 inches. The soil is usually dry from June to November.

The A horizon is dark gray, brown, or reddish brown (10 YR 4/1, 5/3; 5 YR 4/3). It is gravelly sandy loam, sandy loam, loam, or silt loam. Rock fragments range from 5 to 30 percent. It is medium acid to moderately alkaline.

The B2T is dark brown, brown, very pale brown, or reddish brown (10 YR 3/3, 6/3, 7/4; 5 YR 5/3). It is sandy loam, gravelly sandy clay loam, gravelly loam or clay loam. Rock fragments range from 2 to 30 percent. It is medium acid to moderately alkaline. Some pedons contain a C horizon.

**Vegetation:** Annual bromegrass, wild oats, ceanothus, manzanita, scrub oak, or blue oak.

## CUESTA FAMILY

Cuesta Family consist of moderately deep well drained soils formed in material weathered from serpentine rock. They are on mountain uplands at elevations of 1,500 to 4,000 feet. Slopes range from 15 to 70 percent. Annual precipitation is about 22 to 24 inches.

**Taxonomic class:** Clayey-skeletal, serpentinic, thermic Typic Argixerolls.

**Typical pedon:** Typical pedon of Cuesta family is in a unit of Cuesta-Henneke families complex, 15 to 60 percent slopes under cypress and manzanita at an elevation of 2,250 feet.

A1-0 to 2 inches; dark grayish brown (10 YR 4/2) cobbly loam, very dark brown (10 YR 2/2) moist; strong, medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; few, very fine and fine interstitial pores; 12 percent pebbles, 10 percent cobbles, 5 percent stones; neutral (pH 6.7); abrupt smooth boundary.

B21t-2 to 6 inches; dark brown (7.5 YR 3/4) clay loam, dark reddish brown (5 YR 3/2) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium roots; few very fine and fine interstitial pores; common moderately thick clay films on ped faces and in pores; 12 percent pebbles; neutral (pH 6.7); clear smooth boundary.

B22t-6 to 11 inches; mixed, yellowish brown (10YR 5/4) and reddish brown (5YR 4/3) gravelly clay, dark brown (10YR 3/3) and dark reddish brown (5YR 4/3) moist; moderate, fine subangular blocky structure; slightly hard, firm, sticky and plastic; few very fine, fine and common medium roots; few fine interstitial pores; common moderately thick clay films on ped faces and in pores; 20 percent pebbles; neutral (pH 6.7); clear smooth boundary.

B3t-11 to 24 inches; mixed, dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) extremely stony clay loam, dark yellowish brown (10YR 3/4) moist; strong coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine and common medium roots; few fine tubular pores; many thick clay films on ped faces and in pores; 15 percent pebbles, 5 percent cobbles, 70 percent stones; neutral (pH 7.1); gradual wavy boundary.

Cr-24 to 34 inches; soft weathered serpentine rock.

R-34 to 37 inches; hard serpentine rock.

**Type location:** About 2.5 miles west of Cuesta Pass on Cuesta ridge Road; about 50 feet north of the road in the NE 1/4, NW 1/4, Sec. 35, T. 29 S., R. 12 E., M.D.B.M., San Luis Obispo Quadrangle.

**Range in characteristics:** The soil depth to a lithic contact is 21 to 38 inches. The soil is dry from June to November. Surface rock fragments range from 5 to 10 percent.

The A horizon is dark brown, dark reddish brown dark grayish brown, or reddish brown (10YR 3/3; 5 YR 3/3, 4/2, 4/3). It is very gravelly loam, loam or gravelly clay loam. Rock fragments range from 5 to 55 percent. It is neutral to moderately alkaline.

The B2t is dark brown or yellowish brown (7.5YR 3/2, 10YR 5/4). It is clay loam, gravelly clay, or very stony clay. Rock fragments range from 10 to 90 percent. It is neutral to moderately alkaline. Some pedons contain a C horizon.

**Vegetation:** Cypress, manzanita, chamise, ceanothus, or scrub oak.

## DIABLO FAMILY

Diablo family consist of deep, well drained soils formed in material weathered from serpentine, graywacke sandstone or shale. They are on mountain uplands and hill slopes. Elevation is 400 to 4,400 feet. Slopes range from 10 to 40 percent. Annual precipitation ranges from 20 to 30 inches.

**Taxonomic Class:** These soils are fine, montmorillonitic, thermic Chromic Pelloxererts.

**Typical pedon:** Typical pedon of Dablo family is in a unit of Diablo-Altamont-Hennke families association, 10 to 60 percent slopes under annual brome grass and wild oats at an elevation of 2,500 feet.

A11-0 to 1 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; moderate, medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; few very fine interstitial pores; few intersecting slickensides; cracks are 6 to 10 inches apart and 1 to 2 inches wide; mildly alkaline (pH 7.5); clear smooth boundary.

A12-1 to 8 inches; gray (5YR 5/1) clay, very dark gray (5Y 3/1) moist; strong coarse angular blocky structure; hard, friable, sticky and plastic; few very fine roots; few very fine interstitial pores; many intersecting slickensides; cracks are 6 to 10 inches apart and 1 1/2 to 2 inches wide; moderately alkaline (pH 8.0); gradual smooth boundary.

C1ca-8 to 30 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; strong, coarse to very coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores, many intersecting slickensides; cracks are 6 to 10 inches apart and 1 1/2 to 2 inches wide; slightly effervescent in matrix, few, fine irregularly shaped soft white lime masses; moderately alkaline (pH 8.0); clear smooth boundary.

C2ca-30 to 36 inches; mottled olive gray (5Y 5/2) clay, olive gray and dark olive gray (5Y 3/2) moist; strong coarse angular blocky structure; very hard, firm, sticky and plastic; few fine roots; few very fine interstitial pores; many intersecting slickensides; cracks are 6 to 9 inches apart and 1 to 2 inches wide; slightly effervescent in matrix, common fine irregularly shaped soft white lime masses; moderately alkaline (pH 8.0); clear smooth boundary.

C3ca-36 to 45 inches; olive gray (5Y 5/2) clay, olive gray (5YR 4/2) moist; strong coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores; slightly to strongly effervescent in matrix, common fine irregularly shaped soft white lime masses; moderately alkaline (pH 8.0); clear smooth boundary.

Cr-45 to 60 inches; weathered graywacke sandstone.

**Type location:** Approximately 1.2 miles west of the U.S.F.S., Figueroa station near the Forest boundary, about 100 feet north of the road on the west side of the main gully in the NW 1/4, SE 1/4, Sec. 27, T. 8 N., R. 30 W., S.B.B.M., Los Olivos Quadrangle.

**Range in characteristics:** The soil depth to a paralythic or lithic contact is 40 to 60 inches. The soil is usually dry from June to November.

The A horizon is dark gray, gray or very dark grayish brown (5Y 4/1, 5/1; 10YR 3/2). It is silty clay or clay. Rock fragments range from 0 to 10 percent. It is neutral to mildly alkaline. A few pedons contain carbonates.

The C horizon is dark gray olive gray or very dark gray brown (5Y 4/1, 5/1; 10YR 3/2). It is gravelly clay or clay. Rock fragments range from 5 to 30 percent. It is moderately alkaline. Soft lime masses are common.

**Vegetation:** Annual brome grass and wild oats.

## EXCHEQUER FAMILY

Exchequer family consist of shallow, well drained soils formed in material weathered from sandstone. They are on mountain uplands at elevations of 2,100 to 5,000 feet. Slopes range from 25 to 80 percent. Annual precipitation is 14 to 25 inches.

**Taxonomic Class:** Loamy, mixed, nonacid, thermic Lithic Xerorthents.

**Typical pedon:** Typical pedon of Exchequer family is in a unit of Millsholm-Exchequer-Stonyford families complex, 30 to 75 percent slopes under chamise at an elevation of 1,900 feet.

A1-0 to 2; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate, fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots, common fine interstitial pores; 5 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

C1-2 to 12 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; common medium roots; few medium inter-

stitial pores; 5 percent pebbles; slightly acid (pH 6.5); gradual smooth boundary.

R-12 to 15 inches; hard fractured sandstone.

**Type location:** 0.3 miles north of the Forest boundary on Pozo Grade, 100 feet up a hillside in the NW 1/4, SE 1/4, Section 12, T. 30 S., R. 16 E., M.D.B.M., Pozo Summit Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 5 to 14 inches. The soil is usually dry from June to November.

The A horizon is dark brown, brown or very pale brown (10Yr 4/3, 5/3, 7/4). It is gravelly sandy loam or loam. Rock fragments range from 0 to 20 percent. It is strongly acid to moderately alkaline.

The C horizon is brown, light yellowish brown, or reddish yellow (10YR 5/3, 6/4, 7; 5YR 7/6). It is gravelly sandy loam or sandy loam. Rock fragments range from 0 to 35 percent. It is strongly acid to moderately alkaline.

**Vegetation:** Chamise, manzanita, toyon or annual brome grass.

## FLUVENTS

Fluents soils consist of deep or very deep soils formed in alluvium. They are on recent stream terraces and alluvial bottomlands at elevations of 2,700 to 4,800 feet. Slopes range from 0 to 15 percent. Annual precipitation is 8 to 17 inches.

**Range in characteristics:** Depth is 60 inches or more. The substratum is stratified and the organic matter decreases irregularly with depth.

The A horizon is light brownish gray, brown or yellow (2.5 YR 6/2; 10 YR 5/3, 7/6). It is loamy fine sand,

sandy loam, or sandy clay loam. Rock fragments range from 2 to 15 percent. It is moderately alkaline to strongly alkaline.

The C horizon is pale brown or very pale brown (10YR 6/3, 8/3). It is gravelly sand, gravelly sandy loam, sandy loam, or sandy clay loam. Rock fragments range from 0 to 30 percent. It is moderately alkaline to strongly alkaline. Some pedons contain very thin horizons of silt or gravel.

**Vegetation:** Sagebrush, rabbitbrush, annual brome grass, or California buckwheat.

## GINSER FAMILY

Ginser family consist of deep, well drained soils formed in material weathered from gneiss or schist. They are on mountain uplands at elevations of 6100 to 8800 feet. Slopes range from 10 to 65 percent. Annual precipitation is 16 to 35 inches.

**Taxonomic Class:** Loamy-skeletal, mixed, frigid Pachic Haploxerolls.

**Typical pedon:** Typical pedon of Ginser family is in a unit of Hades-Ginser-Ola families association, 10 to 30 percent slopes under white fir and Jeffrey pine at an elevation of 8,200 feet.

01-2 inch to 0; undecomposed pine needles.

A1-0 to 7 inches; dark grayish brown (10YR 4/2) sandy loam, black (10YR 2/1) moist; moderate, very fine to fine subangular blocky structure; soft, very friable, non-sticky and non-plastic; many very fine, fine and few coarse roots; moderate very fine tubular pores; 10 percent cobbles; neutral (pH 7.0); clear wavy boundary.

B1-7 to 23 inches; grayish brown (10YR 5/2) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine subangular blocky structure; soft, very friable, non-sticky and non-plastic; common fine and medium roots; few very fine interstitial pores; 25 percent pebbles, 20 percent cobbles; neutral (pH 6.9); clear wavy boundary.

B21-23 to 34 inches; light olive brown (2.5Y 5/4) very stony sandy clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, fine to medium subangular blocky structure; slightly hard, friable, non-sticky and non-plastic; common very fine, fine and medium roots; few very fine interstitial pores; 15 percent pebbles, 10 percent cobbles, 30 percent stones; neutral (pH 6.8); abrupt smooth boundary.

B22-34 to 48 inches; olive brown (2.5Y 4/4) very cobbly sandy loam, olive brown (2.5Y 4/4) moist; massive breaking to strong, fine to medium subangular blocky structure; few fine roots; common very fine interstitial pores; 15 percent pebbles, 40 percent cobbles, 5 percent stones; neutral (pH 6.8); clear smooth boundary.

C-48 to 60 inches; light yellowish brown (2.5Y 6/4) and yellowish brown (10YR 5/4) cobbly-sandy loam, dark brown (10YR 3/3) moist; weak, medium subangular blocky structure; slightly hard, friable, non-sticky and non-plastic; few fine roots; few medium tubular pores; 20 percent pebbles, 30 percent cobbles, 5 percent stones; neutral (pH 5.8).

**Type location:** 100 feet north around the corner from the Mount Abel ski lodge, northwest facing road cut in the NE 1/4, SW 1/4, Sec. 26, T. 9 N., R. 22 W., S.B.B.M., Sawmill Mountain Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 60 or more inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown or brown (10YR 4/2, 4/3). It is sandy loam or gravelly sandy loam. Rock fragments range from 10 to 25 percent. pH is neutral.

The B2 horizon is light olive brown or olive brown (2.5Y 5/4, 4/4). It is very cobbly sandy loam or very stony sandy clay loam. Rock fragments range from 35 to 65 percent. It is neutral to slightly acid.

The C horizon is olive brown or light yellowish brown (2.5Y 4/4, 6/4; 10YR 5/4). It is very cobbly sandy loam or very stony sandy clay loam. Rock fragments range from 35 to 60 percent. It is neutral to slightly acid. Some pedons do not have a C horizon.

**Vegetation:** White fir, Jeffery pine or black oak.

## GREEN BLUFF FAMILY

Green Bluff family consist of moderately deep, well-drained soils formed in material weathered from sandstone or conglomerate. They are on mountain uplands and hillslopes, at elevations of 4,700 to 8,100 feet. Slopes range from 10 to 60 percent. Annual precipitation is 13 to 30 inches.

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

**Typical pedon:** Typical pedon of Green Bluff family is in a unit of Hohmann-Green Bluff-Konocti families association, 30 to 60 percent slopes under pinyon pine at an elevation of 5,250 feet.

A1-0 to 2 inches; dark grayish brown (2.5Y 4/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; 5 percent pebbles; mildly alkaline (pH 7.4); clear smooth boundary.

A3-2 to 6 inches; dark brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium roots; common medium tubular pores; 8 percent pebbles; strongly effervescent; moderately alkaline (pH 7.9); clear smooth boundary.

B2-6 to 18 inches; light yellowish brown (10YR 6/4) sandy loam, olive brown (2.5 Y 4/4) moist; moderate, medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine, common, medium and coarse roots; few fine tubular pores; few thin clay films between mineral grains; strongly effervescent; 5 percent pebbles; moderately alkaline (pH 8.0); gradual smooth

boundary.

C1-18 to 28 inches; pale brown (10YR 6/3) gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, nonsticky and non-plastic; few medium roots in fractures; few fine tubular pores; 25 percent pebbles, 2 percent cobbles; slightly effervescent; moderately alkaline (pH 8.0).

Cr-28 to 32 inches; weathered sandstone.

**Type location:** Approximately 0.4 miles north (left cut bank on the private dirt road) from the intersection of Lockwood - Ozena Road and Thorn Meadows Road in the NW 1/4, NW 1/4, Section 9, T. 7 N, R. 21 W., S.B.B.M.

**Range in characteristics:** The soil depth to a paralithic contact is 20 to 40 inches. The soil is usually dry from June to October.

The A horizon is light brownish gray, dark grayish brown, or yellowish brown (2.5Y 6/2, 4/2; 10YR 5/4). It is sandy loam, gravelly sandy loam, or loam. Rock fragments range from 0 to 25 percent. It is slightly acid to moderately alkaline.

The B2 horizon is grayish brown, brown, or light yellowish brown (2.5Y 5/2; 10 YR 6/4). It is cobbly sandy loam or sandy loam. Rock fragments range from 5 to 35 percent. It is neutral to moderately alkaline.

The C horizon is grayish brown or pale brown (2.5Y 5/2; 10YR 6/3). It is cobbly coarse loamy sand or gravelly sandy loam. Rock fragments range from 5 to 55 percent. It is neutral to mildly alkaline.

**Vegetation:** Annual brome grass, wild oats, sagebrush, western juniper or pinyon pine.

## HADES FAMILY

Hades family consist of very deep, well drained soils formed in material weathered from gneiss or schist. They are on mountain sides and ridges at elevations of 6,100 to 8,800 feet. Slopes range from 10 to 60 percent. Annual precipitation is 16 to 20 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, frigid Pachic Argixerolls.

**Typical Pedon:** Typical pedon of Hades family is in a unit of Hades-Ginser-Ola families association, 10 to 30 percent slopes under Jeffrey pine at an elevation of 7,750 feet.

A11-0 to 10 inches; brown (10YR 5/3) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and few fine interstitial pores; 25 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

A12-10 to 21 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine, common fine, medium and few coarse roots; many very fine, common fine, and few medium interstitial pores; 25 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B1t-21 to 33 inches; light olive brown (2.5Y 5/4) gravelly sandy clay loam, dark brown (7.5YR 3/4) moist; moderate, medium subangular blocky structure; hard, firm, slightly sticky and nonplastic; few very fine, fine and common medium roots; many very fine, fine and common medium interstitial pores; common moderately thick clay films on ped faces and in pores; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B21t-33 to 49 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 3/4) moist; moderate, fine subangular blocky structure; hard, firm, sticky, and slightly plastic; few very fine, fine and common medium roots; many very fine, fine and common medium interstitial pores; common moderately thick clay films on ped faces and in pores; 25 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B22t-49 to 60 inches; brownish yellow (10YR 6/6) gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate, medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; common fine interstitial pores; common moderately thick clay films on ped faces and in pores; 25 percent pebbles; neutral (pH 7.0).

**Type location:** 0.2 miles south of the west Frazier Mt. Road on the Frazier Mt. Lookout road in the NW 1/4, NW 1/4, Sec. 23, T. 8 N., R. 20 W., S.B.B.M., Frazier Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 60 or more inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown or brown (10YR 4/2, 5/3). It is gravelly sandy loam or gravelly sandy clay loam. Pebbles range from 0 to 25 percent and cobbles 0 to 5 percent. It is slightly acid to neutral.

The B2t is very dark grayish brown, brown, brownish yellow or yellow brown (10YR 3/2, 5/3, 5/4, 6/6). It is gravelly loam, gravelly sandy loam, or clay loam. Rock fragments range from 0 to 40 percent. It is slightly acid to neutral. Some pedons contain a C horizon.

**Vegetation:** Jeffrey pine, white fir, or sagebrush.

## HAGEN FAMILY

Hagen family consist of very deep, excessively drained soils formed in mixed alluvium. They are on alluvial fans, floodplains and valley floors at elevations of 4,250 to 6,600 feet. Slopes range from 0 to 10 percent. Annual precipitation is 19 to 25 inches.

**Taxonomic Class:** These soils are sandy, mixed, mesic Typic Xerorthents.

**Typical pedon:** Typical pedon of Hagen family is in a unit of Oak Glen-Supan-Hagen families association, 0 to 10 percent slopes under annual bromegrass, at an elevation of 5,000 feet.

A11-0 to 1 inches; pale brown (10YR 6/3) coarse sandy loam, dark grayish brown (10YR 4/2) moist; moderate, medium platy structure; soft, very friable, nonsticky and nonplastic; common fine roots; few fine interstitial pores; 10 percent pebbles; mildly alkaline (pH 7.7); clear smooth boundary.

A12-1 to 3 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak, fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine tubular pores; 2 percent pebbles; mildly alkaline (pH 7.7); clear smooth boundary.

C1-3 to 14 inches; light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 4/3) moist; massive; hard, very friable, nonsticky and nonplastic; few fine

roots; few fine interstitial pores; 5 percent pebbles; 5 percent cobbles; mildly alkaline (pH 7.8); clear smooth boundary.

C2-14 to 60 inches; light yellowish brown (10YR 6/4) gravelly loamy coarse sand, dark brown (10YR 4/3) moist; massive hard, very friable, nonsticky and nonplastic; few very fine roots; few fine interstitial pores; 20 percent pebbles, 10 percent cobbles; moderately alkaline (pH 8.0).

**Type location:** 200 feet north of Lockwood Valley Road and 200 feet east of the unsurfaced road to the private airport, in the NE 1/4, NW 1/4, Sec. 25, T. 8 N., R. 21 W., S.B.B.M., Lockwood Valley Quadrangle.

**Range in characteristics:** Depth to a lithic or paralithic contact is 60 inches or more. The soil is usually dry from June to October.

The A horizon is brown or pale brown (10YR 5/3, 6/3). It is coarse sandy loam, sandy loam, or gravelly sandy loam. Rock fragments range from 0 to 30 percent. It is neutral to mildly alkaline.

The C horizon is brown or light yellowish brown (10YR 5/3, 6/4). It is gravelly loamy coarse sand, sandy loam, or gravelly sandy clay loam. Rock fragments range from 0 to 35 percent. It is slightly acid to moderately alkaline.

**Vegetation:** Annual bromegrass, or sagebrush.

## HAMBRIGHT FAMILY

Hambright family consist of shallow, excessively drained soils formed in material weathered from shale and sandstone. They are on mountain sides at elevations of 800 to 4,700 feet. Slopes range from 30 to 90 percent. Annual precipitation is 18 to 28 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, thermic Lithic Haploxerolls.

**Typical pedon:** Typical pedon of Hambright family is in a unit of Lodo-Hambright-Millsholm families association, 30 to 60 percent under salvia at an elevation of 1,100 feet.

01-2 to 0 inches; undecomposed chaparral leaves.

A11-0 to 2 inches; brown (10YR 5/3) extremely gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine, fine and medium roots; common fine interstitial pores; 60 percent pebbles, 15 percent cobbles; neutral (pH 7.3); abrupt wavy boundary.

A12-2 to 8 inches; brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; moderate, fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and common medium roots; common fine interstitial pores; 5 percent pebbles, 20 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

C1-8 to 16 inches; brown (10YR 5/3) very cobbly sandy

loam, dark brown (10YR 4/3) moist; moderate, fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; 35 percent pebbles and 20 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

R-16 to 22 inches; fractured hard shale.

**Type location:** Between Morro Bay and Atascadero on Highway 41, 200 feet east of Host Blvd. and 300 feet up the hillside from the base of the trail, in the NE 1/4, NE 1/4, Sec. 12, T. 29 S., R. 11 E., M.D.B.M., Atascadero Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is dark brown, dark yellowish brown, or brown (10YR 3/3, 4/3, 5/3). It is extremely gravelly sandy loam, very gravelly sandy loam or extremely cobbly loam. Rock fragments range from 5 to 80 percent. It is medium acid to neutral.

The B horizon is brown or yellowish brown (10YR 5/3, 5/6). It is very gravelly sandy loam, very cobbly sandy loam, or very cobbly loam. Rock fragments range from 15 to 70 percent. It is slightly acid to neutral.

**Vegetation:** Ceanothus, chamise, California buckwheat, or coastal sagebrush.

## HENNEKE FAMILY

Henneke family consist of shallow, well or excessively drained soils formed in material weathered from serpentinitic rock. They are on mountain uplands. Elevation is 400 to 4,400 feet. Slopes range from 15 to 70 percent. Annual precipitation ranges from 20 to 30 inches.

**Taxonomic Class:** These soils are clayey-skeletal, serpentinitic, thermic Lithic Argixerolls.

**Typical pedon:** Typical pedon of Henneke family is in a unit of Diablo-Altamont-Henneke families association. 15 to 60 percent slopes under brome grass and manzanita at an elevation of 3,800 feet.

A1-0 to 4 inches; brown (10YR 4/3) cobbly clay loam, dark brown (7.5YR 3/2) moist; moderate, very fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine and fine roots; few very fine pores; 10 percent pebbles, 10 percent cobbles; neutral (pH 7.0); abrupt smooth boundary.

2t-4 to 7 inches; dark reddish brown (5YR 3/4) very cobbly clay, dark reddish brown (5YR 3/2) moist; moderate, fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; few very fine and fine interstitial pores; many thick clay films on ped faces and in

pores, 10 percent pebbles, 30 percent cobbles, 5 percent stones; mildly alkaline (pH 7.5); abrupt smooth boundary.

R-7 to 15 inches; fractured hard serpentine rock.

**Type location:** Road cut on the Figueroa Mountain/Cachuma Saddle Road, approximately 3/4 miles east of the Davey Brown Trail sign in the SE 1/4, SE 1/4, Sec. 31, T. 8 N., R. 29 W., S.B.B.M., Figueroa Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is dry from June to October.

The A horizon is dark brown or brown (10YR 3/3, 5/3). It is sandy loam, cobbly clay loam, or clay loam. Rock fragments range from 5 to 35 percent. It is neutral to moderately alkaline.

The B2t is grayish brown, brown, or dark reddish brown (10YR 5/2; 7.5YR 4/4; 5YR 3/4). It is very gravelly sandy clay loam to very cobbly clay. Rock fragments range from 35 to 60 percent. It is neutral to moderately alkaline.

**Vegetation:** Chamise, scrub oak, annual brome grass, wild oats, ceanothus, Sargent cypress or manzanita.

## HOHMANN FAMILY

Hohmann family consist of moderately deep, well-drained soils formed in material weathered from sedimentary rocks. They are on mountain uplands and hillslopes at elevations of 5,000 to 5,700 feet. Slopes range from 30 to 80 percent. Annual precipitation is 14 to 30 inches.

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

**Typical pedon:** Typical pedon of Hohmann family is in a unit of Hohmann-Greenbluff-Konociti families association, 30 to 60 percent slopes under manzanita and scrub oak at an elevation of 5,500 feet.

A1-0 to 10 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak, fine subangular blocky structure; soft, friable, nonsticky, and nonplastic; few fine roots; few fine interstitial pores; 5 percent pebbles; moderately alkaline (pH 8.0); gradual smooth boundary.

B2-10 to 24 inches; brown (10YR 5/3) loam, dark yellowish brown (10YR 4/4) moist; moderate, medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine roots, few fine interstitial pores; 2 percent pebbles; moderately alkaline (pH 8.0); clear smooth boundary.

Cr-24-30 inches; softly weathered mudstone.

**Type location:** 0.3 mile west of Lockwood Creek (0.50 miles east of benchmark 5425) on Lockwood-Ozena Road (F.S. 9N03), 100 feet up the hillside on the north side of the road in the SE 1/4, NE 1/4, Sec. 8, T. 7 N., R. 21 W., S.B.B.M., San Guillermo Quadrangle.

**Range in characteristics:** Depth to a paralithic contact is 21 to 40 inches. The soil is usually dry from June to October. Some pedons have few, thin clay films in the B2 horizon, but not enough clay increase for an argillic.

The A horizon is brown (10YR 5/3; 7.5YR 5/4). It is sandy loam, loam, silt loam, or sandy clay loam. Rock fragments range from 0 to 10 percent. It is slightly acid to moderately alkaline.

The B2 horizon is brown to brownish yellow (10YR 5/3, 6/6). It is gravelly loam, loam, sandy clay loam, or clay loam. Rock fragments range from 0 to 20 percent. It is slightly acid to moderately alkaline.

A C horizon is present in some profiles. It is brown, very pale brown, or reddish yellow (10YR 5/3, 8/4; 7.5YR 6/6). It is sandy loam, gravelly sandy clay loam to clay loam. It is slightly acid to moderately alkaline.

**Vegetation:** Pinyon pine, sagebrush, manzanita, or scrub oak.

## HUNTMOUNT FAMILY

Huntmount family consist of very deep, well drained soils formed in material weathered from sandstone or conglomerate. They are on mountain uplands at elevations of 870 to 6,600 feet. Slopes range from 30 to 70 percent. Annual precipitation is 19 to 30 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, mesic Typic Haploxeralfs.

**Typical pedon:** Typical pedon of Huntmount family is in a unit of Skalan-Huntmount families association, 30 to 70 percent slopes under manzanita and canyon live oak at an elevation 4,600 feet.

01-1 inch to 0; undecomposed leaves.

A11-light yellowish brown (10YR 6/4) gravelly loam, yellowish brown (10YR 5/6) moist; moderate, medium platty structure; slightly hard, firm, nonsticky and nonplastic; few fine roots; few fine interstitial pores; 15 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

A12-light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/6) moist; weak, fine subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common fine and few coarse roots; common fine interstitial pores; 25 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B2t-6 to 14 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/6) moist; weak, fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and common medium roots; few fine interstitial

pores; common thin clay films on ped faces; 20 percent pebbles; slightly acid (pH 6.2); clear smooth boundary.

C1-14 to 34 inches; light brownish gray (10YR 6/4) very gravelly loam, yellowish brown (10YR 5/4) moist; weak, fine subangular blocky structure; many fine, medium and few coarse roots; few fine interstitial pores; 45 percent pebbles; medium acid (pH 6.0); clear smooth boundary.

Cr-34 to 40 inches; moderately hard weathered sandstone.

**Type location:** 150 feet south of the wilderness gate at Pines Campground on Big Pine Mt. Road in NE 1/4, SW 1/4, Sec. 34, T. 7 N., R. 27 W., S.B.B.M., Big Pine Mountain Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 60 inches or more. The soil is usually dry from June to October.

The A horizon is dark grayish brown light yellowish brown or very pale brown (10YR 4/2, 6/4, 7/3). It is sandy loam or gravelly loam. Rock fragments range from 5 to 30 percent. It is slightly acid to mildly alkaline.

The B2t is dark yellowish brown, light yellowish brown, or strong brown (10YR 4/4, 6/4; 7.5YR 4/6). It is sandy clay loam or gravelly clay loam. Rock fragments range from 0 to 20 percent. It is slightly acid to moderately alkaline. Some pedons contain a C horizon.

**Vegetation:** Jeffery pine, canyon live oak, or manzanita.

## INKS FAMILY

Inks family consist of shallow, somewhat excessively well drained soils formed in material weathered from sandstone, shale or siltstone. They are on mountain uplands at elevations of 1,200 to 6,400 feet. Slopes range from 30 to 80 percent. Annual precipitation is 22 to 38 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, thermic Lithic Argixerolls.

**Typical pedon:** Typical pedon of Inks family is in a unit of Inks-Lodo-Agua Dulce families complex, 30 to 80 percent slopes under ceanothus, chamise and salvia at an elevation of 2,540 feet.

A1-0 to 3 inches; yellow brown (10YR 5/4) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; strong, medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

B2t-3 to 8 inches; brown (10YR 5/3) extremely gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate, very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common very

fine and fine roots; common fine interstitial pores; common thin clay films in pores; 70 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

R-8 to 12 inches; fractured very hard siltstone.

**Type location:** Twenty yards west of Gibraltar Road (approximately 1.5 miles north of junction with East Camino Cielo Road) in NW 1/4, SE 1/4, Sec. 23, T. 5 N., R. 27 W., S.B.B.M.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown, yellowish brown, or reddish brown (10YR 4/2, 5/4; 5YR 5/4). It is gravelly coarse sandy loam, very gravelly sandy loam, or gravelly sandy clay loam. Rock fragments range from 20 to 60 percent. It is medium acid to neutral.

The B2t horizon is dark brown or brown (10YR 5/3; 7.5YR 5/4). It is extremely gravelly sandy clay loam or very gravelly clay loam. Rock fragments range from 35 to 80 percent. It is medium acid to neutral.

**Vegetation:** Ceanothus, scrub oak, or wild oats.

## KILBURN FAMILY

Kilburn family consist of moderately deep, well drained soils formed in material weathered from sandstone, schist, gneiss, or granite. They are on mountain slopes at elevations of 1,750 to 7,800 feet. Slopes range from 10 to 60 percent. Annual precipitation is 14 to 35 inches.

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

**Typical pedon:** Typical pedon of Kilburn family is in a unit of Kilburn-Wrentham-Supan families association, 30 to 60 percent slopes under Jeffrey pine and manzanita, at an elevation of 7,800 feet.

01-5 inches to 0; undecomposed pine needles and twigs.

A11-0 to 4 inches; grayish brown (10YR 5/2) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots, common very fine vesicular pores; 15 percent pebbles, 25 percent cobbles; medium acid (pH 5.7); clear wavy boundary.

A12-4 to 7 inches; gray (10YR 5/1) extremely cobbly sandy loam, very dark gray (10YR 3/1) moist; moderate, fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine vesicular pores; 25 percent pebbles, 35 percent cobbles, 5 percent stones; medium acid (pH 5.7); clear wavy boundary.

B2-7 to 19 inches; light olive brown (2.5Y 5/4) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate, fine subangular blocky structure; soft, friable, slightly sticky and nonplastic; few fine and common medium roots; common very fine and fine interstitial pores; 35 percent pebbles, 10 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

C1-19 to 36 inches; light yellowish brown (2.5Y 6/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; weak, fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common, medium roots; few fine interstitial pores; 50 percent pebbles, 35 percent cobbles, 3 percent stones; slightly acid (pH 6.5); abrupt wavy boundary.

R-36 to 38 inches; fractured hard schist.

**Type location:** 1.0 mile below the ski lodge on Mt. Abel road, about 75 feet on mountainside above the road in the NW 1/4, NW 1/4, Sec. 35, T. 9 N., R. 22 W., S.B.B.M., Sawmill Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 21 to 40 inches. The soil is usually dry from June to October.

The A horizon is gray, grayish brown, or brown (10YR 5/1, 5/2, 5/3). It is very cobbly sandy loam or extremely cobbly sandy loam. Rock fragments range from 15 to 65 percent. It is medium acid to neutral.

The B2 horizon is light olive brown or brown (2.5Y 5/4; 10YR 5/3). It is very cobbly sandy loam or very gravelly loam. Rock fragments range from 10 to 60 percent. It is slightly acid to neutral.

The C horizon is light yellowish brown or strong brown (2.5Y 6/4; 7.5YR 5/8). It is extremely cobbly loam, very gravelly loam or gravelly sandy clay loam. Rock fragments range from 25 to 90 percent. It is slightly acid.

**Vegetation:** Jeffrey pine, ceanothus, mixed conifer, pinyon pine, scrub oak, white fir or sagebrush.

## KILMER FAMILY

Kilmer family consist of moderately deep, well drained soils formed in calcareous shale. They are on hillslopes at elevations of 1,300 to 3,200 feet. Slopes range from 5 to 60 percent. Annual precipitation is 13 to 15 inches.

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

**Typical pedon:** Typical pedon of Kilmer family is in a unit of Kilmer-Nacimiento families association, 10 to 60 percent slopes under brome grass and juniper at an elevation of 1,640 feet.

A11-0-5 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine interstitial pores; 3 percent pebbles; moderately alkaline (pH 8.0); clear smooth boundary.

A12ca-5-13 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (2.5Y 4/2) moist; weak, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine interstitial pores; violently effervescent; lime segregated in common rounded fine size soft masses; 2 percent pebbles, 5 percent cobbles; moderately alkaline (pH 8.2); gradual smooth boundary.

Clca-13-29 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 3/4) moist; weak, coarse

subangular blocky structure; soft, very friable, slightly sticky and plastic; few fine roots; few medium interstitial pores; violently effervescent, lime segregated in common irregularly shaped fine size filaments or threads; 2 percent pebbles and 10 percent cobbles; moderately alkaline (pH 8.2); clear wavy boundary.

CR-29-31 inches; weathered calcareous shale.

**Type location:** On highway 58, 3.4 miles east of Avenales wildlife gate, directly east of the reservoir, 30 yards S.E. of 6 foot cedar in the NW 1/4, NE 1/4, Section 1, T. 29 S., R. 15 E., M.D.B.M., Camatta Ranch Quadrangle.

**Range in characteristics:** Depth to a paralithic contact is 21 to 40 inches. The soil is usually dry from June to October.

The A horizon is light olive brown or pale brown (2.5Y 5/4; 10YR 6/3). It is sandy loam, silt loam, or clay loam. Rock fragments range from 2 to 15 percent and cobbles 5 to 15 percent. It is neutral to moderately alkaline.

The C horizon is light olive brown or pale brown (2.5Y 5/4; 10YR 6/3). It is silt loam or sandy clay loam. Rock fragments range from 2 to 30 percent. It is moderately alkaline.

**Vegetation:** Annual brome grass, wild oats, or scrub oaks.

## KONOCTI FAMILY

Konocti family consist of moderately deep well drained soils formed in material weathered from sandstone or shale. They are on mountain slopes at elevations of 4,000 to 5,700 feet. Slopes range from 30 to 60 percent. Annual precipitation is 14 to 30 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, mesic Typic Haploxeralfs.

**Typical pedon:** Typical pedon of Konocti family is in a unit of Hohmann-Greenbluff-Konocti families association, 30 to 60 percent slopes under Jeffrey pine at an elevation of 4,900 feet.

01-1/4 inch to 0; partially burned duff.

A11-0 to 2 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; weak fine, subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and few fine roots; few fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

A12-2 to 10 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium roots; few fine interstitial pores; 7 percent pebbles; neutral (pH 6.8); abrupt smooth boundary.

B21t-10 to 20 inches; very pale brown (10YR 7/4) extremely gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate, very fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common fine interstitial pores; common thin clay films in pores and on ped faces; 65

percent pebbles; slightly acid (pH 6.3); clear wavy boundary.

B22t-20 to 27 inches; very pale brown (10YR 7/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate, fine subangular blocky structure; hard, firm, sticky and plastic; few fine, medium and coarse roots; common fine interstitial pores; common clay films in pores and on ped faces; 35 percent pebbles; medium acid (pH 6.0); abrupt wavy boundary.

Cr-27 to 30 inches; weathered sandstone.

**Type location:** 50 feet west of road to Kinkaid cabin, 2.4 miles north of Thorn Meadows Road in the SE 1/4, NW 1/4, Section 36, T. 7 N., R. 21 W., S.B.B.M., Lockwood Valley Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 40 inches. The soil is usually dry from June to October. The surface sometimes has a platy structure.

The A horizon is pale brown or light brown (10YR 6/3; 7.5YR 6/4). It is loam, sandy clay loam, or clay loam. Rock fragments range from 10 to 35 percent. It is strongly acid to neutral.

The B2t is pale brown, very pale brown, brown, or reddish yellow (10YR 6/3; 7/4; 7.5YR 5/4, 7/6). It is very gravelly sandy clay loam or extremely gravelly clay loam. Rock fragments range from 20 to 80 percent. It is medium acid to neutral.

**Vegetation:** Jeffery pine or sagebrush.

## LITHIC HAPLOXERALFS

Lithic Haploxeralfs consist of shallow, excessively drained soils formed in sedimentary rocks. They are on mountain slopes at elevations of 1,600 to 6,500 feet. Slopes range from 30 to 90 percent. Annual precipitation is 18 to 28 inches. The mean annual soil temperature at the Lithic contact is 59 to 72 degrees F.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is pale brown, light gray, or brownish yellow (10YR 9/4, 5/3, 6/3) and is 2 to 4 inches thick. It is gravelly sandy loam, loam, or gravelly sandy clay loam. Rock fragments range from 0 to 30 percent.

The B2t is yellowish brown, light gray or brownish yellow (10YR 4/4, 5/3, 5/5) and is 8 to 15 inches thick. It is gravelly sandy loam or extremely gravelly sandy clay loam. Rock fragments range from 10 to 80 percent.

**Vegetation:** Chamise, ceanothus, or manzanita.

## LITHIC XEROCHREPTS

Lithic Xerochrepts consist of shallow excessively drained soils formed in material weathered from sedimentary rocks. They are on mountain slopes at elevations of 1,600 to 6,500 feet. Slopes range from 30 to 90 percent. Annual precipitation is 18 to 28 inches. The mean annual soil temperature at the Lithic contact is 59 to 72 degrees F.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is grayish brown (10YR 5/2) and is 2 to 4 inches thick. It is very gravelly sandy loam, sandy clay loam, or loam. Rock fragments range from 0 to 60 percent.

The B2 horizon is brown (10YR 5/3) and is 8 to 15 inches thick. It is very gravelly sandy loam, sandy clay loam, or silt loam. Rock fragments range from 10 to 80 percent.

**Vegetation:** Chamise, ceanothus, or manzanita.

## LIVERMORE FAMILY

Livermore family consist of moderately deep to deep, well-drained soils formed in material weathered from shale or sandstone. They are on mountain uplands at elevations of 800 to 5300 feet. Slopes range from 30 to 85 percent. Annual precipitation is 20 to 34 inches.

**Taxonomic Class:** Loamy-skeletal, mixed, thermic Typic Haploxerolls.

**Typical pedon:** Typical pedon of Livermore family is in a unit of Livermore-Agua Dulce-Hambright families association, 30 to 80 percent slopes under salvia and coastal sage at an elevation of 1,200 feet.

01-1 1/2 to 0 inches; undecomposed leaves and twigs.

A1-0 to 3 inches; brown (10YR 5/3) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) moist; strong, fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common fine interstitial pores; 20 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B21-3 to 12 inches; yellowish brown (10YR 5/4) very gravelly sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and common fine roots; common fine interstitial pores; few thin clay films on ped faces; 40 percent pebbles, 3 percent cobbles; mildly alkaline (pH 7.5); clear wavy boundary.

B22-12 to 17 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy clay loam, brown (10YR 4/3) moist; moderate, very fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine, fine and few medium roots; common fine interstitial pores; few thin clay films on ped faces; 60 percent pebbles, 2 percent

cobbles; mildly alkaline (pH 7.5); abrupt wavy boundary.

C1-17 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; few fine interstitial pores; 60 percent pebbles, 2 percent cobbles; mildly alkaline (pH 7.5).

**Type location:** 400 feet north of Sage Hill campground on Aliso canyon trail, past the fence, up the right hillside about 200 feet in the NE 1/4, NW 1/4, Sec. 2, T. 5 N., R. 28 W., S.B.B.M., San Marcos Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 21 to 60 or more inches. The soil is usually dry from June to October.

The A horizon is very dark grayish brown or brown (10YR 3/2, 4/3). It is very gravelly sandy loam, loam, gravelly sandy clay loam, or very gravelly sandy clay loam. Rock fragments range from 0 to 60 percent. It is slightly acid to moderately alkaline.

The B2 horizon is yellowish brown, light yellowish brown to brown (10YR 4/3, 5/4, 6/4; 7.5 YR 5/4). It is extremely gravelly sandy loam, loam, very gravelly sandy clay loam, or extremely gravelly sandy clay loam. Rock fragments range from 20 to 90 percent. It is strongly acid to moderately alkaline.

The C horizon is brown or yellowish brown (10YR 5/3, 5/4). It is extremely gravelly sandy loam or extremely gravelly sandy clay loam. Rock fragments range from 20 to 80 percent. It is medium acid to moderately alkaline.

**Vegetation:** Scrub oak, manzanita, chamise, coastal sagebrush, ceanothus, or mountain mahogany.

## LODO FAMILY

Soils in the Lodo family consist of shallow, well to somewhat excessively drained soils formed in material weathered from sandstone, granite, shale, or metamorphic rocks. They are on mountain uplands at elevations of 800 to 6,400 feet. Slopes range from 20 to 80 percent. Annual precipitation is 14 to 38 inches.

**Taxonomic Class:** Loamy, mixed, thermic Lithic Haploxerolls.

**Typical pedon:** Typical pedon of Lodo family is in a unit of Lodo-Hambright-Millsholm families association, 30 to 60 percent slopes under manzanita at 2,250 feet elevation.

A1-0 to 7 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 and fine roots; common fine interstitial pores; 5 percent pebbles; neutral (pH 7.0); abrupt smooth boundary.

R-7 to 14 inches; fractured hard fine-grained sandstone and shale.

**Type location:** 1 1/2 mile south of Cachuma Saddle near the Lion Creek crossing, 40 feet northeast of the northeast corner of the lower river crossing, 200 feet uphill in the NE 1/4, NE 1/4, Sec. 10, T. 7 N., R. 29 W., S.B.B.M., Figueroa Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October. Some pedons contain a B2 and/or a C horizon.

The A horizon is dark brown, yellowish brown or reddish brown (10YR 3/3, 4/3; 7.5YR 4/4). It is sandy loam, cobbly sandy loam or loam. Rock fragments range from 0 to 30 percent. It is medium acid to mildly alkaline.

**Vegetation:** Chamise, California buckwheat, sagebrush, scrub oak, manzanita, ceanothus, annual brome grass, wild oats or chamise.

## LOPEZ FAMILY

Lopez Family consist of shallow, well drained soils formed in material weathered from shale. They are on mountain slopes at elevations of 1,200 to 3,600 feet. Slopes range from 10 to 70 percent. Annual precipitation is 13 to 22 inches.

**Taxonomic Class:** Loamy-skeletal, mixed, thermic Lithic Ultic Haploxerolls.

**Typical pedon:** Typical pedon of Lopez family is in a unit of Lopez-Santa Lucia families association, 10 to 70 percent slopes under manzanita and Coulter pine at an elevation of 2,000 feet.

01-2 to 0 inches; undecomposed pine needles and manzanita leaves.

A11-0 to 3 inches; grayish brown (10YR 5/2) very gravelly clay loam, very dark gray (10YR 3/1) moist; weak, medium granular structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; common fine interstitial pores; 40 percent pebbles; very strongly acid (pH4.7); abrupt smooth boundary.

A12-3 to 11 inches brown (10YR 5/3) very gravelly

clay loam, dark brown (10YR 3/3) moist; weak, medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few medium roots; few fine interstitial pores; 45 percent pebbles; very strongly acid (pH 4.6); abrupt wavy boundary.

R-11 to 21 inches; fractured hard shale.

**Type location:** 7.3 miles past the Santa Margarita Ranch gate on East Cuesta Pass road, 250 feet up the radio facility road and 10 feet up the left bank under the Coulter pine in the NE 1/4, NE 1/4, Section 17, T. 36 S., R. 13 E., M.D.B.M., Lopez Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October. A few pedons contain a B2 horizon.

The A horizon is grayish brown or brown (10YR 5/2, 5/3). It is gravelly sandy loam or very gravelly clay loam. Rock fragments range from 0 to 70 percent. It is extremely acid to slightly acid.

**Vegetation:** Chamise, manzanita, coast live oak, or Coulter pine.

## LOS GATOS

Los Gatos family consist of moderately deep to deep, well drained soils formed in material weathered from granitic, gneiss or granodiorite rock. They are on mountain slopes at elevations of 1,750 to 7,100 feet. Slopes range from 10 to 65 percent. Annual precipitation is 14 to 22 inches.

**Taxonomic Class:** Fine-loamy, mixed, mesic Typic Argixerolls.

**Typical pedon:** Typical pedon of Los Gatos family is in a unit of Los Gatos-Kilburn-Panamint families association, 10 to 30 percent slopes under Jeffrey pine at an elevation of 7,300 feet.

01-1 to 0 inches; undecomposed pine needles and twigs.

A1-0 to 4 inches; dark brown (10YR 3/3) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak, very fine granular structure; soft, very friable, non-sticky and nonplastic; common fine roots; common very fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.2); abrupt smooth boundary.

B1t-4 to 19 inches; dark brown (10YR 3/3) gravelly loam, very dark brown (10YR 2/2) moist; moderate, medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; few fine interstitial pores; few thin clay films on ped faces; 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B2t-19 to 30 inches; brown (7.5YR 4/4) gravelly clay loam, dark-reddish brown (5YR 3/4) moist; weak, fine subangular blocky structure; slightly hard, very friable, sticky and plastic; few fine roots; few fine interstitial pores; common thin clay films on ped faces; 20 percent pebbles; slightly acid (pH 6.3); abrupt smooth boundary.

R-30 to 60 inches; fractured hard granitic rock.

**Type location:** South of McGill campground on Mt. Pinos F.S. road 8N05 in the SW 1/4, SE 1/4, Sec. 3, T. 8 N., R. 21 W., S.B.B.M., Cuddy Valley Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 21 to 60 inches. The soil is usually dry from June to October.

The A horizon is dark brown or brown (10YR 3/3, 5/3). It is loamy sand, sandy loam, gravelly sandy loam or loam. Rock fragments range from 0 to 20 percent. It is slightly acid to mildly alkaline.

The B2t is dark brown, brown, or very pale brown (10YR 3/3, 5/3, 7/4). It is loam, sandy clay loam, gravelly loam, or gravelly clay loam. Rock fragments range from 0 to 35 percent. It is slightly acid to moderately alkaline. Some pedons contain a C horizon.

**Vegetation:** Jeffrey pine, pinyon pine, scrub oak, or manzanita.

## LOS OSOS FAMILY

Los Osos family consist of moderately deep to very deep, well drained soils formed in material weathered from sandstone, shale, siltstone or metashale. They are on mountain slopes, older stream terraces, and hillslopes at 240 to 3,700 feet. Slopes range from 15 to 85 percent. Annual precipitation is 13 to 26 inches.

**Taxonomic Class:** Fine, montmorillonitic, thermic Typic Argixerolls.

**Typical pedon:** Typical pedon of Los Osos family is in a unit of Rincon-Modesto-Los Osos families association, 30 to 60 percent slopes under brome grass and wild oats at an elevation of 2,800 feet.

01-1.5 to 0 inches; grass litter.

A11-0-5 inches; brown (7.5YR 5/2) silt loam, dark brown (5YR 3/2) moist; moderate, medium subangular blocky structure; soft, friable, slightly sticky and nonplastic; many very fine and common fine roots; many very fine and common fine interstitial pores; 5 percent pebbles; neutral (pH 7.0), abrupt wavy boundary.

A12-5 to 13 inches; brown (7.5YR 5/2) silt loam, dark brown (5YR 3/2) moist; strong, medium subangular blocky structure; hard; friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine interstitial pores; 2 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.

B2t-13 to 31 inches; reddish gray (5YR 5/2) clay loam,

brown (5YR 4/2) moist; strong, coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few very fine interstitial pores; common moderately thick clay films on ped faces and in pores; 5 percent pebbles; mildly alkaline (pH 7.8); abrupt irregular boundary.

Cr-31 to 35 inches; brown (7.5YR 4/2); highly fractured soft sandstone.

**Type location:** 1.0 miles west of junction of Painted Caves Road with East Camino Cielo Road on the south side of the road, in the SW 1/4, SE 1/4, Sec. 15, T. 5 N., R. 28 W., S.B.B.M., San Marcos Pass Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact ranges from 21 to 60 or more inches. The soil is usually dry from June to October.

The A horizon is very dark grayish brown, brown, or reddish gray (10YR 3/2, 5/3; 7.5YR 5/2). It is silt loam, gravelly silt loam, loam, or gravelly clay loam. Rock fragments range from 0 to 35 percent. It is medium acid to moderately alkaline.

The B2t horizon is dark grayish brown, very pale brown, dark reddish brown, or reddish gray (10YR 4/4, 7/3; 5YR 3/4, 5/2, 6/2). It is silty clay loam, sandy clay loam, clay loam or clay. Rock fragments range from 0 to 25 percent. It is medium acid to moderately alkaline.

**Vegetation:** Annual brome grass, wild oats, chamise, scrub oak, coast live oak, ceanothus, or blue oak.

## LOS ROBLES FAMILY

Los Robles family consist of moderately deep, somewhat poorly or well drained soils formed in material weathered from sandstone, shale, conglomerate, or metavolcanic rocks. They are on mountain slopes and older stream terraces at elevations of 2,400 to 6,200 feet. Slopes range from 10 to 75 percent. Annual precipitation is 8 to 28 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, thermic Typic Xerochrepts.

**Typical pedon:** Typical pedon of Los Robles family is in a unit of Agua Dulce-Los Robles-Modeska families association, 10 to 60 percent slopes under California buckwheat and brome grass at an elevation of 3,250 feet.

A1-0 to 7 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak, fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; common fine interstitial pores; strongly effervescent; 10 percent pebbles; moderately alkaline (pH 8.0); abrupt wavy boundary.

B1-7 to 14 inches; yellowish brown (10YR 5/4) sandy loam; dark brown (10YR 4/3) moist; weak, medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine roots; common fine interstitial pores; strongly effervescent; 8 percent pebbles; moderately alkaline (pH 8.0); clear smooth boundary.

B2-14 to 27 inches; light yellowish brown (10YR 6/4) sandy clay loam, dark brown (10YR 4/3) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine interstitial pores; strongly effe-

vescent; 10 percent pebbles moderately alkaline (pH 8.0); clear smooth boundary.

B3-27 to 35 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 4/3) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; violently effervescent, common fine irregularly shaped segregated lime in soft masses; moderately alkaline (pH 8.0); clear smooth boundary.

Cr-35 to 48 inches; soft weathered sandstone.

**Type location:** approximately 4 miles east of Ballinger Canyon campground, past the second large creek crossing, (due south of the crossing) near the base of the hill in the NE 1/4, NE 1/4, Sec. 9, T. 9 N., R. 24 W., S.B.B.M., Ballinger Canyon Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 40 inches. The soil is usually dry from June to October.

The A horizon is light olive brown, brown, pale brown, or reddish yellow (2.5Y 5/4; 10YR 6/3, 7/3; 7.5YR 6/6). It is sandy loam, very gravelly sandy clay loam, or loam. Rock fragments range from 0 to 50 percent. It is medium acid to moderately alkaline.

The B2 horizon is pale brown or light yellowish brown (10YR 6/3, 6/4). It is gravelly sandy loam, sandy clay loam or gravelly clay loam. Rock fragments range from 0 to 30 percent. It is neutral to strongly alkaline. Some pedons contain a C horizon that may be calcareous.

**Vegetation:** Chamise, western juniper, California buckwheat, scrub oak, or annual brome grass.

## MILLERTON FAMILY

Millerton family consist of shallow, well drained soils formed in material weathered from sedimentary and metavolcanic rocks. They are on mountain slopes at elevations of 1400 to 7,500 feet. Slopes range from 5 to 85 percent. Annual precipitation is 14 to 34 inches.

**Taxonomic Class:** These soils are loamy, mixed, thermic Lithic Haploxerafs.

**Typical pedon:** Typical pedon of Millerton family is in a unit of Millerton-Millsholm families-Rock Outcrop complex, 30 to 80 percent slopes under chamise, manzanita and ceanothus at an elevation of 2,710 feet.

A11-0 to 2 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B2t-2 to 13 inches; brownish yellow (10YR 6/6) gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate, fine subangular blocky structure; soft, friable, slightly sticky and nonplastic; common very fine, fine and few medium roots; few fine interstitial pores; few thin clay films on ped faces and in pores; 30 percent pebbles; slightly acid (pH 6.5;) abrupt irregular boundary.

CR-13 to 17 inches; soft weathered sandstone.

R-17 to 23 inches; fractured hard sandstone.

**Type location:** 1.7 miles east of the west end of the paved Camino Cielo Road, near the Trappers Camp, at the road cut bank, in the SW 1/4, NE 1/4, Sec. 19, T. 5 N., R. 28 W., S.B.B.M., San Marcos Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is dark yellowish brown, pale brown, or reddish yellow (10YR 3/4, 6/3; 7.5YR 6/6). It is loamy sand, gravelly sandy loam, or clay loam. Rock fragments range from 0 to 30 percent. It is medium acid to moderately alkaline.

The B2t is brown, very pale brown, or reddish yellow (10YR 5/3, 7/3; 7.5YR 6/6). It is gravelly sandy loam, gravelly loam, loam, or gravelly clay loam. Rock fragments range from 0 to 60 percent. It is medium acid to neutral.

**Vegetation:** Ceanothus, chamise, annual brome grass, or manzanita.

## MILLSHOLM FAMILY

Millsholm family consist of shallow, well drained soils formed in material weathered from sedimentary and metamorphic rocks. They are on mountain slopes and hillslopes at elevations of 400 to 7,500 feet. Slopes range from 20 to 85 percent. Annual precipitation is 13 to 36 inches.

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

**Typical pedon:** Typical pedon of Millsholm family is in a unit of Modesto-Rincon-Millsholm families association, 20 to 50 percent slopes under bromegrass, wild oats and interior live oak at an elevation of 1,750 feet.

01-1 to 0 inches; partly decomposed grass and oak leaves.

A1-0 to 6 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 3/3) moist; weak, fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.3); clear smooth boundary.

B21-6 to 12 inches; light yellowish brown (10YR 6/4) loam, brown (10YR 4/3) moist; moderate, medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine interstitial pores; 12 percent pebbles; neutral (pH 7.1); clear smooth boundary.

B22-12 to 16 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak, fine granular structure; hard, firm, sticky and plastic; few fine roots; common fine interstitial pores; 8 percent pebbles; neutral (pH 7.1); abrupt irregular boundary.

R-16 to 21 inches; fractured hard siltstone.

**Type location:** 0.6 miles past American Canyon on the Avenales Ranch Road, at the culvert crossing, 150 feet up the west hillside in the NE 1/4, NE 1/4, Sec. 4, T. 31 S., R. 16 E., M.D.B.M., Pozo Summit Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is light yellowish brown, yellowish brown or brown (10YR 5/3, 6/4 7.5YR 5/4). It is gravelly sandy loam, silt loam, sandy clay loam or clay loam. Rock fragments range from 0 to 20 percent. It is medium acid to moderately alkaline.

The B2 horizon is dark yellowish brown, light yellowish brown, yellow or pinkish gray (10YR 4/4, 6/4, 7/6; 5YR 6/2). It is gravelly sandy loam, loam, silt loam or gravelly clay loam. Rock fragments range from 0 to 35 percent. It is medium acid to moderately alkaline.

**Vegetation:** Scrub oak, ceanothus, chamise annual bromegrass, blue oak, manzanita, wild oats, or digger pine.

## MODESTO FAMILY

Modesto family consist of moderately deep to very deep, well-drained soils formed in material weathered from conglomerate, sandstone, or shale. They are on mountain slopes, alluvial fans and older stream terraces at elevations of 800 to 6,500 feet. Slopes range from 15 to 90 percent. Annual precipitation is 8 to 30 inches.

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

**Typical pedon:** Typical pedon of Modesto family is in a unit of Modesto-Yorba-Agua Dulce families association, 30 to 60 percent slopes under chamise, ceanothus and bromegrass at an elevation of 1,760 feet.

A1-0 to 7 inches; grayish brown (10YR 5/2) coarse sandy loam, dark brown (10YR 3/3) moist; weak, coarse granular structure; soft, friable, nonsticky and nonplastic; common fine roots; few fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B2t-7 to 30 inches; brown (7.5YR 5/4) gravelly sandy clay loam, yellowish red (5YR 4/6) moist, moderate, medium subangular blocky structure; very hard, firm, nonsticky and plastic; few fine roots; few fine interstitial pores; common moderately thick clay films on ped faces; 10 percent pebbles, 5 percent cobbles; medium acid (pH 6.0); clear smooth boundary.

C1-30 to 55 inches; light brown (7.5YR 6/4) very gravelly sandy loam, yellowish red (5YR 4/6) moist; weak, medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine interstitial pores; 30 percent pebbles,

10 percent cobbles; strongly acid (pH 5.5); clear smooth boundary.

Cr-55 to 57 inches; weakly cemented conglomerate rock.

**Type location:** 2.25 miles south of Highway 58, on the road cut bank of F.S. 28S01 in the SE 1/4, NW 1/4, Sec. 3, T. 29 S., R. 15 E., M.D.B.M., Camatta Ranch Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 60 or more inches. The soil is usually dry from June to October.

The A horizon is dark brown, grayish brown or light brownish gray (10YR 4/2, 5/2, 6/2, 10/2; 5YR 5/2). It is gravelly sandy loam, coarse sandy loam, loam, or gravelly sandy clay loam. Rock fragments range from 0 to 35 percent. It is strongly acid to strongly alkaline.

The B2t is brown, dark grayish brown, or light grayish brown (10YR 5/3, 4/2, 6/2). It is gravelly sandy loam, gravelly sandy clay loam, or clay loam. Rock fragments range from 0 to 35 percent. It is strongly acid to moderately alkaline.

The C horizon is very pale brown or light brown (10YR 7/3; 7.5YR 6/4). It is very gravelly sandy loam, gravelly sandy loam, or very gravelly loam. Rock fragments range from 0 to 55 percent. It is slightly acid to moderately alkaline.

**Vegetation:** Annual bromegrass, wild oats, blue oak, coast live oak, redshank, chamise, scrub oak, or pinyon pine.

## MODJESKA FAMILY

Modjeska family consist of moderately deep to deep, well drained soils formed in material weathered from sandstone, shale, granitic, or conglomerate rocks. They are on mountain slopes at elevations of 760 to 6,500 feet. Slopes range from 10 to 80 percent. Annual precipitation is 12 to 34 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, thermic Typic Xerochrepts.

**Typical pedon:** Typical pedon of Modjeska family is in a unit of Yorba-Modjeska-Morical families association, 30 to 60 percent slopes under ceanothus, manzanita, and scrub oak at an elevation of 6,000 feet.

01-2 inches to 0; partly decomposed leaves and branches.

A11-0 to 3 inches; brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine and few medium roots; few fine interstitial pores; 12 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

A12-3 to 6 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure; soft, friable, nonsticky and nonplastic; common very fine, fine and medium roots; common fine interstitial pores; 7 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

B2-6 to 23 inches; yellowish brown (10YR 5/4), ex-

tremely gravelly loam, brown (10YR 4/3) moist; moderate, fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; few fine interstitial pores; 60 percent pebbles; slightly acid (pH 6.5).

R-23 to 25 inches; hard sandstone.

**Type location:** 0.1 mile east of Pine Mountain Lodge on the road to the ridge line east of the lodge, 100 feet south of the road in the NE 1/4, NE 1/4, Sec. 14, T. 6 N., R. 22 W., S.B.B.M., Lion Canyon Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 60 or more inches. The soil is usually dry from June to October.

The A horizon is brown or very pale brown (10YR 4/3, 7/3). It is sandy loam, loam or clay loam. Rock fragments range from 0 to 35 percent. It is medium acid to moderately alkaline.

The B2 horizon is brown, yellowish brown, or light yellowish brown (10YR 4/3, 5/4, 6/4). It is very gravelly sandy loam, extremely gravelly loam, or very gravelly clay loam. Rock fragments range from 35 to 75 percent. It is medium acid to moderately alkaline. Some pedons contain a C horizon that may be calcareous.

**Vegetation:** Annual bromegrass, wild oats, California buckwheat, chamise, toyon, scrub oak, coast live oak, manzanita, ceanothus, or pinyon pine.

## MORICAL FAMILY

Morical family consist of moderately deep to deep, well drained soils formed in material weathered from schist, gneiss, granitic, sandstone or shale rocks. They are on mountain slopes and older stream terraces at elevations of 1,750 to 8,100 feet. Slopes range from 10 to 70 percent. Annual precipitation is 14 to 34 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, mesic Mollic Haploxeralfs.

**Typical pedon:** Typical pedon for Morical family is in a unit of Morical-Supan-Greenbluff families association, 10 to 60 percent slopes under scrub oak, manzanita, pinyon pine, and canyon live oak at an elevation of 6,500 feet.

01-2 to 0 inches; undecomposed leaves and twigs.

A1-0 to 6 inches; brown (10YR 5/3) sandy clay loam, black (10YR 2/1) moist; moderate, fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and few fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

B21t-6 to 15 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, dark brown (10YR 4/3) moist; moderate, medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine, many fine and few medium roots; few fine and medium interstitial pores; few moderately thick clay films on ped faces and in pores; 20 percent pebbles; neutral (pH 7.0); clear wavy boundary.

B22t-15 to 45 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam, strong brown (7.5YR 4/6) moist; moderate, very fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine and medium roots; few fine interstitial

pores; common moderately thick clay films on ped faces and in pores; 30 percent pebbles, 2 percent cobbles; neutral (pH 7.0); clear wavy boundary.

C1-45 to 60 inches; strong brown (7.5YR 5/6) gravelly sandy loam, dark brown (10YR 4/3) moist; weak, very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common medium roots; few fine interstitial pores; 20 percent pebbles, 10 percent cobbles, 5 percent stones; neutral (pH 7.0).

**Type location:** Approximately 1.5 miles south up the Mt. Abel Road from the county highway maintenance station, road cut bank, in the NW 1/4, NW 1/4, Sec. 22, T. 9 N., R. 22 W., S.B.B.M., Sawmill Mountain Quadrangle.

Range in characteristics: Depth to a lithic contact is 21 to 60 inches. The soil is usually dry from June to October.

The A horizon is grayish brown or brown (10YR 5/2; 7.5YR 5/4). It is gravelly sandy loam, loam, or sandy clay loam. Rock fragments range from 0 to 25 percent. It is slightly acid to mildly alkaline.

The B2t is dark grayish brown, yellowish brown or strong brown (10YR 4/2; 5/4; 7.5YR 5/6). It is sandy loam, sandy clay loam or gravelly sandy clay loam. Rock fragments range from 0 to 30 percent. It is strongly acid to mildly alkaline.

The C horizon is yellowish brown or strong brown (10YR 5/4; 7.5YR 5/6). It is sandy loam or gravelly sandy loam. Rock fragments range from 0 to 30 percent. It is medium acid to neutral.

**Vegetation:** Pinyon pine, scrub oak, sagebrush, Jeffrey pine, canyon live oak, manzanita, white fir, or scrub oak.

## NACIMIENTO FAMILY

Nacimiento family consist of moderately deep, well drained soils formed in material weathered from sandstone. They are on hill slopes and mountain slopes at elevations of 1,300 to 3,200 feet. Slopes range from 15 to 60 percent. Annual precipitation is 13 to 20 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, thermic Calcic Haploxerolls.

**Typical pedon:** Typical pedon of Nacimiento family is in a unit of Los Osos-Nacimiento families association, 15 to 45 percent slopes under annual bromegrass and wild oats. at an elevation of 2,000 feet.

A1-0 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine interstitial pores; 2 percent pebbles; strongly effervescent; moderately alkaline (pH 7.9); clear smooth boundary.

ACca-17 to 35 inches; pale brown (10YR 6/3) clay loam,

yellowish brown (10YR 5/4) moist; weak, coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine interstitial pores; strongly effervescent; soft powder, secondary lime nodules; mildly alkaline (pH 7.7); abrupt wavy boundary.

Cr-35 to 50 inches; soft weathered sandstone.

**Type location:** Approximately 4 miles southeast of the Avenales Ranch in the NE 1/4, NE 1/4, Sec. 34, T. 31 S., R. 17 E., M.D.B.M., Los Machos Hills Quadrangle.

**Range in characteristics:** Depth to a paralithic contact is 21 to 40 inches. The soil is usually dry from June to October.

The A horizon is dark gray or brown (10YR 4/1, 5/3). It is clay loam or sandy clay loam. Rock fragments range from 0 to 14 percent. It is mildly to moderately alkaline.

**Vegetation:** Annual bromegrass, wild oats, or blue oak.

## OAK GLEN FAMILY

Oak Glen family consist of moderately deep to deep, well drained soils formed in alluvium or in material weathered from sandstone. They are on valley floors and mountain uplands and ridges at elevations of 4,000 to 7,300 feet. Slopes range from 0 to 60 percent. Annual precipitation is 19 to 36 inches.

**Taxonomic Class:** Coarse-loamy, mixed, mesic Pachic Haploxerolls.

**Typical pedon:** Typical pedon of Oak Glen family is in a unit of Oak Glen-Supan-Hagen families complex, 0 to 10 percent slopes under needlegrass and sagebrush at an elevation of 5,100 feet.

A11-0 to 6 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium granular structure; soft, very friable, nonsticky and nonplastic; few fine roots, few fine interstitial pores; 20 percent pebbles; neutral (pH 7.2); abrupt smooth boundary.

A12-6 to 16 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2); moderate, medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine interstitial pores; 20 percent pebbles; neutral (pH 6.9); clear smooth boundary.

II C1-16 to 23 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few fine interstitial pores; 20 percent pebbles,

5 percent cobbles; neutral (pH 7.2); clear smooth boundary.

III C2-23 to 60 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few fine interstitial pores; 20 percent pebbles, 10 percent cobbles; neutral (pH 7.3).

**Type location:** 150 yards north of road to airport landing strip on the stream bank off of Lockwood Valley Road in SE 1/4, NW 1/4, Sec. 25, T. 8 N., R. 21 W., S.B.B.M., Cuddy Valley Quadrangle.

**Range in characteristic:** Depth to a paralithic or lithic contact is 21 to 60 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown, grayish brown or brown (10YR 4/2, 5/2, 5/3). It is loamy sand, sandy loam, gravelly sandy loam, or gravelly loam. Rock fragments range from 0 to 25 percent. It is medium acid to neutral.

The C horizon is dark grayish brown, brown, or light yellowish brown (10YR 4/2, 4/3, 6/4). It is gravelly sandy loam or gravelly loam. Rock fragments range from 0 to 20 percent. It is strongly acid to neutral. Some pedons contain a B2 horizon.

**Vegetation:** Annual bromegrass, scrub oak, mixed conifer, sagebrush or pinyon pine.

## OLA FAMILY

Ola family consist of moderately deep to deep, well drained soils formed in material weathered from hard granitic rocks. They are on mountain slopes at elevations of 6,100 to 8,600 feet. Slopes range from 10 to 60 percent. Annual precipitation is 16 to 25 inches.

**Taxonomic Class:** These soils are coarse-loamy, mixed, frigid Pachic Haploxerolls.

**Typical pedon:** Typical pedon of Ola family is in a unit of Hades-Ginser-Ola families association, 30 to 60 percent slopes under Jeffrey pine and White fir at an elevation of 8,000 feet.

01-1 to 0 inches; undecomposed pine needles.

A1-0 to 4; dark grayish brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; few fine interstitial pores; 5 percent pebbles; strongly acid (pH 5.5); abrupt smooth boundary.

B2-4 to 22 inches; dark brown (10YR 4/3) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; few fine interstitial pores; 5 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

B3-22 to 30 inches; light yellowish brown (10YR 6/4) cobbly sandy loam, brown (10YR 4/3) moist; weak, fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine interstitial pores; 5 percent pebbles, 25 percent cobbles; slightly acid (pH 6.2); gradual smooth boundary.

R-30 to 35 inches; hard granitic rocks.

**Type location:** Approximately 0.2 miles down the Mt. Pinos road from the parking lot at the top; at the turnout, 100 feet up from the road, in the NW 1/4, SE 1/4, Sec. 5, T. 8 N., R. 21 W., S.B.B.M. Sawmill Mountain Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 60 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown or brown (10YR 4/2, 5/3). It is coarse sandy loam or sandy loam. Rock fragments range from 0 to 15 percent. It is strongly acid to slightly acid.

The B2 horizon is dark brown or brown (10YR 4/3, 5/3). It is gravelly sandy loam, coarse sandy loam, or loam. Rock fragments range from 0 to 30 percent. It is medium acid.

**Vegetation:** White fir, Jeffrey pine or snowberry.

## ORTHENTS

Orthents soils consist of very shallow to very deep, well drained soils formed in mixed alluvium or material weathered from sandstone. They are on valley floors, recent stream terraces, and mountain slopes at elevations of 2,500 to 6,200 feet. Slopes range from 0 to 60 percent. Annual precipitation is 8 to 17 inches.

**Range in characteristics:** Depth to a paralithic or lithic contact is 12 to 60 or more inches.

The A horizon is dark yellowish brown, very pale brown or strong brown (10YR 4/4, 7/4; 7.5YR 5/8). It is cobbly sandy loam or coarse sandy loam. Rock

fragments range from 0 to 40 percent. It is mildly to moderately alkaline.

The C horizon is brown, very pale brown or reddish yellow (10YR 5/3, 7/4; 7.5YR 7/6). It is gravelly sand, sandy loam or gravelly sandy loam. Rock fragments range from 5 to 50 percent. It is mildly alkaline to strongly alkaline.

**Vegetation:** Annual bromegrass, pinyon pine, juniper, coast live oak, California buckwheat, sagebrush, rabbit brush, sycamores, or willows.

## PANAMINT FAMILY

Panamint Family consist of moderately deep to deep well-drained soils formed in material weathered from granitic rock. They are on mountain uplands at elevations of 1,750 to 7,100 feet. Slopes range from 10 to 60 percent. Annual precipitation is 14 to 22 inches.

**Taxonomic Class:** These soils are coarse-loamy, mixed, mesic Typic Haploxeroll.

**Typical Pedon:** Typical pedon of Panamint family is in a unit of Los Gatos-Kilburn-Panamint families association, 30 to 60 percent slopes under pinyon pine, scrub oak, California buckwheat and needlegrass at an elevation of 6,100 feet.

A11-0 to 9 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak, fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

A12-9 to 15 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak, fine subangular blocky structure, soft, very friable, nonsticky and nonplastic; few very fine, common fine and medium roots; common fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B2-15 to 39 inches; yellowish brown (10YR 5/4) coarse

sandy loam, brown (10YR 4/3) moist; moderate, fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and few medium roots; few fine interstitial pores; 10 percent pebbles; medium acid (pH 6.0); clear smooth boundary.

R-39 to 41 inches; hard granitic rock.

**Type location:** 0.8 miles north and east of Cuddy Valley Road (B. M. 5632) on the south side of the road to Cherry Creek Campground in the NW 1/4, SW 1/4, Sec. 19, T. 9 N., R. 20 W., S.B.B.M., Cuddy Valley Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 20 to 60 inches. The soil is usually dry from June to October.

The A horizon is grayish brown or brown (10YR 5/2, 2/3). It is coarse sandy loam or gravelly coarse sandy loam. Rock fragments range from 10 to 15 percent. It is slightly acid to neutral.

The B2 horizon is brown or yellowish brown (10YR 5/3, 5/4). It is coarse sandy loam or gravelly coarse sandy loam. Rock fragments range from 10 to 25 percent. It is medium acid to neutral.

**Vegetation:** Annual bromegrass, wild oats, Jeffrey pine, scrub oak, or pinyon pine.

## RAMONA FAMILY

Ramona family consist of moderately deep, well drained soils formed in mixed alluvium or material weathered from sandstone and shale. They are on mountain slopes and older stream terraces at elevations of 1,400 to 2,500 feet. Slopes range from 30 to 65 percent. Annual precipitation is 20 to 28 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, thermic Typic Haploxeralfs.

**Typical Pedon:** Typical pedon of Ramona family is in a unit of Stonyford-Ramona families association, 30 to 65 percent slopes under chamise and coastal sage scrub at an elevation of 2,400 feet.

01-1 inch to 0; leaves and twigs.

A1-0 to 2 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine granular structure; soft, very friable, nonsticky and nonplastic; common fine roots; few fine interstitial pores; 5 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

B21t-2 to 11 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine interstitial pores; common moderately thick clay films in pores and on ped faces; 10 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

B22t-11 to 22 inches; light yellowish brown (10YR 6/4) gravelly clay loam, brown (10YR 4/3) moist;

weak, fine subangular blocky structure, slightly hard, friable, slightly sticky and slightly plastic; common fine and few coarse roots; common fine interstitial pores; common moderately thick clay films in pores and on ped faces; 30 percent pebbles and 2 percent cobbles; medium acid (pH 6.0) clear wavy boundary.

R-22 to 26 inches; fractured hard sandstone.

**Type location:** 2.5 miles west of Bald Mt. and 100 feet west of water tank, on West Camino Cielo Road, 75 feet down slope on south side of the road in SW 1/4, NE 1/4, Sec. 16, T.5N., R.31W., S.B.B.M., Santa Ynez Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 20 to 40 inches. The subsoil is usually dry from June to October.

The A horizon is brown, very pale brown or pinkish gray (10YR 4/3, 7/3; 5YR 6/2). It is loam, gravelly sandy loam, gravelly loam, or clay loam. Rock fragments range from 0 to 30 percent. It is medium acid to moderately alkaline.

The B2t is dark brown, pale brown, light yellowish brown, brownish yellow or reddish yellow (10YR 3/3, 6/3, 6/4, 6/6; 7.5YR 6/6). It is gravelly sandy loam, clay loam, gravelly clay loam, or silty clay loam. Rock fragments range from 0 to 30 percent. It is medium acid to moderately alkaline. Some pedons contain a C horizon.

**Vegetation:** Chamise, or scrub oak.

## RELIZ FAMILY

Reliz family consist of shallow, excessively well drained soils formed in material weathered from sandstone or shale. They are on mountain slopes at elevations of 760 to 7,200 feet. Slopes range from 20 to 90 percent. Annual precipitation is 18 to 36 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, nonacid, thermic, Lithic Xerorthents.

**Typical Pedon:** Typical pedon of Reliz family is in a unit of Millsholm-Reliz families Rock Outcrop association, 40 to 65 percent slopes under manzanita and chamise at an elevation of 3,900 feet.

01-1/2 inch to 0; undecomposed leaves and twigs.

A1-0 to 4 inches; pale brown (10YR 6/3) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak, very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and few medium roots; few fine interstitial pores; 30 percent pebbles; mildly alkaline (pH 7.5); abrupt smooth boundary.

C1-4 to 10 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark grayish brown (10YR 4/4) moist; weak, fine subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine and medium roots; few fine interstitial pores; 40 percent pebbles,

10 percent cobbles; slightly acid (pH 6.5); abrupt smooth boundary.

Cr-10 to 14 inches; soft weathered sandstone.

R-14 to 22 inches hard sandstone.

**Type location:** 1 mile north of the Murietta divide on the Monte Arido trail on the north side cutbank in SE 1/4, SW 1/4, Sec. 19, T. 5 N., R. 24 W., S.B.B.M., White Ledge Peak Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is grayish brown, pale brown, yellow, or pink (10YR 5/2, 6/3, 7/6; 7.5YR 7/4). It is gravelly sandy loam, very gravelly sandy loam or very gravelly loam. Rock fragments range from 15 to 60 percent. It is medium acid to mildly alkaline.

The C horizon is yellowish brown, pale brown, or very pale brown (10YR 5/4, 6/3, 7/4). It is very gravelly sandy loam or very gravelly loam. Rock fragments range from 45 to 60 percent. It is strongly acid to neutral. Some pedons lack a C horizon.

**Vegetation:** Ceanothus, scrub oak, chamise, or manzanita.

## RINCON FAMILY

Rincon family consist of moderately deep to deep, well drained soils formed in material weathered from sandstone, conglomerate, siltstone or shale. They are on mountain uplands at elevations of 290 to 5,300 feet. Slopes range from 15 to 60 percent. Annual precipitation is 13 to 26 inches.

**Taxonomic Class:** These soils are fine, montmorillonitic thermic Mollic Haploxeralfs.

**Typical Pedon:** Typical pedon of Rincon family is in a unit of Rincon-Livermore-Modesto families association, 30 to 60 percent slopes under annual brome grass and wild oats at an elevation of 2,000 feet.

01-1 inch to 0; undecomposed grasses.

A1-0 to 4 inches; light brownish gray (10YR 6/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong, fine granular structure; slightly hard, friable, slightly sticky and nonplastic; many very fine, common fine and few medium roots; common very fine and few fine interstitial pores; 15 percent pebbles; moderately alkaline (pH 8.0); abrupt wavy boundary.

B21t-4 to 25 inches; pale brown (10YR 6/3) gravelly clay loam, dark brown (10YR 3/3) moist; moderate, medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine, fine, few medium and coarse roots; common fine tubular pores; common moderately thick clay films in pores and on ped faces; disseminated lime; slightly effervescent; 15 percent pebbles; moderately alkaline (pH 8.0); gradual wavy boundary.

B22t-25 to 31 inches; very pale brown (10YR 7/3) gravelly clay loam, brown (10YR 4/3) moist; moderate, fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; common fine interstitial pores; many moderately thick clay films in pores and on ped faces; disseminated lime; strongly effervescent; 15 percent

pebbles, 5 percent cobbles; moderately alkaline (pH 8.0); clear wavy boundary.

C1-31 to 60 inches; light gray (10YR 7/2) extremely gravelly clay loam, dark yellowish brown (10YR 4/4) moist; moderate, fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine and few medium roots; few fine interstitial pores; few moderately thin clay films in pores and on ped faces; disseminated lime; strongly effervescent; 50 percent pebbles, 10 percent cobbles; moderately alkaline (pH 8.0).

**Type location:** 0.9 miles east of Mono Creek Campground, 150 yards north of Camuesa Road on slump scarp in NW 1/4, SE 1/4, Sec. 15, T. 5 N., R. 28 W., S.B.B.M., Hildreth Peak Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 20 to 60 inches. The soil is usually dry from June to October.

The A horizon is dark brown, light brownish gray, or pale brown (10YR 4/3, 6/2, 6/3). It is gravelly sandy loam, gravelly loam, or clay loam. Rock fragments range from 0 to 20 percent. It is medium acid to moderately alkaline.

The B2t horizon is brown, pale brown, very pale brown, yellow, or reddish yellow (10YR 4/3, 7/6; 5YR 5/6). It is gravelly clay loam, clay, or cobbly clay. Rock fragments range from 0 to 30 percent. It is strongly acid to moderately alkaline.

The C horizon is yellowish brown or light gray (10 YR 5/4, 7/2). It is very gravelly sandy clay loam, extremely gravelly clay loam, cobbly clay, or very cobbly silty clay. Rock fragments range from 25 to 75 percent. It is mildly alkaline to moderately alkaline. Some pedons lack a C horizon.

**Vegetation:** Annual brome grass, wild oats, blue oak, ceanothus, or chamise.

## SAN ANDREAS FAMILY

San Andreas family consist of moderately deep soils formed in material weathered from granitic, sandstone or conglomerate rocks. They are on mountain slopes and hillsides at elevations of 1,400 to 3,400 feet. Slopes range from 10 to 70 percent. Annual precipitation is 14 to 20 inches.

**Taxonomic Class:** These soils are coarse-loamy, mixed, thermic Typic Haploxerolls.

**Typical Pedon:** Typical pedon of San Andreas family is in a unit of Trigo-San Andreas-Chular families association, 10 to 50 percent slopes under annual bromegrass, wild oats, ceanothus and Digger pine at an elevation of 1,900 feet.

A1-0 to 3 inches; grayish brown (10YR 5/2) sandy loam, very dark gray (10YR 3/1) moist; weak, fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; few fine interstitial pores; 2 percent pebbles; neutral (pH 6.6); abrupt smooth boundary.

B2-3 to 11 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine granular structure parting to moderate, medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common fine interstitial pores; 5 percent pebbles; neutral (pH 6.8); clear smooth boundary.

C1-11 to 30 inches; yellowish brown (10YR 5/6) sandy loam, strong brown (7.5YR 4/6) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots;

common fine interstitial pores; 10 percent pebbles; neutral (7.2); clear smooth boundary.

Cr-30 to 33 inches; soft weathered granitic rock.

**Type location:** 2.9 miles south of the intersection of Fernandez Road and

Redwing Ranch Road directly under the first series of power lines, west side of road in the SW 1/4, SE 1/4, Sec. 19, T. 29 S., R. 16 E., M.D.B.M., Pozo Summit Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 20 to 40 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown, grayish brown or brown (10YR 4/2, 5/2, 5/3). It is sandy loam, gravelly sandy loam, or loam. Rock fragments range from 0 to 25 percent. It is slightly acid to moderately alkaline.

The B2 horizon is brown or yellowish brown (10YR 4/3, 5/4). It is sandy loam, cobbly sandy loam, or loam. Rock fragments range from 0 to 25 percent. It is medium acid to mildly alkaline.

The C horizon is brown, yellowish brown, or yellow (10YR 5/3, 5/6, 7/6). It is cobbly sandy loam or sandy loam. Rock fragments range from 0 to 30 percent. It is neutral to mildly alkaline. Some pedons lack a C horizon.

**Vegetation:** Scrub oak, Digger pine, chamise, annual bromegrass, wild oats, or ceanothus.

## SANTA LUCIA FAMILY

Santa Lucia family consist of moderately deep, well drained soils formed in material weathered from shale. They are on mountain slopes at elevations of 1,200 to 3,600 feet. Slopes range from 10 to 70 percent. Annual precipitation is 13 to 22 inches.

**Taxonomic Class:** These soils are clayey-skeletal, mixed, thermic Pachic Ultic Haploxerolls.

**Typical Pedon:** Typical pedon of Santa Lucia family is in a unit of Lopez-Santa Lucia families association, 10 to 70 percent slopes under coast live oak and Coulter Pine at an elevation of 2,200 feet.

01-4 to 0 inches; undecomposed pine needles and oak leaves.

A11-0 to 4 - inches; dark grayish brown (10YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; 2 percent pebbles; strongly acid (pH 5.5); abrupt smooth boundary.

A12-4 to 10 inches; brown (10YR 4/3) gravelly clay, dark brown (7.5YR 3/2) moist; moderate, fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine and common medium roots; few fine interstitial pores; 15 percent pebbles; strongly acid (pH 5.5); clear smooth boundary.

B2-10 to 24 inches; brown (7.5YR 5/4) very gravelly

clay, very dark gray (7.5YR 3/1) moist; moderate, fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few thin clay films in pores; few fine and common medium roots; few medium interstitial pores; 42 percent pebbles; strongly acid (pH 5.5); abrupt wavy boundary.

R-24 to 26 inches; fractured hard shale.

**Type location:** Approximately 1.2 miles past the Santa Margarita Ranch gate on the East Cuesta Pass Road, past the second cattle guard, 100 feet up the left hillside in the SW 1/4, SE 1/4, Sec. 6, T. 30 S., R. 13 E., M.D.B.M., Lopez Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 20 to 40 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown, brown or gray (10YR 4/2, 5/3, 5/1). It is a loam, or clay loam. Rock fragments range from 0 to 30 percent. It is medium acid to strongly acid.

The B2 horizon is gray or brown (10YR 5/1; 7.5YR 5/4). It is a very gravelly clay loam or very gravelly clay. Rock fragments range from 35 to 75 percent. It is strongly acid. Some pedons contain a C horizon with greater than 50 percent rock fragments.

**Vegetation:** Annual bromegrass, wild oats, coast live oak, Digger pine, or Coulter pine.

## SKALAN FAMILY

Skalan family consist of moderately deep to deep, well-drained soils formed in material weathered from shale or sandstone. They are on mountain slopes elevations of 870 to 6,800 feet. Slopes range from 30 to 80 percent. Annual precipitation is 19 to 30 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, mesic Ultic Haploxeralfs.

**Typical Pedon:** Typical pedon of Skalan family is in a unit of Witzel-Skalan families complex, 30 to 70 percent slopes under canyon live oak at an elevation of 3,800 feet.

01-2 inches to 0; undecomposed oak leaves.

A11-0 to 2 inches; grayish brown (10YR 5/2) gravelly loam, dark reddish brown (5YR 3/2) moist; weak, very fine subangular blocky structure; soft, friable, nonsticky and nonplastic; few very fine and fine roots; few fine interstitial pores; 30 percent pebbles; neutral (pH 7.0); abrupt smooth boundary.

A12-2 to 6 inches; dark grayish brown (10YR 4/2) gravelly loam, dusky red (2.5YR 3/2) moist; weak, fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; few very fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B21t-6 to 10 inches; light brown (7.5YR 6/4) very cobbly loam, brown (7.5YR 4/4) moist; weak, fine subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine interstitial pores; common thick clay films in pores and on ped faces; 30 percent pebbles, 20 percent cobbles; very strongly acid (pH 4.5); clear smooth boundary.

B22t-10 to 22 inches; brown (7.5YR 5/4) extremely cobbly sandy clay loam, dark brown (10YR 3/3) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium and coarse roots; many very fine interstitial pores; few moderately thick clay films in pores and on peds faces; 20 percent pebbles, 60 percent cobbles, 5 percent stones; strongly acid (pH 5.5); clear smooth boundary.

R-22 to 25 inches; fractured hard shale.

**Type location:** Approximately 1/2 mile east of the end of the Zaca Peak dirt road, down the north facing trail (NW direction) about 100 feet, and about 8 feet above the trail in the SE 1/4, SE 1/4, Sec. 15, T. 8 N., R. 18 E., S.B.B.M., Zaca Peak Quadrangle.

**Range in characteristics:** Depth to a lithic contact is 20 to 60 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown, grayish brown or light brownish gray (10 YR 4/2, 5/2, 6/2). It is very gravelly sandy loam, gravelly loam, or very gravelly clay loam. Rock fragments range from 20 to 40 percent. It is strongly acid to slightly acid.

The B2t is yellowish brown, pale brown, brown, or light brown (10YR 5/4, 6/3; 7.5YR 5/4, 6/4). It is very cobbly loam, extremely cobbly sandy clay loam or very gravelly clay loam. Rock fragments range from 20 to 80 percent. It is very strongly acid to slightly acid. Some pedons contain a C horizon.

**Vegetation:** Jeffrey pine, canyon live oak, white fir, Douglas fir, or big cone pine.

## STONYFORD FAMILY

Stonyford family consist of shallow, well drained soils formed in material weathered from sandstone and shale. They are on mountain slopes at elevations of 1,000 to 5,900 feet. Slopes range from 30 to 75 percent. Annual precipitation is 13 to 30 inches.

**Taxonomic Class:** These soils are loamy, mixed, thermic Lithic Mollic Haploxeralfs.

**Typical Pedon:** Typical pedon of Stonyford family is in a unit of Stonyford-Ramona families association, 30 to 65 percent under annual bromegrass, wild oats, chamise and ceanothus at an elevation of 2,600 feet.

A1-0 to 1 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; strong, fine granular structure; soft, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 3 percent pebbles; slightly acid (pH 6.1); abrupt smooth boundary.

B21t-1 to 7 inches; pale brown (10YR 6/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; moderate, coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine and few medium interstitial pores; common moderately thick clay films in pores and on ped faces; 15 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

B22t-7 to 19 inches; pale brown (10YR 6/3) clay loam,

brown (10YR 4/3) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine interstitial pores; common moderately thick clay films in pores and on ped faces; 10 percent pebbles; medium acid (pH 6.0); clear smooth boundary.

R-19 to 30 inches; fractured hard shale and siltstone.

**Type location:** 100 feet south of FS road 5N29 and about 3.5 miles west of Refugio Rd. in the NW 1/4, NW 1/4, Sec. 15, T. 5 N., R. 31 W., S.B.B.M., Santa Ynez Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is dry from June to October.

The A horizon is dark yellowish brown, pale brown, light yellowish brown or reddish yellow (10YR 4/6, 6/3, 6/4; 7.5YR 6/8). It is gravelly sandy loam, loam or gravelly loam. Rock fragments range from 0 to 25 percent. It is medium acid to neutral.

The B2t horizon is brown, pale brown, brownish yellow or pink (10YR 5/3, 6/3, 6/6; 7.5YR 7/4). It is gravelly loam, gravelly sandy clay loam or clay loam. Rock fragments range from 5 to 30 percent. It is strongly acid to mildly alkaline. Some pedons contain a C horizon.

**Vegetation:** Annual bromegrass, wild oats, chamise, or ceanothus.

## SUPAN FAMILY

Supan family consist of moderately deep to very deep, well drained soils formed in mixed alluvium or material weathered from gneiss, schist, granitic or sandstone rocks. They are on mountain slopes and valley floors at elevations of 3,100 to 8,100 feet. Slopes range from 0 to 60 percent. Annual precipitation is 14 to 25 inches.

**Taxonomic Class:** These soils are fine-loamy, mixed, mesic Pachic Argixerolls.

**Typical Pedon:** Typical pedon of Supan families association is in a unit of Kilburn-Wrentham-Supan families association, 10 to 30 percent slopes under Jeffery pine and pinyon pine at an elevation of 7,300 feet.

01-2 inches to 0; undecomposed pine needles and twigs.

A1-0 to 2 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak, medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common fine interstitial pores; 5 percent pebbles; strongly acid (pH 5.5); abrupt smooth boundary.

B21t-2 to 12 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark brown (10YR 2/2) moist; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium and few coarse roots; many very fine and common fine interstitial pores; few thin clay films in pores; 10 percent pebbles; neutral (pH 7.0); clear smooth boundary.

B22t-12 to 30 inches; brown (10YR 5/3) moist; gravelly

sandy clay loam, dark brown (10YR 3/3) moist; weak, coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few medium roots; many very fine, common fine and medium interstitial pores; few moderately thick clay films in pores; 20 percent pebbles; medium acid (pH 6.0); abrupt irregular boundary.

R-30 to 33 inches; hard granitic rock.

**Type location:** 1.7 miles west of the dead end sign on the road to the West Frazier Mt. pine plantation. The profile is 50 feet northwest of the road and 75 feet west of the pine plantation boundary's west end in NW 1/4, NW 1/4, Sec. 27, T. 8 N., R. 20 W., S.B.B.M., Frazier Mountain Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 20 to 60 or more inches. The soil is dry from June to October.

The A horizon is dark gray, dark grayish brown, or brown (10YR 4/1, 4/2, 5/3). It is sandy loam, gravelly sandy loam, loam or sandy clay loam. Rock fragments range from 0 to 30 percent. It is strongly acid to moderately alkaline.

The B2t is very dark grayish brown, dark grayish brown, or yellowish brown (10YR 3/2, 4/2, 5/4). It is sandy clay loam, loam, or gravelly clay loam. Rock fragments range from 0 to 30 percent. It is medium acid to moderately alkaline. A few pedons contain a C horizon.

**Vegetation:** Jeffrey pine, scrub oak, pinyon pine, sagebrush, or annual bromegrass.

## TRIGO FAMILY

Trigo Family consist of shallow, well or somewhat excessively drained soils formed in material weathered from granitic or sedimentary rocks. They are on mountain slopes at elevations of 1,400 to 6,200 feet. Slopes range from 15 to 90 percent. Annual precipitation is 8 to 26 inches.

**Taxonomic Class:** These soils are loamy, mixed, nonacid, thermic, shallow Typic Xerorthents.

**Typical Pedon:** Typical pedon of Trigo family is in a unit of Trigo-Modesto- families-Badlands association, 45 to 90 percent slopes under annual bromegrass, wild oats, California buckwheat, manzanita, and scrub oak at an elevation of 4,700 feet.

A11-0 to 1 inches; pink (7.5YR 7/4) sandy loam, dark brown (7.5YR 4/4) moist; strong, medium platy structure parting to moderate fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and few fine roots; fine interstitial pores, 5 percent pebbles; mildly alkaline (pH 7.5); abrupt smooth boundary.

A12-1 to 5 inches: light brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/2) moist; weak, fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine interstitial pores; 10 percent pebbles; mildly alkaline (pH 7.5); clear smooth boundary.

C1-5 to 12 inches; reddish yellow (7.5YR 7/6) gravelly sandy loam, brown (7.5YR 5/4) moist; weak, very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and coarse roots; few fine interstitial pores; 30 percent pebbles; mildly alkaline (pH 7.5); clear smooth boundary.

Cr-12 to 16 inches; softly weathered conglomerate.

**Type location:** North side of a steep ridge that is parallel to Quatal Canyon Road's north side in the NE 1/4, NW 1/4, Sec. 19, T. 9 N., R. 22 W., S.B.B.M., Apache Canyon Quadrangle.

**Range in characteristics:** Depth to a paralithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is brown, or light yellowish brown or pink (10YR 5/3, 6/4; 7.5 YR 7/4). It is gravelly coarse sandy loam or sandy loam. Rock fragments range from 0 to 30 percent. It is medium acid to moderately alkaline.

The C horizon is yellowish brown or reddish yellow (10YR 5/6; 7.5 YR 7/6). It is gravelly coarse sandy loam, gravelly sandy loam or sandy loam. Rock fragments range from 0 to 30 percent. It is medium acid to moderately alkaline. Some pedons lack a C horizon.

**Vegetation:** Annual bromegrass, lupine, manzanita, scrub oak, California buckwheat, needle grass, chamise, red shank, pinyon pine, or western juniper.

## VERTIC XEROCHREPTS

Vertic Xerochrepts consist of very deep somewhat poorly drained soils formed in materials weathered from mudstone. They are on mountain slopes and hillslopes at elevations of 3,800 to 4,700 feet. Slopes range from 10 to 40 percent. Annual precipitation is 8 to 12 inches. Mean annual soil temperature at 20 inches is 59 to 72 degrees F.

**Range in characteristics:** Depth to a paralithic or lithic contact is 60 or more inches. The soil moisture control section is usually dry from June to November and moist in some or all parts the rest of the year.

The A horizon is light olive brown, dark gray or brown (2.5YR 6/2; 10YR 4/1, 6/3). It is silty clay or clay. Rock fragments range from 0 to 5 percent. It is moderately alkaline.

The C horizon is olive gray or yellowish brown (5YR 5/2; 10YR 5/4). It is silty clay loam, silty clay or clay. Rock fragments range from 0 to 5 percent. It is moderately alkaline.

**Vegetation:** Annual bromegrass or buckwheat.

## WITZEL FAMILY

Witzel family consist of shallow, well drained soils formed in material weathered from shale. They are on mountain slopes at elevations of 2,000 to 4,300 feet. Slopes range from 30 to 90 percent. Annual precipitation is 22 to 26 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, mesic Lithic Ultic Haploxerolls.

**Typical Pedon:** Typical pedon of Witzel family is in a unit of Witzel-Skalan families complex, 30 to 70 percent slopes under white fir and canyon live oak at an elevation of 3,600 feet.

01-3 inches to 0; undecomposed leaves, twigs and needles.

A1-0 to 3 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam, very dark gray (10YR 3/1) moist; weak, fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; few very fine interstitial pores; 25 percent pebbles; slightly acid (pH 6.5); clear smooth boundary.

B21-3 to 8 inches; brown (10YR 4/3) very gravelly sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine granular structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; few fine interstitial pores, 40 percent pebbles, 2 percent cobbles; mildly acid (pH 6.0); clear smooth boundary.

B22-8 to 17 inches; brown (10YR 5/3) very gravelly sandy clay loam, dark brown (10YR 3/3) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many fine, medium and few coarse roots; few fine interstitial pores; 45 percent pebbles; strongly acid (pH 5.5); abrupt smooth boundary.

R-17 to 24 inches; fractured hard shale.

**Type location:** 0.1 miles north of Catway picnic site on Catway Road, 50 feet up the northwest slope from draw on east side of road in NE 1/4, SW 1/4, Sec. 25, T. 8 N., R. 30 W., S.B.B.M., Figueroa Mountain Quadrangle.

**Range in characteristics:** Depth to a lithic contact is less than 20 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown (10YR 4/2). It is very gravelly sandy loam, gravelly loam, or gravelly sandy clay loam. Rock fragments range from 20 to 35 percent. It is slightly acid to neutral.

The B2 horizon is very dark grayish brown or brown (10YR 3/2, 5/3). It is very cobbly sandy clay loam, very gravelly sandy clay loam, or very gravelly loam. Rock fragments range from 35 to 45 percent. It is strongly acid to medium acid.

**Vegetation:** Canyon live oak, white fir or Ponderosa pine.

## WRENTHAM FAMILY

Wrentham family consist of moderately deep, well drained soils formed in weathered granitic, gneiss or sandstone rocks. They are on mountain slopes at elevations of 3,100 to 7,800 feet. Slopes range from 10 to 60 percent. Annual precipitation is 14 to 35 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, mesic Pachic Haploxerolls.

**Typical Pedon:** Typical pedon of Wrentham family is in a unit of Kilburn-Wrentham-Supan families association, 10 to 30 percent slopes under Jeffrey pine, pinyon pine, and canyon live oak at an elevation of 6,100 feet.

01-1 inch to 0; undecomposed pine needles.

A1-0 to 3 inches; yellowish brown (10YR 5/4) loamy coarse sand, dark brown (10YR 3/3) moist; weak, fine granular structure; soft, very friable, nonsticky and nonplastic; few fine roots; common fine interstitial pores; 4 percent pebbles; neutral (pH 7.0); abrupt smooth boundary.

B21-3 to 12 inches; brown (10YR 4/3) very cobbly sandy loam, dark brown (10YR 3/3) moist; weak, medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine interstitial pores; 8 percent pebbles, 30 percent cobbles; neutral (pH 7.0); clear smooth boundary.

B22-12 to 29 inches; brown (10YR 4/3) very cobbly sandy loam, dark brown (10YR 3/3) moist; weak,

medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few medium roots; few fine interstitial pores; 12 percent pebbles, 35 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

R-29 to 30 inches; hard granite.

**Type location:** One tenth mile down road to Salt Creek Campground from Cherry Creek sign on Forest Service Road 9N22. Cherry Creek sign is 1 mile from the junction of Forest Service Road 9N22 and Cuddy Valley Road (9N05). The profile is 50 feet north of road in burrow pit in the SE 1/4, NW 1/4, Sec. 19, T. 9 N., R. 21 W., S.B.B.M., Cuddy Valley Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 40 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown or yellowish brown (10YR 4/2, 5/4). It is loamy coarse sand, cobbly sandy loam, or very gravelly loam. Rock fragments range from 20 to 60 percent. It is slightly acid to neutral.

The B2 horizon is very dark grayish brown or brown (10YR 3/2, 4/3, 5/3). It is very gravelly sandy loam or very cobbly sandy loam. Rock fragments range from 30 to 75 percent. It is slightly acid to neutral.

**Vegetation:** Jeffrey pine, mixed conifer, pinyon pine, white fir or canyon live oak.

## XEROFLUVENTS

Xerofluvents consist of very deep, well drained soils formed in alluvium. They are on recent stream terraces and valley floors at elevations of 1,400 to 1,600 feet. Slopes range from 0 to 15 percent. Annual precipitation is 25 to 35 inches. The mean annual soil temperature at 20 inches is 59 to 72 degrees F. These soils are stratified and their organic carbon content decreases irregularly with depth.

**Range in characteristics:** Depth to a paralithic or lithic contact is greater than 60 inches. The soil moisture control section is estimated to be dry from June to October and moist in some or all parts the rest of the

year.

The A horizon is 3 to 22 inches thick and is yellowish brown or brownish yellow (10YR 5/4, 6/6). It is fine sandy loam or very gravelly sandy loam. Rock fragments range from 5 to 45 percent.

The C horizon is greater than 40 inches thick. It is very cobbly sandy loam, very gravelly sandy loam, or coarse sandy loam. Rock fragments range from 5 to 50 percent.

**Vegetation:** Annual brome grass or wild oats.

## XERORTHENTS

Xerorthents consist of very deep soils formed in alluvium. They are on recent stream terraces, and valley floors at elevations of 1,400 to 1,600 feet. Slopes range from 0 to 15 percent. Annual precipitation is 25 to 35 inches. The mean annual soil temperature at 20 inches is 59 to 72 degrees F.

**Range in characteristics:** Depth to a paralithic or lithic contact is greater than 60 inches. The soil moisture control section is estimated to be dry from June to October and moist in some or all parts the rest of the year.

The A horizon is 4 to 16 inches thick and is brown or very pale brown (10YR 5/3, 7/4). It is very gravelly sandy loam or sandy loam. Rock fragments range from 5 to 45 percent.

The C horizon is greater than 40 inches thick. It is very cobbly sandy loam, very gravelly sandy loam, or sandy loam. Rock fragments range from 5 to 60 percent.

**Vegetation:** Annual bromegrass or wild oats.

## YORBA FAMILY

Yorba family consist of moderately deep to deep, well drained soils formed in material weathered from sedimentary rocks. They are on mountain slopes at elevations of 1,000 to 6,500 feet. Slopes range from 30 to 65 percent. Annual precipitation is 12 to 34 inches.

**Taxonomic Class:** These soils are loamy-skeletal, mixed, thermic Typic Haploxeralfs.

**Typical Pedon:** Typical pedon of Yorba family is in a unit of Yorba-Modjeska-Morical families association, 30 to 60 percent slopes under ceanothus, scrub oak and Jeffrey pine at an elevation of 6,000 feet.

01-2 inches to 0: partly decomposed leaves.

A11-0 to 3 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak, fine granular structure; soft, very friable slightly sticky and slightly plastic; few fine roots; common fine interstitial pores; 10 percent pebbles; slightly acid (pH 6.5); abrupt smooth boundary.

B2t-3 to 12 inches; very pale brown (10YR 7/3) extremely gravelly clay loam, yellowish brown (10YR 5/4) moist; weak, fine subangular blocky structure; slightly hard, firm, sticky and plastic; common medium roots; common fine interstitial pores; common thin clay films on ped faces and in pores; 60 percent pebbles, 5 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.

B3t-12 to 24 inches; very pale brown (10YR 7/3) ex-

tremely gravelly clay loam, yellowish brown (10YR 5/4) moist; weak, fine subangular blocky structure, slightly hard, firm, sticky and plastic; common medium roots; common fine interstitial pores; few thin clay films on peds and in pores; 70 percent pebbles, 10 percent cobbles; slightly acid (pH 6.5) clear smooth boundary.

R-24 to 30 inches; fractured hard siltstone.

**Type location:** 0.1 mile east of Pine Mountain Lodge on the road to the ridgeline east of the lodge, 150 feet north of the road in the NE 1/4, NE 1/4, Sec. 14, T. 6 N., R. 22 W., S.B.B.M., Ballinger Canyon Quadrangle.

**Range in characteristics:** Depth to a paralithic or lithic contact is 21 to 60 inches. The soil is usually dry from June to October.

The A horizon is dark grayish brown, light yellowish brown or light brown (10YR 4/2, 6/4; 7.5YR 6/4). It is sandy loam, loam, gravelly loam, or gravelly sandy clay loam. Rock fragments range from 0 to 35 percent. It is medium acid to neutral.

The B2t is brown, yellow, or red (10YR 5/3, 7/6; 2.5YR 4/6). It is very gravelly loam, extremely gravelly sandy clay loam, or extremely gravelly clay loam. Rock fragments range from 30 to 80 percent. It is strongly acid to mildly alkaline.

**Vegetation:** Chamise, manzanita, scrub oak, Jeffery pine or ceanothus.

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## Glossary

**Alluvium.** Material, such as sand, silt, clay, or rock fragments, 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 of 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 exchange of the 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 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 ped face or lining pores or root channels.

**Coarse fragments.** Mineral or rock particles greater than 2 mm in size.

**Coarse textured soil.** Sand or loamy sand.

**Cobble.** A fragment of rock 3 to 10 inches in diameter.

**Colluvium.** A deposit of soil material and/or rock fragments accumulated on steep slopes or at the bases of steep slopes primarily under the influence of gravity, but facilitated by the overland flow of water.

**Complex.** An area with two or more kinds of soil or of a soil and miscellaneous areas 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 pre-existing rocks or minerals and composed of rounded to subangular rock fragments (larger than 2mm) commonly with a matrix of sand and 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.

**Depth Class.** The distance from the surface of the soil to underlying bedrock, consolidated substratum, or other material that would either greatly restrict root distribution or soil moisture and nutrient supply.

**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. now or other source, and its channel is at all times above the water table.

**Dry ravel.** Unconsolidated rock mineral, organic matter, and soil which moves downslope by gravitational forces.

**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.

**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 from 2 mm 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, 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 by (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil 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 Roman numeral II precedes the letter C.

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

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups (see Detailed soil Map Units).

**Igneous rock.** Rock formed from the cooling and solidification of magma, and that has not been changed appreciably since its formation.

**Inclusions.** Soils occurring in the mapping 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 is impractical

to dig with a spade. If a single mineral, it must have a hardness by Moh's 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.

**Mean annual soil temperature.** Annual soil temperature which is measured at 20 inches depth or a contact with bedrock, whichever is shallower.

**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 (e.g., rock outcrop, riverwash).

**Mollic epipedon.** A thick, dark-colored, organic-rich surface horizon, high in nutrients, with good structure. It is not both massive and hard or very hard when dry. It should be moist in at least some part for 3 months or more (cumulative) of the year in more than 7 out of 10 years. There is at least 1 percent organic matter.

**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 Moh's scale of less than 3. If it is not a single mineral, chunks of gravel size that can be bro-

ken out 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.

**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 management. The differences are too small, however, to justify separate taxonomic units. The phases used in this survey are based on differences in climate.

**pH value.** (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

**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 is expressed as:

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

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

**River wash.** 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; for example, gravels, pebbles, cobbles, 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 millimeters 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 not more than 10 percent clay.

**Sandstone.** A sedimentary rock containing dominantly sand-size 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.

**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 U.S.

**Soil survey.** The systematic examination, description, classification, and mapping of soils in an area. Soil surveys are classified according to the kind and intensity of field examination.

**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 (50cm) or at a lithic or paralithic contact, whichever is shallower. Unless used in a higher category, soil temperature classes are used at the family level.

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

**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 term of a soil textural class based on the percentage of rock fragments in the soil.

Percent (volume)	Descriptive Term
15 to 35	gravelly
35 to 60	very gravelly
> 60	extremely gravelly

**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.

# Accessibility Statement

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- (1) mail: U.S. Department of Agriculture  
Office of the Assistant Secretary for Civil Rights  
1400 Independence Avenue, SW  
Washington, D.C. 20250-9410;
- (2) fax: (202) 690-7442; or
- (3) email: [program.intake@usda.gov](mailto:program.intake@usda.gov).

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