SOIL RESOURCE INVENTORY OF SEQUOIA NATIONAL PARK, CENTRAL PART, CALIFORNIA

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Pedologic Investigations in Support of Acid Rain Studies, Sequoia National Park, California.

Soil Resource Inventory of Sequoia National Park, Central Part

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December 11, 1987

Dr. David J. Parsons
Park Scientist
Kings Canyon and Sequoia National Parks
Three Rivers, California 93271

Dear Dr. Parsons:

I am very pleased to submit herewith the final report for the project, supported by the National Park Service under CA Order No. CA 8005-2-0002, entitled Pedologic Investigations in Support of Acid Rain Studies, Sequoia National Park, California.

This report supercedes advance reports and maps for this project submitted January 30, 1984 and August 11, 1986.

Sincerely yours,

Gordon L. Huntington
Principal Investigator

GLH:kb

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Pedologic Investigations in Support of Acid Rain Studies, Sequoia National Park, California
Soil Resource Inventory of Sequoia National Park, Central Part

1.0 Introduction

The investigations undertaken in this project have provided a systematic study of the soils within a broad band of National Park land that includes the watersheds between the Marble and Middle Forks of the Kaweah River and the southerly side of Ash Peaks Ridge. The products of this study are: 1) a reconnaissance (Order 4) soil map and map unit descriptions of the selected area: and 2) ultra-detailed (Order 1) soil maps and map unit descriptions of three sites within the larger area at which long-range, intensive studies on the ecologic effects of acid precipitation are underway. The latter are: the Emerald Lake Area, the Log Meadow Area, and the Elk Creek Area.

1.1 Objective

To provide base-line information on the soils of the locality from which possible effects of acid precipitation on the flora, fauna, soils, and aquatic systems may be gauged over time. Until now, no systematic soil resource inventory has been made of the lands within Sequoia National Park. Such inventories have been made on the Forest Service and private lands surrounding the Park. In addition to providing a pedologic evaluation base for the ecologic effects of acid precipitation, the information herein presented will augment the Park's knowledge of its resources, and contribute to the general knowledge of the Sierra Nevada soil region.

1.2 How the Work was Done

California Soil-Vegetation Survey procedures (6) and National Cooperative Soil Survey procedures (5) were used. The procedures were appropriately modified to meet the needs of the project. Prior to the first field season, stereoscopic interpretive delineations of the principal vegetative cover classes for the entire area were made on 1973, 1:15840 scale aerial photos supplied by the National Park Service. This provided a preliminary estimate of important soil differences within the area, but not the nature of the different soils. Such vegetation-soil relationships are more striking in natural preserves than in managed or cut-over lands.

Systematic study, identification and mapping of the soils was accomplished over a two-year period (1982-1983) during the snow-free seasons. The relationships among the identified soils, existing cover types, and the preliminary stereo interpretations were continuously evaluated during the field studies. Soil boundaries and delineations of soil phases, appropriate to the Project's objective, were drawn on frosted mylar overlays attached to the aerial photo field sheets and identified by symbols from a map unit legend designed for the area and the objectives of the Project. Site investigations were located and marked on the overlays as well as other pertinent observations. The sites, observations and mapped units of soils were coupled to a daily record of notes that became a permanent Project file.

During each field season, representative soils throughout the survey area were carefully described and sampled for laboratory characterization. These became benchmark sites upon which definition and correlation of the soil map units were based. This information is in Appendix I and II. Ad hoc grab samples for limited laboratory analyses were also secured from time to time to provide answers to soil taxonomic questions that arose during the course of the mapping.

Upon completion of the field and laboratory work, a final correlation was made of the map units seen in the field. Decisions were made concerning the significant units to be shown on the published maps. Orthophoto base, 7.5 minute standard quadrangles, prepared by the U.S. Geological Survey from 1976 orthophotography covering the Project area, were supplied by the National Park Service and used as the base for the reconnaissance soil map. Of necessity, enlargements of appropriate portions of the 1973 aerial photos, used in field mapping, were selected as the base for the ultra-detailed soil maps of the three intensive study sites. Photographic distortions of some linear distances, due to elevational differences of the land surface, are inherent in the latter.

The correlated map units were transferred from the field photos to the orthophoto bases and, through the assistance and facilities of Reprographics, University of California, Davis, half quadrangle sheets for the reconnaissance soil map, and sheets for the ultra-detailed soil maps of the intensive study sites, were printed. The facilitating maps for this report were also prepared and printed.

1.3 How to Use This Report

The core and bulk of information in this report lies in the reconnaissance soil map and its map unit descriptions, and in the soil map sheets for the three intensive study areas and their map unit descriptions. A General Soil Map provides an overview of the soil panorama of the area. Table 1 is a legend and guide to its map units which are described in Section 4.2. An Index to Map Sheets (Section 9.0 - fold out) provides a guide to the seven-half quadrangle sheets comprising the reconnaissance soil map. The locations of the Emerald Lake and Log Meadow intensive-study areas are shown by name on sheets 4 and 5 of the Index Map. The Elk Creek area lies just west of Potwisha on sheet 2 of the Index Map. Also shown on the Index to Map Sheets are the locations of the soil sampling sites described in Appendixes I and II in Section 7.0. Table 2 is a legend and guide to the reconnaissance soil map units and their descriptions given in Section 5.2. Table 3 is a legend and guide to the map units of the ultra-detailed soil maps of the intensive study areas. The descriptions of these map units are given in Section 6.2.

Information may be obtained from perusal of the maps. The map unit symbol within a delineation in an area of interest leads the reader to the appropriate table and legend to learn the map unit name, its extent and proportion of the survey area, and further to a description of the unit in Section 4.2, 5.2, or 6.2. Conversely, the description of a soil (map unit)

leads to its map symbol plus a general identification of its location that can, by use of the map symbol, be more accurately located on a map sheet where its relative location with respect to other soils, as well as its position on the landscape, can be perceived.

Some of the more specialized pedologic and geologic terms used in this report are listed in the Glossary of Terms in Section 7.0 (Appendix III).

In the course of map compilation, and subsequent printing of the soil maps, errors occur. A list of identified map errata is given in Section 7.0. (Appendix IV).

2.0 Description of the Area

2.1 Location

The central part of Sequoia National Park selected for this pedographic study lies in the southern Sierra Nevada of California. It comprises about 19900 ha lying between latitudes 36°26′15" and 36°37′30" north, and longitudes 118°30′ and 118°52′30" west. It is bounded on the south by the National Park boundary and the Middle Fork of the Kaweah River, including the Hamilton Lakes drainage from Eagle Scout Peak. The eastern boundary consists of the drainage divide between the Kaweah and Kern Rivers to Triple Divide Peak. The northern boundary is the drainage divide between the Kaweah and Kings Rivers from Triple Divide Peak to the upper reach of the Marble Fork of the Kaweah River, and follows the Marble Fork itself to a point below Marble Falls. Thence, the western boundary rises to Ash Peaks Ridge and continues along the ridge crest to its intersection with the National Park boundary.

2.2 Terrain

The area is hilly to mountainous with many deep canyons, prominent peaks, and a gentler relief in the Giant Forest and Tableland areas. Elevations range from about 410 to 3850 m. More than 90 percent of the area has very steep to extremely steep slopes. The balance of the area consists of sloping to steep lands with minor areas, principally meadow lands, that are nearly level. Throughout the survey area, these slopes have aspects in all directions. However, from locality to locality there are differing prevailing directions of the slopes.

In the lower and middle elevations, the terrain, as a part of the western slope of the Sierra Nevada, has been formed mainly by: the action of normal erosion through running surface waters, controlled in part by rock jointing and different rock types; raindrop impact; and mass wasting. At the higher elevations, these processes also operate but have been augmented by past glacial activity, by past and current frost wedging, and by avalanche action.

2.3 General Geology

The foothill zone, below and west of Moro Rock, is the most complex geologically in terms of different rock types. The general matrix is acid igneous intrusive rock, varying irregularly from tonalite to granodiorite to granite. Promontories such as Cactus Point and Frys Point are mainly granite. A series of irregular roof pendants or remnant septa of metamorphic rock strike generally northwesterly across this zone. They consist of mica schist, marblized limestone, and weakly metamorphosed gabbro or diorite. The middle and high elevations, above and east of Moro Rock, are almost entirely acid igneous intrusive rock, principally granodiorite and some granite. A few scattered remnants of mica schist and diorite lie in the alpine zone.

2.4 Climate

The climate of the survey area reflects the general mid-latitude Pacific coastal annual pattern of winter precipitation and a virtually rainless summer period. The latter is broken periodically and irregularly, particularly at the higher elevations, by summer thunderstorms following intrusions of moist, tropical air from the Gulf of California or the Gulf of Mexico (2). Annual precipitation is measured mostly as rainfall in the foothill zone; rain and snowfall in the middle mountain zone: and mainly as snowfall in the alpine zone.

Mean annual precipitation ranges from about 500 mm at the lowest elevations to about 1300 mm at the higher elevations, tending to decrease somewhat at the highest elevations (2). Mean annual air temperatures range from about 18°C at the lowest elevations on southerly aspects to several degrees below 0°C at the highest elevations on northerly aspects. These values were calculated from Harradine's regression equations for mean annual air temperatures on the west slope of the Sierra Nevada (1).

2.5 Vegetation

The natural vegetation reflects the climatic pattern of the area. The foothills are principally chaparral areas with some areas of woodland-grass. The middle mountain areas are mixed conifers, including sequoias, grading to red fir forests and krumholz conifers at the edge of the alpine zone. The latter supports scattered shrubs, largely willows, and a variety of alpine plants where sufficient soil exists.

3.0 The Soils of the Area

3.1 Soil Formation

The surface of a large part of the survey area consists of a mantle of soil overlying variably weathered rock at depths ranging from a few centimeters to several meters. A substantial portion, particularly in the alpine zone, lacks this mantle and the land surface consists of variably fractured rock. Closer observation shows that the soil mantle is, in reality, a collection of natural soil bodies each of which is a distinct

kind of soil. All, except a very few, are mainly composed of mineral particles - comminuted rock - mixed with both living and dead organic mater, and capable of supporting plant life in a natural setting.

There are several external factors, essentially independent of one another, that, in concert, control or determine the kind and intensity of local physical and chemical processes that, in turn, determine the internal characteristics of the natural soil bodies. These resultant characteristics include the color, organic matter content, texture, structure, porosity, acidity or alkalinity, base saturation, bulk density, and moisture retention ability of the layers or horizons that develop within the profiles of these soil bodies.

The external soil forming factors are: 1) the physical and mineralogical nature of the initial material weathered in place from the parent rock, or emplaced by stream or glacial action, or emplaced by gravitational transfer down a hillslope through creep or avalanche action; 2) the local climate under which the initial material has accumulated or existed since accumulation; 3) the potential biota for the region which determine, in turn, the resultant kind of flora and fauna (dependent factors) that strongly influence soil development; 4) the relief or topography of the land surface; and 5) the length of time that the soil forming processes have acted on the initial materials.

3.2 Soil Classification

The system of soil classification used in this work is Soil Taxonomy (4). It is the standard used by the National Cooperative Soil Survey in the U.S. It has six categories. From the highest to the lowest these are: Order, Suborder, Great Group, Subgroup, Family, and Soil Series. Soil identification and classification is based on soil properties and diagnostic features observed or measured in the field, and by laboratory analyses. The taxonomic units recognized in the survey area are shown in Table A and in Table B. In the following paragraphs, the categories of the system are defined and discussed in relation to this area.

ORDER: In Soil Taxonomy, there are ten classes at the Order level; six have been recognized in this area. They are differentiated by the presence or absence of diagnostic horizons or features that reflect in the soil differences in degree and kind of dominant sets of soil forming processes. At the Order level, each class is identified by a name ending in "-sol". It is prefixed by a formative element, taken mainly from Latin or Greek words, that reflects the character and dominant soil forming processes. An example: Inceptisol - derivation: "incept-" from L. inceptum or beginning and "-sol" from L. solum or soil. The class includes soils with weakly developed profiles, particularly in subsoil differentiation.

SUBORDER: Each class at the Order level is divided into one or more classes at the Suborder level primarily on the basis of soil properties that produce a more homogeneous grouping of soils and reflect greater similarity in their genesis, as well as having importance to plant growth.

The names of the classes at this level have two syllables. The last syllable identifies the Order class, the first connotes something of the diagnostic properties of the soils involved. An example: Umbrept- derivation: "umbr-" from L. umbra or shade (dark) denoting the presence of dark umbric epipedons, and "ept" a formative element from the Order class name, Inceptisol.

GREAT GROUP: Each Suborder class is divided into one or more classes at the Great Group level on the basis of: close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture or soil temperature regimes; or status of base saturation. Each Great Group class is identified by the name of the Suborder class and a prefix that indicates the important differentiating property of the class. An example: Cryumbrept - derivation: "cry-" from Gr. kryos, icy cold, is prefixed to "umbrept" denoting an Umbrept with mean annual soil temperatures between 0° and 8°C, and having cool to cold summer soil temperatures.

SUBGROUP: Each Great Group class has a central or typical concept that has been defined. A departure from this concept, not sufficient to warrant placing the soil in another Great Group, can be recognized. Subgroups that are not typical (Typic) are considered "intergrades" or "extragrades". Intergrades have subordinate properties suggestive of other Great Groups in the same Suborder, in other Suborders, or in other Orders. Extragrades have features indicating transition to conditions considered "not-soil", such as rock, water, ice, or air. Intergrades or extragrades are identified by an adjective added to the Great Group name in the place of "Typic". An example: Entic Cryumbrept - derivation: "Entic", a word suggesting transitional characteristics to Entisols (an Order of soils that lack subsoil development) is the adjective. Entic Cryumbrepts lack cambic subsoil horizons that are characteristic of Typic Cryumbrepts.

FAMILY: Subgroup classes are divided into Families on the bases of properties that are important to more specific soil-plant, soil-water, or soil-air relationships or interactions. The intensity of this study and its objectives did not warrant recognition of soil families. Many of the soil map units - phases of Subgroups - do recognize partial characteristics of possible Families within a Subgroup.

SOIL SERIES: Families are divided into Soil Series, the unit of classification for Soil Taxonomy. The soils within a Series are quite homogeneous with only narrow ranges of the properties used to place each Series in its Order, Suborder, Great Group, Subgroup and Family through the process of accumulating differentia. The objective of this study precluded identification of soils at the Soil Series level. However, such correlation is possible with additional detailed study.

3.3 Table A. Names of soil taxonomic units recognized in the mapping of the Sequoia National Park, Central Part Area (alphabetically listed).

1. General Soil Map

Humults

Ochrepts

Orthents

Orthods

Umbrepts

Xeralfs

Xerolls

2. Reconnaissance Soil Map (Order 4 intensity)

Aquepts

Cryaquepts

Cryorthods

Entic Cryumbrepts

Entic Ultic Haploxerolls

Entic Xerumbrepts

Haploxerolls

Lithic Cryorthents

Lithic Cryumbrepts

Lithic Xerumbrepts

Pachic Haplumbrepts

Pachic Ultic Haploxerolls

Pachic Xerumbrepts

Typic Cryofluvents

Typic Cryorthents

Typic Xerochrepts

Typic Xerorthents

Ultic Haploxeralfs

Ultic Haploxerolls

Ultic Palexeralfs

Xeric Haplohumults

Table A - continued

3. Ultra-detailed Soil Maps (Order 1 intensity)

Elk Creek Area

Entic Ultic Haploxerolls

Typic Xerochrepts

Ultic Haploxeralfs

Ultic Palexeralfs

Log Meadow Area

Aquepts

Cumulic Haplumbrepts

Lithic Xerumbrepts

Pachic Xerumbrepts

Typic Haploxerults

Emerald Lake Area

Cryaquepts

Entic Cryumbrepts

Histic Lithic Cryaquepts

Lithic Cryorthents

Lithic Cryumbrepts

Typic Cryofluvents

Typic Cryorthents

Typic Cryorthods

3.4 Table B. Soil Taxonomic Units recognized on the Reconnaissance Soil Map of Sequoia National Park, Central Part - according to their hierarchal location within the alphabetically arranged Soil Order taxa of Soil Taxonomy. (Units are underlined).

ALFISOLS
- Palexeralfs
  - Ultic Palexeralfs
- Haploxeralfs
  - Ultic Haploxeralfs

ENTISOLS
- Cryofluvents
  - Typic Cryofluvents
- Cryorthents
  - Typic Cryorthents
  - Lithic Cryorthents
- Xerorthents
  - Typic Xerorthents

INCEPTISOLS
- Aquepts
  - Cryaquepts
- Ochrepts
  - Xerochrepts
  - Typic Xerochrepts
- Umbrepts
  - Cryumbrepts
  - Entic Cryumbrepts
  - Lithic Cryumbrepts
  - Xerumbrepts
  - Entic Xerumbrepts
  - Lithic Xerumbrepts
  - Pachic Xerumbrepts
  - Haplumbrepts
  - Pachic Haplumbrepts

MOLLISOLS
- Haploxerolls
  - Entic Ultic Haploxerolls
  - Pachic Ultic Haploxerolls
  - Ultic Haploxerolls

SPODOSOLS
- Cryorthods

ULTISOLS
- Haplohumults
  - Xeric Haplohumults

4.0 The General Soil Map

The general soil map in this section shows broad areas that have distinctive patterns of soils, relief, local climate and vegetation. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit represents one or more major soils or miscellaneous areas that characterize the area and is named for these soils or miscellaneous areas.

The general soil map can be used to obtain an overall perception of the distribution of natural soil bodies within the area, and of important general ecologic relationships. The map units are grouped into three major zones that reflect position on the western slope of the Sierra Nevada as well as associated local climate and vegetation. A tonal pattern is superimposed to highlight the important soil temperature regimes within the survey area.

4.1 See Table 1 Guide to the map units, General Soil Map

4.2 General Soil Map Unit Descriptions

4.21 Soils of the Foothill Zone

There are ten map units in this group (see map errata). They make up about 30.4 percent of the survey area. These are the soils and miscellaneous areas of the lower elevations which range from about 410 to 1950 m. Mean annual precipitation ranges from about 510 to 1015 mm, most of which falls as rain. Mean annual air temperatures range from about 17° down to about 10°C. The natural vegetation consists of and ranges generally from woodland-grass at lower elevations to woodland-chaparral at higher elevations.

Oc Ochrepts, thermic

Shallow to deep soils formed on very steep to extremely steep hillslopes from materials weathered from acid igneous intrusive, basic igneous intrusive, and metamorphic sedimentary rocks. The soils have thin, dark colored, moderately coarse textured surface soils overlying brighter colored, similar textured subsoils, and are slightly to medium acid. In places, they are associated with Xerolls, Xeralfs, and Rock outcrops areas. Mean annual soil temperatures range from about 15° to 17°C. The vegetation consists of either chaparral or woodland grass.

Or1 Orthents, thermic

Shallow to deep soils formed on very steep hillslopes from material weathered from acid igneous and basic igneous intrusive rock. They are moderately coarse textured, have thin, dark colored surface soils and no development of subsoil horizons. The soils are slightly acid. Mean annual soil temperatures range from about 15° to 16.5°C. The vegetation consists mainly of chaparral.

4.1 Table 1. General Soil Map. Guide to the map units, their area and proportionate extent.

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
F	Felsenmeer	317.6	1.6
G	Glacial rubble land	73.6	0.4
L	Lakes	118.0*	0.6*
Oc	Ochrepts, thermic	288.0	1.4
Od	Orthods, cryic	133.3	0.7
Or1	Orthents, thermic	274.1	1.4
Or2	Orthents, cryic	332.9	1.7
R	Rock outcrop	2,417.0	12.2
RO1	Rock outcrop-Orthents, thermic	90.3	0.4
RO2	Rock outcrop-Orthents, mesic	100.3	0.5
RU1	Rock outcrop-Umbrepts, mesic	457.0	2.3
RU2	Rock outcrop-Umbrepts, frigid	48.3	0.2
RU3	Rock outcrop-Umbrepts, cryic	1,712.4	8.6
RX1	Rock outcrop-Xerolls, thermic	21.25	1.1
RX2	Rock outcrop-Xerolls, mesic	89.9	0.4
T	Talus	510.8	2.6
U1	Umbrepts, mesic	4,152.3	20.9
U2	Umbrepts, frigid	1,555.8	8.4
U3	Umbrepts, cryic	1,176.0	5.9
UH	Umbrepts-Humults, mesic	700.4	3.5
Xf1	Xeralfs, thermic	1,716.0	8.6
Xf2	Xeralfs, mesic	141.7	0.7
Xo1	Xerolls, thermic	737.3	3.7
Xo2	Xerolls, mesic	2,433.5	12.2
	TOTAL	19,900.0	100.0

*includes unnamed and named lakes

RO1 Rock outcrop-Orthents, thermic

Acid igneous intrusive rock exposures dominate this map unit. Less than half of the unit consists of shallow Orthents (see Or1) formed in material weathered from the local rock on very steep hillslopes. Mean annual soil temperature range from about 15° to 16°C. The vegetation on the soils consists of chaparral-woodland. Some shrubs grow and survive in open, soil-filled fractures in the outcrops.

RO2 Rock outcrop-Orthents, mesic

Acid igneous intrusive rock exposures dominate this map unit. Less than half of the unit consists of shallow Orthents, similar to Or1, formed in material weathered from the local rock on very steep hillslopes. They differ from Orthents, thermic in having mean annual soil temperatures ranging from about 11° to 14°C. The vegetation on the soils consists of chaparral and scattered conifers. Some shrubs grow in fractures in the outcrops.

RX1 Rock outcrop-Xerolls, thermic

Acid igneous intrusive or marbleized limestone rock exposures dominate this map unit. Less than half of the unit consists of shallow to moderately deep soils formed on very steep hillslopes in material weathered from the local rock. They have thick, dark colored, moderately coarse textured surface soils containing moderate amounts of organic matter. They lack subsoil development in places, but have brighter colored, similar textured subsoils at other sites. They are neutral to slightly acid with more than 50 percent base saturation throughout. The mean annual soil temperatures range from about 15° to 17.5°C. The vegetation on the soils is chaparral.

RX2 Rock outcrop-Xerolls, mesic

Acid igneous intrusive rock exposures dominate this map unit. Less than half of the unit consists of Xerolls (see RX1) that have formed on very steep or extremely steep hillslopes in material weathered from the local rock under cooler conditions. They are shallow, lack subsoil development, and are slightly acid. The mean annual soil temperatures range from about 10° to 13°C. The vegetation on the soils consists of chaparral with clusters of woodland and scattered conifers.

Xf1 Xeralfs, thermic

Moderately deep to very deep soils formed on sloping to very steep hillslope in material weathered from acid igneous intrusive, basic igneous intrusive, and metamorphic sedimentary rock. They have brownish, moderately coarse to moderately fine textured, structureless, neutral to slightly acid surface soils overlying thick, reddish colored, moderately fine to fine textured and structured, slightly acid to medium acid subsoils. In places, these soils are in association with Ochrepts, Xerolls, or Rock outcrop areas. Mean annual soil temperatures range

from about 15° to 19°C. The vegetation consists of woodland-grass or chaparral.

Xf2 Xeralfs, mesic (see Map Errata - Appendix IV, Section 7.0)

Moderately deep to very deep soils formed on very steep hillslopes from material weathered from acid igneous intrusive rock. They are similar to Xf1, but have mean annual soil temperatures that range from about 11° to 13.5°C. These soils are in association with Ochrepts. The vegetation consists of chaparral, woodland clusters and scattered conifers.

Xo1 Xerolls, thermic

Shallow to very deep soils formed on very steep to extremely steep hillslopes in material weathered from acid igneous intrusive rock. They have thick, dark colored, moderately coarse textured, granular surface soils containing moderate amounts of organic matter. In places they lack subsoil development or have brighter colored, similar textured subsoils. They are neutral to slightly acid with more than 50 percent base saturation. In places, they are associated with Ochrepts, Xeralfs, or Rock outcrop areas. The mean annual soil temperatures range from about 15° to 17.5°C. The vegetation consists of woodland-grass or chaparral.

Xo2 Xerolls, mesic

Shallow to very deep soils formed on very steep to extremely steep hillslopes in material weathered from acid igneous intrusive, basic igneous intrusive, and metamorphic sedimentary rock. The soils are similar to Xo1 except for mean annual soil temperatures that range from about 10° to 14°C. The vegetation consists of chaparral, chaparral-woodland, and scattered conifers in places in the higher elevations.

4.22 Soils of the Middle Mountain Zone

There are five map units in this group (see map errata). They make up about 35.3 percent of the survey area. These are the soils and miscellaneous areas of the middle elevations ranging from about 1950 to 2800 m. Mean annual precipitation ranges from about 1015 to 1300 mm, much to most of which falls as snow. Mean annual air temperatures range from about 14° down to about 4°C; mean summer air temperatures are warm, usually somewhat above 14°C. With increasing elevation, the vegetation grades from mixed conifers with shrubs to a red fir forest.

Ru1 Rock outcrop-Umbrepts, mesic

Acid igneous intrusive rock exposures dominate this map unit. Less than half of the unit consists of Umbrepts (see U1) formed on sloping to extremely steep hillslopes in material weathered from the local rock. The soils in this unit are shallow, resting on only slightly weathered rock at depths ranging from about 10 to 50 cm. Mean annual soil

temperatures range from about 8° to 13°C. The vegetation consists of shrubs and mixed conifers, some of which are established and survive in soil-filled rock joints in the outcrops.

Ru2 Rock outcrop-Umbrepts, frigid

Acid igneous intrusive rock exposures dominate this map unit. Less than half of the unit consists of Umbrepts (similar to U1) formed on very steep hillslopes from material weathered from the local rock. The soils in this unit are shallow, resting on only slightly weathered rock at depths ranging from about 10 to 50 cm. Mean annual soil temperatures range from about 5° to 8°C; mean summer soil temperatures are warm, usually somewhat above 14°C. The vegetation on the soils consists of shrubs and open stands of red fir. Some shrubs and conifers are established and survive in soil-filled rock joints in the outcrops.

U1 Umbrepts, mesic

Shallow to very deep soils formed on sloping to extremely steep hillslopes in material weathered from acid igneous intrusive rock. They have thick to very thick, dark colored, coarse to moderately coarse textured surface soils with moderately high organic matter content. They generally lack significant subsoil development and rest on weathered or unweathered parent rock at depths ranging from about 30 to more than 150 cm. The soils are medium to strongly acid and have base saturation less than 50 percent. In places, they are associated with rock outcrop areas. Mean annual soil temperatures range from about 8° to 13°C. The vegetation consists of shrubs and mixed conifers, or mixed conifers, including sequoias, with little understory; denser shrub cover is associated with the shallower soils.

UH Umbrepts-Humults, mesic

Deep to very deep soils formed on sloping to extremely steep hillslopes in material weathered from acid igneous intrusive rock. The Umbrepts (see U1) predominate. Less than half of the unit consist of very deep, well leached soils with thick, brown, moderately coarse textured, crumb structured surface soils with moderately high organic matter content overlying reddish, slightly finer textured subsoils. These soils are neutral to medium acid, but have less than 50 percent base saturation in the surface soils and less than 35 percent in the subsoils. The mean annual soil temperatures range from about 8° to 12.5°C. The vegetation consists of mixed conifers, including sequoias.

U2 Umbrepts, frigid

Shallow to very deep soils formed on sloping to extremely steep hillslopes in materials weathered from acid igneous intrusive rock. They are similar to U1, but have lower mean annual soil temperatures that range from about 5° to 8°C. Mean summer soil temperatures are usually warmer than 14°C. In places, they are associated with rock outcrop areas.

4.23 Soils of the High Mountain Zone

There are four map units in this group. They make up about 16.9 percent of the survey area. These are the soils and miscellaneous areas of the high elevations, ranging from about 2800 to 3850 m. Mean annual precipitation ranges from about 1200 to 1300 mm, nearly all of which falls as snow. Mean annual air temperature ranges from about 8° down to 0°C on southerly slopes; it is less than 0°C on some protected, north facing slopes. The vegetation ranges from shrubs and mixed red fir and western white pine to krumholz conifers to sparse alpine shrubs and plants with increasing elevation.

Od Orthods, cryic

Moderately deep soils formed on sloping to very steep hill-slopes in material weathered from acid igneous intrusive rock, or emplaced by glacial action. They have thin, brownish colored, gravelly, coarse textured surface soils that rest on a thin, white, moderately coarse layer that overlies a brown to yellowish brown, very gravelly coarse textured subsoil that, in turn, rests abruptly on slightly weathered rock. Mean annual soil temperatures are less than 14°C; surface litter (O horizons) is thin. The vegetation consists of scattered shrubs and mixed red fir and western white pine or lodgepole pine.

Or2 Orthents, cryic

Shallow to very deep soils formed on sloping to very steep hillslopes in materials weathered from acid igneous intrusive rock or emplaced by glacial action. The soils are similar to Orl, but have formed under colder conditions. They are gravelly to very gravelly, coarse or moderately coarse textured, and strongly to extremely acid throughout. In places, they are associated with Umbrepts, Rock outcrops, or Felsenmeer areas. The mean annual soil temperatures range from about 0° to 4°C, and the mean summer soil temperatures are less than 14°C; surface litter (O horizon) is thin. The vegetation ranges from open stands of red fir and western white pine to sparse alpine shrubs and plants with increasing elevation.

RU3 Rock outcrop-Umbrepts, cryic

Acid igneous intrusive rock exposures dominate this map unit. Less than half of the unit consists of Umbrepts (see Ul) formed under colder conditions on sloping to extremely steep hillslopes in material weathered from the local rock or emplaced by glacial action. The soils are shallow, resting on only slightly weathered rock at depths ranging from about 10 to 50 cm. The mean annual soil temperatures range from about -1° to 4°C; mean summer soil temperatures are less than 14°C; surface litter (O horizons) is thin. The vegetation on the soils consists mainly of sparse alpine shrubs and plants, some of which establish themselves and survive in soil-filled rock joints of the extensive outcrops.

U3 Umbrepts, cryic

Shallow to very deep soils formed on sloping to very steep hillslopes in material weathered from acid igneous intrusive rock, or emplaced by glacial action. These soils are similar to U1, but have mean annual soil temperatures that range from about -1° to 6°C; mean summer soil temperatures are less than 14°C; surface litter (O horizon) is thin. In places, they are associated with Orthents, Orthods, Rock outcrop and Talus areas. The vegetation ranges from semi-open stands of mixed red fir and western white pine and varying shrub cover to sparse alpine shrubs and plants with increasing elevation.

4.24 Miscellaneous Areas

These are land areas lacking significant areas of natural soils. They are confined largely to the alpine areas of the High Mountain Zone. Moro Rock, Tharps Rock, and Sugarbowl Dome are notable exceptions.

F Felsenmeer

Ridge-crest areas of jumbled, frost riven rock masses that lie above previously existing ice fields and glacial activity of the Pleistocene.

G Glacial rubbleland

Areas of morainal rock fragments from activity of the glacierets on the north side of Mt. Stewart.

R Rock outcrop

Large areas of jointed or unjointed acid igneous intrusive rock. In places, there are inclusions of shallow soil areas, small lakes or ponds, and small meadows.

T Talus

Significant areas of rock fall accumulated at the base of large cliffs.

Wet Meadow (Aquepts)

Areas of poorly drained, dark colored, moderately deep to very deep soils, usually high in organic matter content, formed in alluvial material accumulated in rock basins or former small lakes or ponds. Has a dense growth of hydrophyllic plants; sufficiently extensive to warrant an ad hoc symbol on the General Soil Map.

L Lakes - unamed (see Map Errata)

The identified lakes within the survey area are outlined and named.

5.0 The Reconnaissance Soil Map

The map units delimited on the reconnaissance soil map accompanying this report represent the dominant kinds of soils or miscellaneous areas that exist within the overall survey area. A given map unit may exist as a single delineation, or as two or more separate delineations on the soil map. Each delineation is identified by a semi-connotative symbol consisting of 2 to 5 letters.

The soil map units are consociations or associations of soil taxonomic units (taxons) identified at the suborder, great group, or subgroup level as defined in Soil Taxonomy (4). The miscellaneous area map units consist of consociations of kinds of "not-soil", such as Rock outcrop, Talus and others recognized in the revised Soil Survey Manual (3). Some of these latter units may also occur in association with other identified soils.

The taxons recognized in the soil map units have been separated into phases to bring out differences within such taxonomic units that are important to our understanding of the many soil-landscapes within the survey area. These differences, in turn, are important to plant and water relationships with the soils. The phase characteristics recognized include: particle-size class of the subsoil or subsurface; soil temperature regimes; soil depth classes; significant differences in parent rock; and the dominant surface slope class within the map unit.

The soil map units, listed alphabetically by symbol, are grouped and described following the description of their dominant soil taxon. Site and general environmental data are given for each taxon along with a general profile description of a representative soil pedon, plus observed ranges of the soil properties. Detailed pedon profile descriptions and laboratory characterization data in the appendixes to this report are referenced. Soil map units within each group are compared to their taxonomic unit description. Particular characteristics relating to phase designations are described. If the unit is an association of soil taxons, additional reference is made to representative descriptions of the subordinate taxon, or taxons, identified in the map unit name. The dominant vegetation species associated with each map unit are given. Also given is the general location and elevation of the unit, its extent, and its position on the landscape.

No map unit, particularly at a reconnaissance scale of mapping, consists entirely of the phase of the identified soil taxon or taxons. An estimate is given of the proportion of the map unit's area that is occupied by the identified soil taxon or taxons. The balance of this area consists of inclusions of other soils or miscellaneous areas. These are briefly described.

5.1 See Table 2 Guide to the map units, Reconnaissance Soil Map

5.1 Table 2. Reconnaissance Soil Map. Guide to the map units, their area and proportionate extent.

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
Aqf	Aquepts, frigid	18.6	0.1
Aqm	Aquepts, mesic	18.6	0.1
Caq	Cryaquepts	13.7	0.1
CoD	Cryorthods, sloping to steep	12.2	0.1
CoF	Cryorthods, very steep	121.1	0.6
EaD	Entic Cryumbrepts, sandy-skeletal, sloping to steep	8.5	<0.1
EbD	Entic Cryumbrepts, coarse-loamy, sloping to steep	97.3	0.5
EbF	Entic Cryumbrepts, coarse-loamy, very steep	32.3	0.2
EcD	Entic Cryumbrepts, loamy-skeletal, sloping to steep	50.5	0.3
EcF	Entic Cryumbrepts, loamy-skeletal, very steep	360.4	1.8
EdF	Entic Cryumbrepts-Cryorthods association, very steep	25.3	0.1
EfF	Entic Cryumbrepts-Granitic talus association, very steep	53.5	0.3
EhF	Entic Cryumbrepts-Jointed granitic outcrop association, very steep	36.4	0.2
EjF	Entic Cryumbrepts-Lithic Cryumbrepts-Jointed granitic outcrop association, very steep	42.0	0.2
EkF	Entic Cryumbrepts-Typic Cryorthents association, very steep	361.5	1.8
EubF	Entic Ultic Haploxerolls, thermic-Jointed granitic outcrop association, very steep	98.5	0.5
EubG	Entic Ultic Haploxerolls, thermic-Jointed granitic outcrop association, extremely steep	63.2	0.3
EucF	Entic Ultic Haploxerolls-Ultic Haploxeralfs association, thermic, very steep	64.3	0.3
ExaF	Entic Xerumbrepts, mesic, very steep	830.5	4.2
ExbF	Entic Xerumbrepts, shallow, frigid-Jointed granitic outcrop association, very steep	20.8	0.1
ExcG	Entic Xerumbrepts, frigid-Jointed granitic outcrop association, extremely steep	59.1	0.3
ExdF	Entic Xerumbrepts, loamy-skeletal, frigid-Jointed granitic outcrop association, very steep	32.7	0.2
ExeD	Entic Xerumbrepts, shallow, mesic-Jointed granitic outcrop association, sloping to steep	12.6	0.1
Ga	Glacier	10.8	<0.1
Gf	Granitic felsenmeer	95.8	0.5
GfeF	Granitic felsenmeer and Entic Cryumbrepts, very steep	137.9	0.7
Gfg	Granitic felsenmeer-Granitic talus association	29.7	0.1
Ggr	Granitic glacial rubble land	62.8	0.3
Gt	Granitic talus	510.8	2.6
HoF	Haploxerolls, mesic, very steep	1,296.8	6.5
HoG	Haploxerolls, mesic, extremely steep	207.0	1.0

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
HoaF	Haploxerolls, mesic, mafic, very steep	21.9	0.1
HobF	Haploxerolls, mesic-Jointed granitic outcrop association, very steep	72.1	0.4
HobG	Haploxerolls, mesic-Jointed granitic outcrop association, extremely steep	124.5	0.6
HodG	Haploxerolls, mesic-Jointed limestone outcrop association, extremely steep	72.8	0.4
HoeG	Haploxerolls, mesic-Jointed mafic outcrop association, extremely steep	61.7	0.3
HofF	Haploxerolls, thermic-Jointed granitic outcrop association, very steep	342.6	1.7
HofG	Haploxerolls, thermic-Jointed granitic crop association, extremely steep	46.1	0.2
Jg	Jointed granitic outcrop	1,781.0	9.0
JgeF	Jointed granitic outcrop-Entic Ultic Haploxerolls, shallow, thermic association, very steep	141.2	0.7
JghF	Jointed granitic outcrop-Haploxerolls, mesic association, very steep	25.3	0.1
JghG	Jointed granitic outcrop-Haploxerolls, mesic association, extremely steep	64.6	0.3
JgmF	Jointed granitic outcrop-Lithic Cryumbrepts, sandy-skeletal association, very steep	165.0	0.8
JgnD	Jointed granitic outcrop-Lithic Cryumbrepts, loamy association, sloping to steep	490.4	2.5
JgnF	Jointed granitic outcrop-Lithic Cryumbrepts, loamy association, very steep	880.6	4.4
JgnG	Jointed granitic outcrop-Lithic Cryumbrepts, loamy association, extremely steep	132.6	0.7
JgoF	Jointed granitic outcrop-Lithic Xerumbrepts, frigid association, very steep	48.3	0.2
JgpD	Jointed granitic outcrop-Lithic Xerumbrepts, mesic association, sloping to steep	61.3	0.3
JgpF	Jointed granitic outcrop-Lithic Xerumbrepts, mesic association, very steep	242.6	1.2
JgpG	Jointed granitic outcrop-Lithic Xerumbrepts, mesic association, extremely steep	152.3	0.8
JgrF	Jointed granitic outcrop-Typic Xerorthents, shallow, mesic association, very steep	100.3	0.5
JgsF	Jointed granitic outcrop-Typic Xerorthents, shallow, thermic association, very steep	90.3	0.4
JhuF	Jointed limestone outcrop-Ultic Haploxerolls, thermic association, very steep	71.3	0.3
Jm	Jointed mafic outcrop	114.8	0.6
JmxF	Jointed mafic outcrop-Lithic Cryumbrepts association, very steep	43.8	0.2
Js	Jointed schistose outcrop	3.0	<0.1
L	Lake (if unnamed)	118.0*	0.6*
LcbF	Lithic Cryorthents-Entic Cryumbrepts association, very steep	72.1	0.4

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
LucD	Lithic Cryumbrepts, sloping to steep	8.9	<0.1
LucF	Lithic Cryumbrepts, very steep	14.1	0.1
LueD	Lithic Cryumbrepts-Entic Cryumbrepts association, sloping to steep	14.8	0.1
LueF	Lithic Cryumbrepts-Entic Cryumbrepts association, very steep	17.8	0.1
LujD	Lithic Cryumbrepts-Jointed granitic outcrop association, sloping to steep	23.0	0.1
LujF	Lithic Cryumbrepts-Jointed granitic outcrop association, very steep	16.0	0.1
LxmF	Lithic Xerumbrepts, mesic, very steep	4.1	<0.1
LxnF	Lithic Xerumbrepts, frigid-Jointed granitic outcrop association, very steep	195.1	1.0
LxoD	Lithic Xerumbrepts, mesic-Jointed granitic outcrop association, sloping to steep	23.8	0.1
LxoF	Lithic Xerumbrepts, mesic-Jointed granitic outcrop association, very steep	331.4	1.7
LxpD	Lithic Xerumbrepts-Pachic Xerumbrepts association, mesic, sloping to steep	9.5	<0.1
PhxF	Pachic Haplumbrepts, frigid-Pachic Xerumbrepts, frigid-Jointed granitic outcrop association, very steep	108.5	0.5
PuhF	Pachic Ultic Haploxerolls, mesic, very steep	236.3	1.2
PxaD	Pachic Xerumbrepts, sandy-skeletal, frigid, sloping to steep	26.7	0.1
PxbD	Pachic Xerumbrepts, coarse-loamy, frigid, sloping to steep	139.7	0.7
PxbF	Pachic Xerumbrepts, coarse-loamy, frigid, very steep	589.3	3.0
PxcD	Pachic Xerumbrepts, coarse-loamy, mesic, sloping to steep	129.6	0.6
PxcF	Pachic Xerumbrepts, coarse-loamy, mesic, very steep	1,891.0	9.5
PxdF	Pachic Xerumbrepts, loamy-skeletal, frigid, very steep	115.9	0.6
PxeD	Pachic Xerumbrepts, loamy-skeletal, mesic, sloping to steep	56.1	0.3
PxeF	Pachic Xerumbrepts, loamy-skeletal, mesic, very steep	73.2	0.4
PxeG	Pachic Xerumbrepts, loamy-skeletal, mesic, extremely steep	159.4	0.8
PxgF	Pachic Xerumbrepts, coarse-loamy, frigid-Jointed granitic outcrop association, very steep	98.5	0.5
PxhD	Pachic Xerumbrepts, coarse-loamy, mesic-Jointed granitic outcrop association, sloping to steep	72.8	0.4
PxhF	Pachic Xerumbrepts, coarse-loamy, mesic-Jointed granitic outcrop association, very steep	360.8	1.8
PxhG	Pachic Xerumbrepts, coarse- loamy, mesic-Jointed granitic outcrop association, extremely steep	173.9	0.9
PxjF	Pachic Xerumbrepts, loamy-skeletal, frigid-Jointed granitic outcrop association, very steep	160.1	0.8
PxmF	Pachic Xerumbrepts, coarse-loamy, frigid-Lithic Xerumbrepts, frigid-Jointed granitic outcrop association, very steep	62.8	0.3

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
PxnD	Pachic Xerumbrepts-Lithic Xerumbrepts association, mesic, sloping to steep	8.1	<0.1
PxoD	Pachic Xerumbrepts-Xeric Haplohumults association, mesic, sloping to steep	385.7	1.9
PxoF	Pachic Xerumbrepts-Xeric Haplohumults association, mesic, very steep	180.6	0.9
PxoG	Pachic Xerumbrepts-Xeric Haplohumults association, mesic, extremely steep	100.3	0.5
Sf	Schistose felsenmeer	54.2	0.3
TcfB	Typic Cryofluvents, nearly level	8.4	<0.1
TcfD	Typic Cryofluvents, sloping to steep	5.1	<0.1
TcoF	Typic Cryorthents, very steep	154.6	0.8
TcpF	Typic Cryorthents-Entic Cryumbrepts association, very steep	27.9	0.1
TcrF	Typic Cryorthents-Granitic felsenmeer association, very steep	55.7	0.3
TcsF	Typic Cryorthents-Jointed granitic outcrop association, very steep	12.1	<0.1
ThuF	Xeric Haplohumults, mesic, very steep	33.8	0.2
TxcaF	Typic Xerochrepts, shallow, thermic, very steep	37.5	0.2
TxcbG	Typic Xerochrepts, shallow, thermic, schistose-Jointed schistose outcrop association, extremely steep	18.2	0.1
TxcdF	Typic Xerochrepts, thermic, schistose-Jointed schistose outcrop association, very steep	8.8	<0.1
TxcmF	Typic Xerochrepts-Ultic Haploxeralfs association, thermic, mafic, very steep	168.0	0.8
TxcuF	Typic Xerochrepts, thermic-Ultic Haploxerolls, thermic-Jointed limestone outcrop association, very steep	56.5	0.3
TxoaF	Typic Xerorthents, shallow, thermic, very steep	91.0	0.5
TxobF	Typic Xerorthents, thermic, very steep	115.5	0.6
TxocF	Typic Xerorthents, thermic, mafic, very steep	67.6	0.3
UhaF	Ultic Haploxeralfs, fine-loamy, thermic, very steep	164.6	0.8
UhbF	Ultic Haploxeralfs, fine-loamy, thermic, mafic, very steep	221.1	1.1
UhcF	Ultic Haploxeralfs, fine-loamy, thermic, schistose, very steep	293.9	1.5
UhdF	Ultic Haploxeralfs, fine, thermic, schistose, very steep	42.7	0.2
UheD	Ultic Haploxeralfs-Entic Ultic Haploxerolls association, thermic, sloping to steep	83.6	0.2
UheF	Ultic Haploxeralfs-Entic Ultic Haploxerolls association, thermic, very steep	37.2	0.2
UhfF	Ultic Haploxeralfs-Haploxerolls association, mesic, very steep	59.0	0.3
UhgF	Ultic Haploxeralfs-Typic Xerochrepts association, mesic, very steep	181.7	0.9
UhhF	Ultic Haploxeralfs-Typic Xerochrepts association, thermic, very steep	703.7	3.5

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
UhjG	Ultic Haploxerolls, mesic, schistose, extremely steep	178.0	0.9
UhkG	Ultic Haploxerolls, mesic, schistose-Jointed schistose outcrop association, extremely steep	162.4	0.8
UhnG	Ultic Haploxerolls-Typic Xerochrepts association, thermic, schistose, extremely steep	122.6	0.6
UpaF	Ultic Palexeralfs-Ultic Haploxeralfs association, thermic, very steep	70.2	0.4
Ut	Unjointed granitic outcrop	558.0	2.8
	TOTAL	19,900.0	100.0

*includes unnamed and named lakes

5.2 Map Unit Descriptions - Reconnaissance Soil Map

Aquepts

This suborder includes poorly drained soils formed in alluvium, or in colluvium with variable contents of rock fragments, derived from granitic rock sources that have accumulated in the lower parts of small valleys or rock basins. They support a wet meadow vegetation and are widely distributed in the middle mountain zone and in the subalpine and alpine areas of the high mountain zone. Here mean annual precipitation ranges from about 1010 to 1140 mm most of which falls as snow during the winter. Only a few areas of these soils are large enough to be shown separately on the reconnaissance soil map; most are inclusions in other map units or are shown by ad-hoc meadow symbols.

These soils are normally dark colored reflecting a high organic matter content. This often varies irregularly with depth further reflecting alluvial stratification or periodic burial of older soil surfaces. Mineral soil textures may be coarse, moderately coarse or medium. Some horizons consist of organic soil material. These soils are commonly strongly acid but may range from medium to very strongly acid. They are usually saturated throughout, but the water table or zone of saturation does fluctuate seasonally. This is seen in the scattering of rust colored mottles below the surface soil or in the low chroma colors of the mineral soil horizons lacking mottles. Depth to underlying rock ranges from less than 50 cm to many meters. Mean annual soil temperatures range from about 1.5°C to 10°C. Some areas with mean annual soil temperatures less than about 5°C have mean summer soil temperatures lower than 13°C.

Following is a profile description of a representative pedon located near Wolverton; elevation 2,200 m; for additional data, see pp I-13, 14 and II-7 in the Appendix. Sect. 7.0; (colors are for moist soil).

Oa -- 7 to 0 cm; very dark brown gritty muck; structureless; held together as a dense sod by many very fine and common medium roots; occasional twigs and branches of lodgepole pine; strongly acid (pH 5.2); abrupt smooth boundary.

Ag -- 0 to 8 cm; very dark grayish brown coarse sand, common medium distinct dark brown mottles; single grain; many very fine and common fine roots; strongly acid (pH 5.3); abrupt smooth boundary.

O'a -- 8 to 24 cm; black muck; structureless; many very fine and common fine roots; strongly acid (pH 5.4); abrupt smooth boundary.

2A'g -- 24 to 68 cm; black sandy loam; massive; many very fine and common fine roots; strongly acid (pH 5.5); clear smooth boundary.

2Cg -- 68 to 108 cm; very dark gray coarse sandy loam; massive; few very fine and fine roots; 15 percent by volume partially weathered rounded granitic pebbles; scattered black zones of decomposed twigs or roots; medium acid (pH 6.0).

Underlain by stratified moderately coarse and coarse alluvium to depths in excess of 150 cm. Some areas of these soils have rock fragments of pebble, cobble and stone size.

Aqf - Aquepts, frigid. This map unit consists of nearly level to very gently sloping, deep, wet meadow soils that occupy small, slowly drained valleys or depressions at elevations ranging from about 2,100 to 2,500 m. The soils have a frigid soil temperature regime; mean annual soil temperatures range from about 5°C to 8°C.

This unit contains the soil described as representative of the Aquepts. It is limited in extent, comprising about 0.1 percent of the survey area. The single delineation of this unit is located in Long Meadow at Wolverton. The soils support dense growths of water-loving grasses and herbs with some willow along the periphery of the meadow and a few invading lodgepole pines. Very small, unmapped areas of these soils are located in Panther and Red Fir Meadows and in other unnamed meadows nearby.

The described soils comprise about 85 percent of the map unit. About 15 percent of the unit consists of deep, well drained dissimilar soils formed in sandy alluvium from surrounding steeper lands.

Aqm - Aquepts, mesic. This map unit comprises about 0.1 percent of the survey area. The soils are similar to the deep soils described as representative of Aquepts, but are somewhat warmer having a mesic soil temperature regime. Mean annual soil temperatures range from about 8°C to 10°C. They occupy nearly level to gently sloping depressions in rolling to hilly terrain at elevations ranging from about 1,900 to 2,100 m in the vicinities of Giant Forest and Sugar Bowl Dome. They are located in Round Meadow, Crecent Meadow, Log Meadow and Lower Bearpaw Meadow as well as in smaller named and unnamed meadows that are included in other soil map units. They support dense covers of water-loving grasses and herbs, and some willow.

The described soils comprise about 90 percent of the map unit. The balance consists of somewhat better drained sandy soils formed in minor alluvial deposits in the meadows, a few small rock outcrops, and the trunks of several large fallen Sequoia - particularly in Log Meadow.

Caq - Cryaquepts. The soils of this map unit are Aquepts that have formed in a cold environment. They are similar to the soil described as representative of the Aquepts but have a cryic soil temperature regime; mean annual soil temperatures range from about 1.5°C to 5°C and mean soil summer temperatures are less than 13°C. They are limited in extent, comprising about 0.1 percent of the survey area. They are located in the subalpine and alpine zones at Alta Meadow; in the vicinity of Tamarack Lake; and in the Tablelands at elevations ranging from about 2,700 to 3,300 m. Many small areas of these soils are widely distributed as inclusions in larger miscellaneous areas of rockland in the vicinity of alpine lake basins and on

gentle rocky terrain where seeping meltwater from lingering snow deposits can accumulate and maintain a saturated soil in the late spring and summer.

Cryaquepts are generally shallower than Aquepts at lower elevations, ranging in depth from less than 50 cm to about 2 m to a solid or fragmented rock base. Some of these soils have muck or peaty-muck surface soils ranging in thickness from about 20 to 40 cm. Others have mineral surface soils well supplied with organic matter. Near cliffs and steep colluvial slopes, these soils are often very gravelly or stony. They support a dense cover of meadow grasses, often forming a springy sod that is hummocky in places. Scattered clusters of short alpine willow are not uncommon.

Cryaquepts comprise from about 75 to 90 percent of the delineations of this map unit. The balance of the delineated areas consist of inclusions of rock outcrops, scattered boulders and small, better drained sandy alluvial fans or deltas at the margins of these soil bodies.

Cryorthods

This great group includes well to somewhat excessively drained soils formed in colluvium, residuum and morainal deposits derived from granitic rock sources in the subalpine areas of the high mountain zone at elevations ranging from about 2,700 to 3,100 m. Mean annual precipitation is about 1100 mm, nearly all of which falls as snow in the winter. Random, periodic rainfall may occur during summers from thunder storms.

The soils are very limited in extent. They have a profile morphology that is uncommon for soils in the higher Sierra Nevada. Distinctive, bleached E horizons overlying darker as well as brighter, yellowish brown, very gravelly sandy subsoils distinguish these soils from associated, more extensive Cryorthents discussed subsequently. Morphologically, these soils are placed in the Spodosol order based on the presence of observed, dark silt-sized particles coated with organic matter in the yellowish subsoils. However, the subsoils do not quite meet the chemical requirements currently used to identify a spodic horizon. Subsequent microscopic studies of the E horizon clearly show that it is largely composed of vitric shards (R.J. Southard, personal, communication). This suggests a thin volcanic ash layer and that the profiles of these soils are pseudomorphs of Spodosols. Further independent studies are being carried out on these soils. If the current classification is found to be in error, these soils will be classed with Cryorthents.

These soils support open to semi-open stands of old growth western white pine (Pinus monticola), foxtail pine (Pinus balfouriana), lodgepole pine (Pinus contorta murrayana), and some red fir (Abies magnifica) at slightly lower elevations. In places there are understory clusters of chinquapin (Castanopsis sempervirens) or a scattering of small subalpine plants. A perennial short-grass sod has developed on these soils around Tamarack Lake.

Cryorthods have a cryic soil temperature regime; mean annual soil temperatures range from about 1°C to 4°C. Typically, they have a thin

litter overlying a thin, dark colored surface soil that rests abruptly on an equally thin, pale colored subsurface soil that overlies a subsoil, somewhat darker colored in its upper part and grading to brighter colors with depth. Paler colored substrata underlies the subsoil and, in turn, rests abruptly on slightly weathered granitic rock.

Following is a profile description of a representative pedon located about 400 m east-northeast of the outlet to Emerald Lake; elevation about 2,930 m; semi-open stand of old growth western white pine with a scattered chinquapin understory: (colors are for dry soil unless otherwise noted).

0 -- 1 to 0 cm; brown, loose conifer needle litter.

A -- 0 to 5 cm; pale brown (10YR 6/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, loose, nonsticky, nonplastic; few very fine roots; extremely acid (pH 4.0); very abrupt wavy boundary.

E — 5 to 6.5 cm; white (10YR 8/2) coarse sandy loam, light yellowish brown (10YR 6/4) moist, massive; soft, very friable, nonsticky, nonplastic; few very fine roots; few very fine tubular pores; very strongly acid (pH 4.5); very abrupt wavy boundary.

Bh -- 6.5 to 18 cm; brown (10YR 5/3) very gravelly loamy coarse sand, dark brown (10YR 3/3) moist; massive; soft, very friable to loose, nonsticky, nonplastic; common fine and very fine roots; very strongly acid (pH 4.5); clear smooth boundary.

Bs — 18 to 64 cm; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/5) moist; massive; soft, very friable, nonsticky, nonplastic; common fine, few medium roots; very strongly acid (pH 5.0); clear smooth boundary.

C — 64 to 69 cm; very pale brown (10YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable to loose, nonsticky, nonplastic; few fine roots; strongly acid (pH 5.5); very abrupt smooth boundary.

2R -- 69 to 75+ cm; light gray, slightly weathered granitic rock.

Cryorthods in this area range in depth to underlying rock from about 35 to 200 cm. The deeper sites are associated with morainal deposits. The underlying rock may be slightly weathered, solid granitic rock or buried felsenmeer (see ahead). The solum thicknesses range from about 40 to 70 cm. Textures range from sandy to moderately coarse and are usually modified, particularly in the subsoils, by the presence of from about 10 to 50 percent pebbles or cobbles and stones. The pebble size is normally fine, ranging from 2 to about 10 mm in diameter; cobbles and stones are rounded in morainal deposits but irregular and angular where associated with buried felsenmeer or local colluvium.

The A horizon may or may not be present. The E horizon ranges in thickness from about 1 to 8 cm. The Bh horizon may or may not be present. Field recognition of the B (spodic) horizon is based on the darker appearance of the upper part of the subsoil (if present) in relation to the brighter colored lower part and an overlying, bleached E horizon. The organic carbon content of the upper 10 cm or more of the subsoil ranges from about 2.5 to 4 percent.

CoD - Cryorthods, sloping to steep. This map unit comprises about 0.1 percent of the survey area. The soils have formed in morainal deposits in the near vicinity of Tamarack Lake at elevations ranging from about 2,800 to 2,900 m. The soils are similar in profile to the representative pedon for Cryorthods, but are deeper to underlying rock and contain more cobbles and stones.

Surface slopes range from about 10 to 30 percent. The soils support a semi-open to open stand of lodgepole pine (P. contorta murrayana) including some young growth. A moderate to dense sod of short perennial grasses has developed on most of the soils.

Inclusions make up about 15 percent of this map unit. These consist of widely scattered rock outcrops, glacially transported boulders, and areas of Cryorthents.

CoF - Cryorthods, very steep. This map unit comprises about 0.6 percent of the survey area. It is located in several delineations in the vicinity of both Heather and Emerald Lakes at elevations ranging from about 2,700 to 3,100 m. The unit contains the pedon used to represent these soils. In the vicinity of Emerald Lake, these soils have formed in moderately deep colluvium accumulated on slopes ranging from about 30 to 60 percent. In the vicinity of Heather Lake, the soils have formed in both colluvium and morainal material on similar slopes; some slopes are less than 30 percent in the areas of morainal deposits.

Northeast of Emerald Lake, these soils support a semi-open stand of western white pine (P. monticola) with a semi-dense understory of chinquapin (C. sempervirens). Northwest of Emerald Lake, these soils support an open stand of foxtail pine (P. balfouriana) without any understory vegetation. West of Heather Lake, the largest delineation of this unit supports a semi-open cover of western white pine, some lodgepole pine (P. contorta murrayana), and, at its lowest elevations, red fir (A. magnifica).

The map unit delineations consist mainly of Cryorthods. These soils comprise 70 to 80 percent of the delineations near Emerald Lake with inclusions of 10 to 25 percent Cryorthents, and 5 to 15 percent rock outcrops or detached boulders. West of Heather Lake, the delineation consists of about 55 percent Cryorthods. The remainder consists of variably distributed inclusions of Cryumbrepts, Cryorthents, Rock outcrop, Glacial rubble land and a few small meadows or seep areas containing Aquepts.

Entic Cryumbrepts

This subgroup includes moderately deep to very deep, dark-colored, well to somewhat excessively drained soils lacking significant subsoil development that have formed in colluvium, alluvium, ground moraine, or granitic rock residuum. They are moderately extensive in the subalpine and alpine areas of the high mountain zone at elevations ranging from about 2,700 to 3,540 m. Mean annual soil temperatures range from about 1° to 5°C. Mean annual precipitation ranges from about 1010 to 1270 mm, nearly all of which falls as snow during the winter. Random, periodic rainfall may occur during the summer from local thunderstorms.

These soils have cryic soil temperature regimes. Some have udic or ustic soil moisture regimes because of natural moistening from local seepage during the summer period. Most, however, are considered to have xeric moisture regimes.

At the lower limit of their elevational range, these soils support semi-dense, semi-open and open stands of red fir (Abies magnifica) in association with western white pine (Pinus monticola). In the subalpine areas, the semi-open and open stands of conifers are mainly western white pine and lodgepole pine (Pinus contorta murrayana), with occasional foxtail pine (Pinus balfouriana) and white bark pine (Pinus albacaulis). Understory shrubs, where present, consist of greenleaf manzanita (Arctostaphylos patula), pinemat manzanita (Arctostaphylos nevadensis), snow bush (Ceanothus cordulatus), and chinquapin (Castanopsis sempervirens). In both subalpine and alpine areas, there is a sparse ground cover of willow (Salix sp.) in relatively moist sites, and hens and chickens (Dudleya cymosa minor), lupine (Lupinus sp.), rockbrake (Cryptogramma acrostichoides) and some short perennial grasses in relatively drier sites.

Typically, these soils are gravelly, cobbly, or stony throughout. They have dark colored, strongly acid surface layers with textures of the fine earth fraction ranging from coarse to moderately coarse. These overlie somewhat lighter colored medium to strongly acid, similar textured layers having lower contents of organic carbon. In turn, these rest on slightly to moderately weathered bed rock or closely packed rock fragments at depths ranging from about 50 cm to more than 150 cm.

Following is a profile description of a representative pedon located on a 50 percent slope in a master joint trace partly filled with stony colluvium and morainal debris, about 220 m east-northeast of the outlet to Emerald Lake at elevation of about 2,860 m; sparse cover of short perennial grasses; bare soil surface has a thin, fine gravel erosion pavement; for additional data, see pp I-46,47 and II-23 in Appendixes I and II-Section 7.0: (colors are for dry soil unless otherwise noted).

> A1 -- 0 to 6 cm; grayish brown gravelly loamy coarse sand, very dark gray moist; very weak fine granular structure; many very fine and few medium roots; 30 percent gravel and stones; strongly acid (pH 5.2); abrupt smooth boundary.

A2 -- 6 to 28 cm; brown gravelly coarse sandy loam, very dark grayish brown moist; weak fine granular structure; many very fine and fine, few medium roots; 20 percent pebbles and stones; strongly acid (pH 5.1); clear wavy boundary.

A3 -- 28 to 55 cm; brown gravelly coarse sandy loam, very dark grayish brown moist; very weak fine granular structure; common very fine roots; 25 percent pebbles; strongly acid (pH 5.3); abrupt wavy boundary.

AC -- 55 to 70 cm; light brownish gray very gravelly coarse sandy loam, dark brown moist; massive; few fine roots; 35 percent pebbles and cobbles; strongly acid (pH 5.4); very abrupt irregular boundary.

C -- 70 to 150 cm; interlocking granitic cobbles and stones; very pale brown coarse sandy loam in the interstices.

The organic carbon content of these soils range from about 1 to 4 percent to depths of about 80 cm, below which it diminishes. Reflecting this, the surface soil colors range from grayish brown to brownish gray when dry, and very dark grayish to dark gray when moist. The subsurface horizons range in color from brown to grayish brown when dry, grading to light brownish gray, light gray, or pale brown with depth. When moist, they are very dark grayish brown to dark brown.

Surface soil textures range from loamy coarse sand to loam. These texture classes are appropriately modified in places as gravelly, very gravelly or very stony. The subsurface soil textures range from loamy coarse sand to coarse sandy loam with coarse fragment modifiers ranging from gravelly to extremely stony.

Soil reactions range from medium to extremely acid. The dominant surface slopes of the various map units of Entic Cryumbrepts range from about 5 to 75 percent.

<u>EaD - Entic Cryumbrepts, sandy-skeletal, sloping to steep</u>. This map unit is very limited in extent, comprising less than 0.1 percent of the survey area. These soils have formed in a stony colluvial-alluvial deposit along the eastern part of a glacially plucked step above Tamarack Lake at an elevation of about 2,970 m. Some of the deposit was probably emplaced as avalanche debris. Surface slopes range from about 10 to 30 percent. The soils are similar in profile to the representative pedon for Entic Cryumbrepts, but differ in having a very cobbly or stony surface and textures to depths of 1 meter or more that are very cobbly or very stony sands and loamy sands.

Runoff waters from adjacent very steep rockland and talus slopes seasonally flush these very permeable soils. They support a variety of alpine plants, including clusters of lupine. Some willow (Salix sp.) grows in locally moist sites.

About 20 percent of this unit consists of similar soil on very steep slopes and about 10 percent consists of Granitic talus.

EbD - Entic Cryumbrepts, coarse-loamy, sloping to steep. This map unit comprises about 0.5 percent of the survey area. It is located in two delineations at about 2,800 m elevation. One surrounds Alta Meadow, the other is southwest of Tharp's Rock. The soils have formed in colluvial accumulations on the southerly flanks of Alta Peak. The unit has an irregular surface relief from accumulations of mass wasting. Dominant surface slopes range from about 5 to 30 percent.

The soils are similar in profile to the pedon representative of Entic Cryumbrepts. They support a sparse cover of lupine (Lupinus sp.) and sub-alpine plants. A few low-site red fir (A. magnifica) and western white pine (P. monticola) are associated.

Inclusions make up about 45 percent of the unit. These are: 10 percent rock outcrops and detached boulders; 5 percent of similar soils with udic or ustic moisture regimes from seepage waters during the summer; 5 percent Cryumbrepts; 10 percent Entic Cryumbrepts, sandy-skeletal; and 15 percent Entic Cryumbrepts, loamy-skeletal.

EbF - Entic Cryumbrepts, coarse-loamy, very steep. This map unit makes up about 0.2 percent of the survey area and is located in two delineations east of Alta Meadow at elevations ranging from about 2,700 to 2,900 m. It is very similar to EbD - Entic Cryumbrepts, coarse-loamy, sloping to steep, differing principally in its steeper surface slopes that range from about 40 to 70 percent. The vegetation is very similar .

Inclusions in this unit are; about 10 percent rock outcrop and large boulders; about 5 percent very similar soils that have surface slopes less than 30 percent; and about 15 percent similar soils that have more than 35 percent pebbles and cobbles in at least the upper meter of their profiles.

EcD - Entic Cryumbrepts, loamy-skeletal, sloping to steep. About 0.3 percent of the survey area is occupied by this map unit. It occurs along Lone Pine Creek at elevations ranging from about 2,500 to 2,700 m. The soils have formed in colluvial and alluvial aprons of cobbly and stony granitic material accumulated on the lower side slopes of the canyon. They are very similar in profile to the representative pedon for the Entic Cryumbrepts, but have formed on gentler surface slopes ranging from about 5 to 30 percent.

The soils support a shrub-grass-scattered conifer cover. Dominant shrubs are greenleaf manzanita (A. patula) and snowbush (C. cordulatus); the grasses are perennial; the conifers are red fir (A. magnifica) and occasional lodgepole pine (P. contorta murrayana).

About 70 percent of the unit consists of Entic Cryumbrepts with loamy-skeletal horizons to depths of at least one meter. Included in the unit are about 10 percent rock outcrop and large boulders, and about 20 percent Entic Cryumbrepts with sandy-skeletal horizons to depths of 1 meter or more.

EcF - Entic Cryumbrepts, loamy-skeletal, very steep. This unit is limited in extent. It comprises about 1.8 percent of the survey area and consists of several delineations located on the southeast flank of Alta Peak; along the side walls of Lone Pine Creek canyon; in the vicinity of Elizabeth Pass; on the ridge slope west of Lion Lake; and flanking the larger of the Hamilton Lakes. The soils range in elevation from about 2500 to 3400 m. Surface slopes range from about 30 to 75 percent.

The soils are typical of Entic Cryumbrepts and have profiles very similar to the representative pedon. Some variations exist in the parent rock from which the parent materials have weathered. Most of the unit consists of soils formed in deep cobbly colluvium from granitic rock sources. West of Lion Lake some of these soils have formed in colluvium from mica schist, while those in the vicinity of Hamilton Lakes have formed in colluvium from diorite. In the vicinity of Alta Peak some of these soils have formed in ground moraine or relicts of lateral moraines.

The vegetation associated with these soils consists mainly of open to semi-open covers of subalpine and alpine shrubs, grasses and forbs. A few scattered red fir (A. magnifica) and western white pine (P. monticola) are associated in places. The shrubs are mainly greenleaf manzanita (A. patula), pinemat manzanita (A. nevadensis) at higher elevations, snowbush (C. cordulatus), chinquapin (C. castanopsis), and willow (Salix sp.) in moist areas. Grasses consist mainly of short perennials. The forbs include lupine (Lupinus sp.), bracken fern and heather.

About 40 percent of the unit consists of inclusions of other soils and miscellaneous areas which are not evenly distributed among the delineations. These are: about 15 percent very cobbly and stony Cryorthents; about 15 percent rock outcrops and detached boulders; 5 percent Glacial rubble land; and 5 percent talus.

EdF - Entic Cryumbrepts-Cryorthods association, very steep. This map unit is very limited in extent, comprising about 0.1 percent of the survey area. It is located in a single delineation near the Watchtower on north facing slopes of Marble Fork canyon at elevations ranging from about 2650 to 2880 m. The slopes range from about 45 to 75 percent. The unit consists mainly of an association of Entic Cryumbrepts and Cryorthods impractical to map separately.

The Entic Cryumbrepts are similar in profile to their representative pedon. They have formed in residuum and local gravelly or cobbly colluvium from granitic country rock. The Cryorthods are similar in profile to their representative pedon (see Cryorthods, page 26) but are generally shallower, ranging in depth from about 35 to 60 cm to underlying weathered or slightly weathered granitic rock.

The vegetation consists of a semi-open cover of red fir (A. magnifica) and western white pine (P. monticola) with a sparse ground cover of lupine (Lupinus sp.) and other subalpine plants.

Entic Cryumbrepts comprise about 55 percent of the unit; Cryorthods comprise about 25 percent of the unit. Included are about 15 percent granitic outcrops and associated large, detached boulders, and 5 percent Lithic Cryumbrepts.

EfF - Entic Cryumbrepts-Granitic talus association, very steep. This map unit is very limited in extent, comprising about 0.3 percent of the survey area. It is located in a single delineation north of Tamarack Lake on the south facing slopes of Lone Pine Creek canyon at elevations ranging from about 2800 to 3300 m. Surface gradients range from about 45 to 75 percent, steepening upward from the lower canyon slopes. The unit consists mainly of an association of Entic Cryumbrepts and Granitic talus impractical to map separately.

The Entic Cryumbrepts are similar in profile to their representative pedon, but are very cobbly or very stony throughout. They have formed in very cobbly or very stony colluvium weathered, detached and transported from local granitic rock upslope, as well as in remnants of ground moraine veneered on parts of the canyon slopes. The Granitic talus (see Gt-Granitic talus, page 45) consists of masses of coarse rock fragments accumulated as debris-fall at the base of cliffs and extremely steep areas of granitic rock outcrop above this map unit. It also consists of low ridges and splays of rock fragments emplaced by avalanche action originating from the outcrop area.

The vegetation in this unit is confined entirely to the Entic Cryumbrepts and other similar soil inclusions. It consists mainly of a semi-dense cover of shrubs and scattered growths of perennial grasses and forbs in protected sites. The shrubs consist of pinemat manzanita (A. nevadensis), chinquapin (C. sempervirens), with greenleaf manzanita (A. patula) and snowbush (C. cordulatus at relatively lower elevations, and alpine willow (Salix sp.) in moist areas. There are scattered clusters of western white pine (P. monticola), red fir (A. magnifica) and lodgepole pine (p. contorta murrayana) on relatively gentler slopes. The Granitic talus areas are essentially barren of plants. Older areas of rock fall have lichen growths on rock fragments; younger areas lack these growths.

Entic Cryumbrepts comprise about 60 percent of the unit; Granitic talus about 25 percent. About 15 percent of the unit consists of inclusions of Jointed granitic outcrops, Typic Cryorthents, and Cryorthods.

EhF - Entic Cryumbrepts-Jointed granitic outcrop association, very steep. This map unit comprises about 0.2 percent of the survey area. It occurs in three delineations; two located on the southerly facing canyon slopes of Lone Pine Creek; one on the upper watershed of Buck Creek. Elevations range from about 2800 to 3200 m; lower elevation sites are under the influence of cold air drainage down Lone Pine Creek. The surface configurations are rough and irregular with slopes ranging from about 45 to 75 percent. A few, narrow avalanche chutes cut across some of the delineations exposing the underlying granitic bed rock.

This unit is an association of Entic Cryumbrept soils and Jointed granitic outcrops that are impractical to separate in mapping. The Entic Cryumbrepts are similar in profile to their representative pedon, but are very cobbly or very stony throughout. They have formed in very cobbly or very stony colluvium previously weathered and detached from local granitic country rock upslope. The Jointed granitic outcrops (see Jg – Jointed granitic outcrop, page 53) exist as exposures and protuberances of the underlying granitic rock. They are of varying size, ranging from several square meters to several hectares. Avalanche activity has exposed some of the rock.

The vegetation in this unit is confined entirely to the Entic Cryumbrepts and similar included soils. It is principally a semi-dense cover of shrubs with some perennial grasses and forbs near ephemeral water courses and seeps, and open clusters of conifers. The shrubs consist mainly of greenleaf manzanita (A. patula), snowbush (C. cordulatus), and chinquapin (C. sempervirens), with alpine willow (Salix sp.) in moist sites at higher elevations. The conifers consist of red fir (A. magnifica) at lower elevations, and western white pine (P. monticola) at higher elevations along with occasional Sierra juniper (Juniperus occidentalis) and lodgepole pine (P. contorta murrayana).

Entic Cryumbrepts comprise about 55 percent of the unit; Jointed granitic rock outcrops about 25 percent. Inclusions comprise about 20 percent, consisting of: Granitic talus associated with avalanche chutes and at the bases of adjoining cliffs and extremely steep areas of granitic outcrops; Lithic Cryumbrepts; Typic Cryorthents; and Cryorthods.

<u>EjF – Entic Cryumbrepts-Lithic Cryumbrepts-Jointed granitic outcrop association, very steep</u>. This map unit comprises about 0.2 percent of the survey area. It exists in two delineations in the lower part of Lone Pine Creek canyon under the influence of down-canyon cold air drainage at elevations ranging from about 2300 to 2500 m. One delineation is part way up the west side of the canyon. Surface slopes range from about 45 to 75 percent. Several small, parallel streamlets draining large rock faces higher on canyon walls have incised and produced a fluted relief in both delineations.

The unit is an association of Entic Cryumbrepts, Lithic Cryumbrepts, and Jointed granitic outcrops impractical to map separately. The Entic Cryumbrepts are similar in profile to their representative pedon. The Lithic Cryumbrepts are similar to their representative pedon (see page 66), but range in depth from about 15 to 50 cm to the underlying slightly weathered granitic rock. Within this shallow soil, gravel and cobbles range from about 10 to 40 percent by volume. The Jointed granitic outcrops (see Jg – Jointed granitic outcrop page 53) exist as many irregular rocky knobs, smooth fractured expanses of rock, and stream exposed rock surfaces.

The vegetation consists of a semi-dense cover of shrubs and scattered conifers on the Cryumbrept components of this unit. The conifers are more prevalent on the deeper Entic Cryumbrepts. The granitic outcrops are virtually devoid of vegetation. The shrubs consist mainly of greenleaf

manzanita (A. patula), snowbush (C. cordulatus), and some chinquapin (C. sempervirens). The conifers are red fir (A. magnifica) and western white pine (P. monticola). The latter grows only at the higher elevations within the unit.

Entic Cryumbrepts comprise about 35 percent of the unit Lithic Cryumbrepts about 25 percent, and Jointed granitic outcrops about 25 percent. Inclusions comprise about 15 percent, consisting of Granitic talus and Unjointed granitic outcrops.

EkF - Entic Cryumbrepts-Typic Cryorthents association, very steep. This map unit comprises about 1.8 percent to the survey area. It consists of several delineations. These are located in the vicinities of Elizabeth Pass, Alta Meadow, and Heather and Emerald Lakes. They occupy mountain and canyon slopes with southerly to westerly aspects and range in elevation from about 2500 to 3400 m. The land surface ranges from smooth to rough and irregular, broken in a few places by relicts of former avalanche chutes. Slope gradients range from about 45 to 75 percent.

The unit is an association of Entic Cryumbrepts and Typic Cryorthents that are impractical to separate in mapping. The Entic Cryumbrepts are similar in profile to their representative pedon (see page 29), but have formed mainly in very cobbly and often stony sandy colluvium; also in very cobbly, sandy ground moraine at higher elevations. The Typic Cryorthents are similar to their representative pedon (see page 96) and have formed in colluvium on steeper slopes and in residuum on ridge and hill crests.

The vegetation ranges from open covers of alpine shrubs and plants at the highest elevations to semi-open covers of shrubs and conifers at lower elevations. Some areas have a semi-dense cover. The shrubs consist mainly of pinemat manzanita (A. nevadensis), chinquapin (C. sempervirens), and willow (Salix sp.) at higher elevations, and greenleaf manzanita (A. patula), snowbush (C. cordulatus), and chinquapin (C. sempervirens) at lower elevations. Western white pine (P. monticola) predominates at higher elevations and red fir (A. magnifica) at lower elevations. Bare ground and rock surfaces occur where vegetation is lacking.

In general, the Entic Cryumbrepts comprise about 60 percent of the unit, and Typic Cryorthents about 30 percent. However, in the vicinity of Elizabeth Pass, the proportion of soils in that delineation is reversed. About 10 percent of the unit consists of inclusions of granitic outcrops and large boulders.

Entic Ultic Haploxerolls

This subgroup includes shallow to deep, somewhat excessively drained, dark colored soils that are moderately leached and lack significant subsoil development. They have formed mainly in residuum from granodiorite. In places, they have formed in local colluvium and in residuum from metamorphosed diorite. They comprise about 1 percent of the survey area and are located on sloping to extremely steep, lower canyon slopes of the Middle Fork of the Kaweah River. In this area, these soils are mapped as members

of an association with other soils or miscellaneous areas. They also are recognized as inclusions in yet other soil map units.

Elevations range from about 410 to 1500 m. The mean annual soil temperatures range from about 15°C to 18°C depending upon elevation and aspect of a given site. Mean annual precipitation ranges from about 635 to 760 mm. Most of this falls as rain during the winter, but some falls as snow. These soils have a thermic soil temperature regime and a xeric soil moisture regime.

The vegetation cover is variable, ranging from semi-open woodland-grass with scattered shrubs to dense chaparral. The grass cover consists mainly of annual grasses and forbs. The woodland trees are Douglas blue oak (Quercus douglasii) and interior live oak (Quercus wislizenii). The shrubs in semi-open areas are whiteleaf manzanita (Arctostaphylos viscida) and buck brush (Ceanothus cuneatus). The areas of dense chaparral consist almost entirely of chamise (Adenostoma fasciculatum).

Typically, these soils have moderately coarse, dark colored, medium to slightly acid surface soils less than 50 cm thick. They have base saturations between 50 and 75 percent and overlie either well weathered parent rock or moderately coarse textured, pale colored subsurface soils of similar reaction with base saturations above 50 percent. This grades into, or rests abruptly on, well weathered parent rock at depths in excess of 50 cm.

Following is a profile description of a representative pedon located of the eastside of the Moro Trail about 1100 m. south-south-east of the base of Moro Rock at an elevation of about 1400 m; dense cover of chamise: (colors are for moist soil).

0 -- 1 to 0 cm; dark brown chamise leaves and twigs; loose; very abrupt boundary.

A1 -- 0 to 6 cm; very dark grayish brown (10YR 3/2) coarse sandy loam; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; very few very fine roots; slightly acid; clear smooth boundary.

A2 -- 6 to 26 cm; dark brown (10YR 3/3) coarse sandy loam; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; slightly acid; clear wavy boundary.

AB -- 26 to 48 cm; dark brown (10YR 4/3) coarse sandy loam; massive; hard, very friable, nonsticky and nonplastic; few fine and medium roots; few fine and medium tubular pores; medium acid; clear wavy boundary.

Bw -- 48 to 56 cm; light yellowish brown (10YR 6/4) loamy coarse sand, scattered dark gray flecks of mafic mineral fragments; massive; slightly hard; very friable, nonsticky and nonplastic; medium acid; abrupt wavy boundary.

Cr -- 56 to 70+ cm; well weathered granodiorite.

The organic carbon content of these soils ranges from about 0.6 to 2.5 percent to depths of about 40 to 50 cm. Below 50 cm, the organic carbon content is less than 0.6 percent. Soil colors reflect this, the surface soils range from grayish brown to brown when dry, and from dark brown to very dark grayish brown when moist. Subsurface soil colors range from light brownish gray to light yellowish brown when dry, and from grayish brown or light yellowish brown to dark yellowish brown when moist.

Surface soil textures are commonly coarse sandy loams, but range in places to loamy coarse sand, sandy loam and loam. Subsurface soils range from dull colored coarse sandy loam to brighter colored loamy coarse sand.

Soil reactions range from medium to slightly acid in both surface and subsurface soils. Base saturation is above 50 percent throughout, but is less than 75 percent in some or all parts of the surface soils.

The soils range in depth from about 30 cm to 125 cm to weathered rock. Surface slopes of the soils range from about 30 to 80 percent.

<u>EubF - Entic Ultic Haploxerolls, thermic-Jointed granitic outcrop association, very steep</u>. This map unit comprises about 0.5 percent of the survey area and occurs in two delineations. One is located along the Kaweah River in the near vicinity of the Ash Mountain Headquarters of Sequoia National Park at elevations ranging from about 410 to 510 m. The other is on the intermediate canyon slopes above the river and south of Moro Rock at elevations ranging from about 1000 to 1500 m. The land surface is rough, irregular and frequently studded with rock outcrops. Slopes range from about 35 to 75 percent. It was impractical to separate the principal named components in mapping this unit.

The Entic Ultic Haploxerolls are similar to their representative pedon which is located in one of the delineations of this unit. These soils range in depth from about 50 to 100 cm to weathered rock. The Jointed granitic outcrops (see Jg - Jointed granitic outcrop, page 53) exist as irregular exposures, small cliffs and fractured protuberances of the underlying granitic parent rock of the soils. They are more abundant in the delineation near Moro Rock where many show a parallel lineation. Near Ash Mountain Headquarters, they are smaller, fewer in number, and are mainly fractured protuberances of rock.

The vegetation in this unit differs between its two delineations. Near Ash Mountain Headquarters, it consists of a semi-open woodland-grass-shrub cover. The grass cover is mainly annual grasses and forbs; the woodland consists of Douglas blue oak (Q. douglasii) and interior live oak (Q. wislizenii); the shrub cover consists of scattered whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus). Near Moro Rock it is a dense cover of chaparral consisting predominantly of chamise (A. fasciculatum).

Entic Ultic Haploxerolls comprise about 40 percent of the unit; Jointed granitic outcrops range from 20 to 30 percent. Inclusions range from 30 to 40 percent and consist of: similar soils that are shallow to either weathered or unweathered parent rock; other similar soils that are shallow to weathered parent rock and have significantly less organic carbon in their surface soils, but that have well developed clay loam subsoils.

EubG - Entic Ultic Haploxerolls, thermic-Jointed granitic outcrop association, extremely steep. This map unit comprises about 0.3 percent of the survey area. It occurs in a single delineation located on the extremely steep slopes along the Middle Fork of the Kaweah River, below the Middle Fork Trail, from the mouth of Panther Creek down stream to the ridge rising to Moro Rock. Surface slopes, having mostly a southerly aspect, range from 65 to 85 percent and are mainly part of an inner gorge cut by the river in its canyon. Elevations range from about 900 to 1350 m. Mean annual soil temperature ranges from about 15° to 16°C.

It was impractical to separate the principal named components of this unit in mapping. The Entic Ultic Haploxerolls are similar to their representative pedon. They range in depth from about 50 to 75 cm to weathered rock. The Jointed granitic outcrops (see Jg - Jointed granitic outcrop, page 53) exist as irregular exposures, small cliffs flanking the river channel, and protuberances of the underlying granitic rock.

The vegetation in this unit is mainly dense chamise (A. fasciculatum) with clusters of Douglas blue oak (Q. douglasii) and California laurel (Umbellaria californica) in protected areas. In places, there are growths of whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus). Annual grasses and forbs cover a few open areas devoid of shrubs.

Entic Ultic Haploxerolls comprise about 40 percent of the unit; Jointed granitic outcrops about 30 percent. Inclusions comprising about 30 percent of the unit consist of deep Ultic Haploxeralfs, moderately deep Typic Xerochrepts, and shallow Haploxerolls overlying only slightly weathered granitic rock.

EucF - Entic Ultic Haploxerolls-Ultic Haploxeralfs association, thermic, very steep. This unit comprises about 0.3 percent of the survey area. It occurs in a single delineation located along the Middle Fork of the Kaweah River southeast of Potwisha Campground on very steep slopes with mainly southerly aspects. Elevations range from about 630 to 855 m. Mean annual soil temperatures range from about 16° to 17.5°C. In mapping this unit, it was impractical to separate the principal named components. The Entic Ultic Haploxerolls are similar to their representative pedon. They range in depth from about 50 to 125 cm to weathered rock. The Ultic Haploxeralfs are similar to their representative pedon (see Ultic Haploxeralfs, page 108) and are deep to weathered parent rock.

The vegetation in this unit is varied. The western portion of the unit has a semi-open to semi-dense woodland-grass-shrub cover. The grass cover is mainly annual grasses and forbs; the tree cover is dominantly Douglas blue oak (Q. douglasii) and some interior live oak (Q. wislizenii); shrubs

are whiteleaf manzanita (A. viscida), buck brush (C. cuneatus), and some chamise (A. fasciculatum). The eastern part of the unit is dominantly chaparral with some oaks and grass. The chaparral is chamise; the oaks and grass are the same as in the western part.

The Entic Ultic Haploxerolls comprise about 45 percent of the unit; the Ultic Haploxeralfs about 40 percent. Inclusions comprise about 15 percent and consist of: Ultic Haploxerolls; Typic Xerochrepts; soils similar to the Ultic Haploxeralfs but with, thicker, dark colored surface soils; and a few irregular rock outcrops.

Entic Xerumbrepts

This subgroup includes shallow to very deep, dark colored, somewhat excessively drained, well leached soils lacking significant subsoil development. The soils have formed in both colluvium and residuum from granodiorite rock. Comprising about 4.9 percent of the survey area, they are located on: the middle to upper slopes of the Middle Fork canyon of the Kaweah River; in the Giant Forest area near Huckleberry Meadow; on the north slope of Panther Peak; in the upper drainage of Wolverton Creek; and on the north facing slopes of Tokapah Valley west of the Watch Tower. Elevations range from about 1300 to 2680 m - the lower elevations are on north facing slopes. Mean annual soil temperatures range from about 4° to 13°C. Mean annual precipitation ranges from about 900 to 1010 mm. most of which falls as snow during the winter. At higher elevations, some random rainfall occurs during the summer from local thunderstorms. These soils have mesic or frigid soil temperature regimes and xeric soil moisture regimes.

The vegetation on these soils is variable, ranging from a semi-open to dense cover of conifers, oak and shrubs. Areas without woody vegetation support some annual grasses and forbs at lower elevations; at middle and higher elevations they consist of bare ground with litter and growths of lupine (Lupinus sp.). The conifers at lower elevations are yellow pine (Pinus ponderosa); at middle and higher elevations, one finds white fir (Abies concolor) and Jeffrey pine (Pinus jeffreyi), and red fir (Abies magnifica) becomes dominant at highest elevations. Black oak (Quercus kelloggii) and canyon live oak (Quercus chrysolepis) are prevalent at lower elevations and less prominent at middle elevations. Shrubs at lower elevations are principally bear clover (Chamaebatia foliolosa) and white leaf manzanita (Arctostaphylos viscida). Bear clover disappears at higher elevations where greenleaf manzanita (A. patula), chinquapin (Castanopsis sempervirens), pinemat manzanita (Arctostaphylos nevadensis) and snowbush (Ceanothus cordulatus) appear and predominate.

Typically, these soils have coarse and moderately coarse, dark colored, medium to strongly acid surface soil less than 50 cm thick; base saturation is less than 50 percent. They overlie similar textured, paler colored subsurface soils, similar in reaction and base saturation, that grade into or rest abruptly on weathered parent or underlying rock.

Following is a profile description of a representative pedon located about 400 m SE of the High Sierra Trail crossing of Mehrten Creek at an

elevation of about 2340 m; semi-dense cover of Jeffrey pine, white fir and greenleaf manzanita; (colors are for dry soil unless otherwise noted).

O -- 3 to 0 cm; litter of manzanita leaves, twigs; pine and fir needles.

A1 -- 0 to 5 cm; very dark grayish brown (10YR 3/2) coarse sandy loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; few fine roots; strongly acid (pH 5.5); clear wavy boundary.

A2 -- 5 to 46 cm; dark brown (10YR 4/3) coarse sandy loam, dark brown (10YR 3/3) moist; moderately fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; very strongly acid (pH 5.0); clear wavy boundary.

AB -- 46 to 61 cm; pale brown (10YR 6/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; very strongly acid (pH 5.0); clear wavy boundary.

Bw -- 61 to 107 cm; pale brown (10YR 6/3) loamy coarse sand, dark yellowish brown (10YR 3/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; very strongly acid (pH 5.0); clear wavy boundary.

C -- 107 to 150 cm; very pale brown (10YR 7/3) loamy coarse sand, brown (10YR 5/3) moist; massive; slightly hard, nonsticky and nonplastic; few medium roots; very strongly acid (pH 5.0); abrupt wavy boundary.

Cr -- 150 to 170+ cm; granitic gray, well weathered granodiorite.

The surface soils range in texture from coarse sandy loam to loamy coarse sand. Coarse fragments that may modify the texture class range in size from fine gravel to cobbles. They occupy from about 10 to 40 percent of the soil volume. Surface soil colors range from grayish brown to very dark grayish brown when dry. Moist colors range from very dark grayish brown to black.

The subsurface soils are similar in texture and coarse fragments. They range in color from pale brown to light yellowish brown when dry; brown to dark yellowish brown when moist. In some areas, the subsurface soils are missing and the surface soils rest directly upon well weathered granitic rock at shallow depths.

These soils range in reaction from medium to very strongly acid and have base saturations less than 50 percent.

<u>ExaF - Entic Xerumbrepts, mesic, very steep</u>. This map unit comprises about 4.2 percent of the survey area. It exists in two large delineations west of Buck Creek on the south facing slopes of the Kaweah River's middle fork canyon. These soils occupy interfluve ridges and have surface slopes

ranging from about 45 to 75 percent. Elevations range from about 1300 to 2380 m; lower elevations of the unit are on protected northwesterly aspects of stream canyons tributary to the river. Southerly aspects are at elevations above about 1600 m. Mean annual soil temperatures range from about 13° down to about 8° C with increasing elevation.

The Entic Xerumbrepts are similar to their representative pedon. It is located within this unit. The soils range from moderately deep to very deep; textures range from loamy coarse sand to coarse sandy loam; in places, coarse fragments in excess of 35 percent by volume are associated with colluvial accumulations on the canyon slopes.

The vegetation is a semi-dense cover of shrubs and conifers, either of which may predominate from place to place within the unit. In addition, oaks are widely distributed. The shrubs are predominantly whiteleaf manzanita (A. viscida) and bear clover (C. foliolosa) at lower elevations, with greenleaf manzanita (A. patula) replacing white leaf manzanita at higher elevations. The conifers are yellow pine (P. ponderosa) and incense cedar (C. decurrens) at lower elevations, and sugar pine (P. lambertiana), Jeffrey pine (P. jeffreyi), and white fir (A. concolor) at middle and higher elevations. The oaks are black oak (Q. kelloggii) and canyon live oak (Q. chrysolepis).

Entic Xerumbrepts comprise about 60 percent of the unit. Among the 40 percent of inclusions are; shallow Entic Xerumbrepts; Pachic Xerumbrepts; Lithic Xerumbrepts; soils similar to the Entic Xerumbrepts but with identifiable weak subsoil development (cambic horizons), and outcrops of granitic rock.

<u>ExbF – Entic Xerumbrepts, shallow, frigid-Jointed granitic outcrop association, very steep</u>. This map unit, very limited in extent, comprises only about 0.1 percent of the survey area. It consists of one delineation located east of Wolverton along Wolverton Creek at elevations ranging from about 2350 to 2500 m. The unit has a westerly aspect with slopes ranging from about 40 to 60 percent and is incised by several small streamlets tributary to Wolverton Creek. The mean annual soil temperatures range from about 5° to 7° C.

It was impractical to map the principal components of this association separately. The Entic Xerumbrepts are similar to their representative pedon, but have soil depths less than 50 cm to weathered rock. They have formed mainly in residuum and partly in shallow colluvium accumulated on the very steep slopes. Soil textures range from loamy coarse sand to coarse sandy loam and are very gravelly in places. The Jointed granitic outcrops (see Jg – Jointed granitic outcrop, page 53) exist as irregular exposures or protuberances of the underlying granitic rock.

The vegetation consists of a semi-open cover of conifers and shrubs. Open areas consist of bare ground with and without litter, areas of perennial grasses, scattered growths of lupine (Lupinus sp.), and areas of bare rock. The conifers are red fir (A. magnifica) and white fir

(A. concolor). Shrubs are greenleaf manzanita (A. patula), pinemat manzanita (A. nevadensis), and chinquapin (C. sempervirens).

Entic Xerumbrepts comprise about 60 percent of the unit; Jointed granitic outcrops about 20 percent. Included are deep, sandy soils lacking thick, dark colored surface horizons.

ExcG - Entic Xerumbrepts, frigid-Jointed granitic outcrop association, extremely steep. This map unit comprises about 0.3 percent of the survey area. It exists as a single delineation located in the Marble Fork canyon on the north facing slopes of Tokopah Valley west of the Watch Tower. Elevations range from about 2130 to 2450 m. Surface slopes are in excess of 75 percent for the most part; steepest slopes occupy the higher parts of the unit, becoming relatively less steep downslope toward the Marble Fork. Parallel drainages and avalanche chutes have incised and roughened the surface. Mean annual soil temperatures range from about 6° to 8°C.

It was impractical to map the principal components of this association separately. The Entic Xerumbrepts are similar to their representative pedon, having formed in very gravelly or cobbly sandy colluvium and in remnants of ground moraine veneered on the canyon slopes. Textures are mainly very gravelly or very cobbly loamy sands and sands. The Jointed granitic outcrops (see Jg - Jointed granitic outcrop, page 53) granitic rock. They are more prevalent in the higher parts of the unit.

The vegetation consists of a semi-dense cover of conifers and shrubs. The conifers are largely red fir (A. magnifica) and white fir (A. concolor), with occasional Jeffrey pine (P. jeffreyi) and with some lodgepole pine (P. contorta murrayana) along the Marble fork. Shrubs are largely greenleaf manzanita (A. patula), pinemat manzanita (A. nevadensis), snowbush (C. cordulatus), and chinquapin (C. sempervirens).

Entic Xerumbrepts comprise about 40 percent and jointed granitic outcrops about 30 percent of the unit. Inclusions consist of both shallow and deep very gravelly and very cobbly loamy coarse sands lacking thick, dark colored surface soils; Granitic talus; and remnants of Glacial granitic rubble land.

ExdF - Entic Xerumbrepts, loamy-skeletal, frigid-Jointed granitic outcrop association, very steep. This map unit comprises about 0.2 percent of the survey area. It occurs in a single delineation occupying the north facing slopes just below Panther Peak. Elevation ranges from about 2550 to 2680 m. Surface slopes range from about 30 to 60 percent.

It was impractical to map the principal components of this map unit separately. The Entic Xerumbrepts are similar to their representative pedon, but differ in having more than 35 percent be volume of rock fragments throughout their profiles. In addition, the fine-earth fraction consists of coarse sandy loams throughout. These soils have formed in both colluvium and residuum. The Jointed granitic outcrops (see Jg - Jointed granitic outcrop, page 53) exist as scattered, irregular protuberances of the underlying granitic rock.

The vegetation consists of a semi-dense to semi-open cover of conifers and little or no shrub cover. The conifers are red fir (A. magnifica). Such shrub cover as exists consists of greenleaf manzanita (A. patula), pinemap manzanita (A. nevadensis), and snowbush (C. cordulatus). Open areas consist of bare ground, conifer litter, or rock surfaces.

Entic Xerumbrepts comprise about 40 percent and Jointed granitic outcrops about 25 percent of this unit. Inclusions comprise about 35 percent and consist of Pachic Xerumbrepts, Lithic Xerumbrepts, and soils similar to Entic Xerumbrepts but having thin or no dark colored surface soils. A small area of Aquepts, frigid is also included in the north part of the unit.

Exed - Entic Xerumbrepts, shallow, mesic-Jointed granitic outcrop association, sloping to steep. In proportional extent, this unit makes up only about 0.1 percent of the survey area. It exists as a single delineation located west of Huckleberry Meadow in the Giant Forest area at an elevation of about 2075 m. The surface relief is undulating to hilly with hill slopes ranging from about 10 to 30 percent. The mean annual soil temperature is about 8° to 9°C.

It was impractical to map the principal components of this unit separately. The Entic Xerumbrepts are similar to their representative pedon but differ in being no deeper than 50 cm to the underlying weathered parent rock. The Jointed granitic outcrops (see Jg - Jointed granitic outcrop, page 53) exist as scattered irregular exposures and protuberances of the underlying granitic rock.

The vegetation is a semi-dense cover of conifers and shrubs. The conifers consist of low site quality white fir (A. concolor), Jeffrey pine (P. jeffreyi) and sugar pine (P. lambertiana). The shrubs are mainly greenleaf manzanita (A. patula) and snowbush (C. cordulatus). In open areas there is bare ground, conifer litter and rock surfaces.

Entic Xerumbrepts comprise about 45 percent and Jointed granitic outcrops about 30 percent of the unit. Inclusions consist of Lithic Xerumbrepts and shallow soils lacking dark colored surface soils.

Ga - Glacier. This miscellaneous area map unit consists of perennial ice masses at the base of north facing cliffs on the side of Mt. Stewart southeast of Tamarack Lake. The unit is very limited in extent, comprising less than 0.1 percent of the survey area. It exists in four delineations ranging in elevation from about 3170 to 3400 m.

The delineations of this unit are the southern-most alpine glacierets in the Sierra Nevada. There are distinct bergschrunds at their contact with the protective cliffs of Mt. Stewart, and irregular morainal rubble flanks them on their north and downslope sides. The surfaces of the glacierets may be covered with seasonal snow or show rough and pitted ice surfaces.

Gf - Granitic felsenmeer. This map unit consists of chaotic jumbles of large granitic rock pieces completely mantling the surface in the alpine zone at elevations above about 2900 m. It occupies high lying ridge crests,

slopes and shoulders that were never subjected to Pleistocene glacial ice action. The unit comprises about 0.5 percent of the survey area and exists in several separate delineations, as well as being a component of two other map units. The separate delineations are located: on the shoulders of Mt. Stewart and Lion Peak; on the drainage divides in the vicinity of Elizabeth Pass; northwest of Hamilton Lakes; on the ridge between Buck Creek and Lone Pine Creek; and on the ridge west of Emerald Lake.

The areas of felsenmeer (sea of rocks) are exceedingly rough. The large angular blocks of granitic rock range in size from about 1 to 5 m across. They reflect severe frost wedging of initially well and frequently jointed rock. The surfaces of some blocks are fresh in appearance, others are deeply pitted, weathered, and covered with lichen growths. The openings between blocks, often up to a meter in width, are irregular and tortuous to uncertain depths; small sandy pockets of soil material can be found in some shallow openings. In places, these support sparse plant growth. Travel across the surface of this unit can be hazardous; many blocks are loose and moveable.

These areas of jumbled rock fragments are much better infiltration sites for snow melt water or rainfall in comparison to areas of unjointed or jointed rock outcrop. In some delineations of this unit, up to 20 percent consists of inclusions of granitic rock outcrop.

<u>GfeF - Granitic felsenmeer and Entic Cryumbrepts, very steep</u>. This map unit is limited in extent. It comprises about 0.7 percent of the survey area and consists of a single delineation located on the crest of the ridge separating Buck Creek and Lone Pine Creek. Elevations range from about 2900 to 3410 m. Surface slopes of the soils range from about 30 to 75 percent.

The named components of this unit occur in a very uneven and irregular relationship throughout the extent of the delineation. It was impractical to separate them in mapping. The Granitic felsenmeer occupies less steep slopes of the ridge crests and adjoining spurs. This portion of the unit is described in more detail in map unit Gf - Granitic felsenmeer on page 44. The Entic Cryumbrepts soils are similar in profile to their representative pedon given of page 29. The soils have formed in deep, very cobbly or stony colluvium. The fine-earth material around the rock fragments may be either sandy or loamy.

The vegetation is sparse and confined to the Cryumbrepts in this unit. It consists mainly of subalpine shrubs with some perennial grasses and forbs in protected sites. The shrubs consist of pine mat manzanita (A. nevadensis), snowbush (C. cordulatus), and alpine willow (Salix sp.). A variety of lichens grow on some fragments of the felsenmeer.

The Granitic felsenmeer and the Entic Cryumbrepts each comprise about 30 percent of the unit. Included are: areas of Typic Cryorthents in very stony colluvium; shallow areas of Lithic Cryorthents and Lithic Cryumbrepts; craggy areas of Jointed granitic outcrop; and small areas of Granitic talus.

Gfg - Granitic felsenmeer-Granitic talus association. This map unit is very limited in extent, comprising only about 0.1 percent of the survey area. It occurs in 2 delineations on the east-facing crest slopes of Alta Peak ridge and its spurs west of Moose Lake. Elevations range from about 3050 to 3410 m. Surface slopes are steep to extremely steep. In mapping, it was impractical to separate the named components of this unit.

The Granitic felsenmeer is located on less steep slopes along ridge and spur crests; the Granitic talus has accumulated below the felsenmeer areas as extremely steep, cones and aprons of block fall. More detailed information for each component is available in the map unit descriptions of Gf - Granitic felsenmeer on page 43, and Gt - Granitic talus on page 45.

The unit is virtually devoid of vegetation, but lichen growths are prevalent on surfaces of rock masses that have not been recently displaced. Scattered small patches of alpine willow (Salix sp.) do grow where melt-water from snow tends to concentrate.

The Granitic felsenmeer and Granitic talus each comprise about 40 percent of the unit. Included are linear areas of Jointed granitic outcrop and small areas of Typic Cryorthents. The latter have formed on slopes less than 40 percent in places along the ridge crests.

Ggr - Granitic glacial rubble land. This map unit comprises about 0.3 percent of the survey area and consists of 5 separate delineations located: below the small glaciers on the north side of Mt. Stewart; around the lakes north of Lion Peak; and along the lake in the cirque northwest of Elizabeth Pass. Elevations range from about 3170 to 3410 m.

The unit consists of angular boulders, stones, cobbles and gravel heaped in semi-arcuate ridges of low relief by the forward movement and retreat of glacial ice. All areas of this unit are located in the upper reaches of alpine cirques, rest on glaciated rock surfaces at depths in excess of 2 m, and are likely the result of recent, neoglacial action.

The rock rubble was originally plucked from the local granitic country rock or fell to the active ice mass from higher cliffs. In place, it forms an extremely rough and uneven surface with many large, irregular voids between the rock fragments. Where it forms end moraines across lake outlets, the material provides a pervious dam. The entire unit offers numerous pathways for rapid infiltration and internal flow of melt-water from ice or snow, or from rainfall. In this way it behaves similarly to Granitic felsenmeer and Granitic talus.

The unit is virtually devoid of plant life except for lichen growth on some rock surfaces. About 80 percent of the unit consists of glacially deposited rock fragments. Included are small areas of very steep Granitic talus and Jointed granitic outcrops.

Gt - Granitic talus. This map unit consists of irregular accumulations of irregular, angular boulder-, stone-, and cobble-sized fragments of

granitic rock at the bases of nearly vertical cliffs, or extremely steep slopes of rock outcrop, from which the fragments have dislodged and fallen or tumbled. Some areas have resulted from dislodged rock masses that occasionally cascade down avalanche chutes.

The unit comprises about 2.6 percent of the survey area and occurs located in the alpine zone. A few are located in the sub-alpine zone in the vicinity of Heather and Emerald Lakes. Elevations range from about 2800 to 3500 m.

The rock fragments comprising this unit exhibit freshly broken faces with little or no lichen growth. They have been dislodged by frost wedging or by exfoliation. The unit is a post-glacial, geologically recent feature. As with areas of felsenmeer and glacial rubble, areas of talus readily absorb and divert meltwater flow from snow and runoff from rainfall through many open, toruous passageways between rock fragments. These water may quickly appear and flow on downslope from the talus base where it rests on areas of unbroken rock, or the waters may be absorbed to seep slowly downslope where the talus rests on deep, earthy colluvium or ground moraine.

The unit is devoid of vegetation, but does afford shelter sites to alpine animal life. More than 80 percent of the unit consists of talus accumulations. Some delineations include small areas of Jointed granitic outcrop, Unjointed granitic outcrop, and Granitic felsenmeer. The latter occupies ridge crests above the talus.

Haploxerolls

This great group includes dark colored, well to somewhat excessively drained, shallow to very deep, medium to moderately coarse textured soils on very steep to extremely steep slopes. They have formed in both residuum and colluvium from a variety of rock types, including acid igneous, basic igneous, and metamorphic sedimentary rock. The surface soils are relatively high in organic carbon content and normally have a granular structure. Subsoil development may be lacking or may only be weakly expressed as an horizon of alteration (cambic horizon).

Map units that are identified only at this great group level of abstraction include a wider variety of these kinds of soils than map units identified as subgroups of Haploxerolls elsewhere in the survey area. Haploxeroll map units are moderate in extent, comprising about 11.5 percent of the survey area. They are located in the upper parts of the foothill area from Ash Peaks Ridge to the base of Moro Rock, and east of Moro Rock on the lower slopes of the Middle Fork canyon of Kaweah River. Elevations range from about 670 to 1950 m. Mean annual soil temperatures range from about 10° to 17°. The soils support a dense chaparral or oak woodland cover.

The mean annual precipitation ranges from about 760 to 900 mm. Most of it falls as rain in the winter, but snow is not uncommon, particularly in the Middle Fork canyon east of Moro Rock. Because of the southerly aspects and relatively low elevations, snow melts quickly after falling. The soils

have xeric soil moisture regimes, thermic or mesic soil temperature regimes and support a dense cover of vegetation.

Under chaparral, the vegetation consists largely of chamise (Adenostema fasciculatum), with some buck brush (Ceanothus cuneatus), chaparral whitethorn (Ceanothus leucodermis) and California laurel (Umbellularia californica) in both shrub and tree form. On the south facing slopes of the Middle Fork canyon, the shrub cover also includes whiteleaf manzanita (Arctostaphylos viscida). Under oak woodland cover, canyon live oak (Quercus chrysolepis) is dominant. At higher elevations, these soils support some ponderosa pine (Pinus ponderosa), black oak (Quercus kelloggii), and bear clover (Chamaebatia foliolosa).

Following is a pedon profile description of an <u>example</u> of Haploxerolls located about 500 m northwest of Sycamore Spring - west of Ash Mountain Park Headquarters; semi-dense cover of chamise with annuals and bare ground in open areas; elevation - 680 m: (colors are for moist soil)

A -- 0 to 9 cm; very dark brown (10YR 2/2) coarse sandy loam; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and very fine roots; slightly acid; clear smooth boundary.

AB -- 9 to 26 cm; dark brown (10YR 3/3) coarse sandy loam; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots; slightly acid; clear wavy boundary.

Bt -- 26 to 70 cm; brown (10YR 4/3) coarse sandy loam; massive; hard, very friable, slightly sticky and nonplastic; common medium roots; thin clay films bridging sand grains; slightly acid; abrupt wavy boundary.

Cr -- 70 to 80+ cm; granitic gray, weathered granodiorite; rock fabric visible; with effort, crushes to coarse sand.

These soils range in depth from about 25 to 170 cm to underlying weathered rock. At shallowest depths, the underlying rock may be weathered or unweathered. Subsoil development, as shown in the example profile, may or may not be present. If absent, the surface soil may extend to the underlying lithic or paralithic contact, or may overlie parent material (subsurface soil) that extends to the underlying rock.

The surface soils range in thickness from about 25 to 60 cm; organic carbon content ranges from about 1 to 5 percent. Colors range from brown to dark grayish brown when moist; from brown to grayish brown when dry. Organic carbon content in the subsoils or subsurface soils is less than 1 percent. Subsoil or subsurface soil colors range from brown to dark yellowish brown when moist, and from yellowish brown to pale brown when dry. Surface soil and subsoil or subsurface soil textures range from loamy coarse sand to loam; angular pebble or cobble fragments are present in places, ranging from about 10 to 45 percent by volume. The reactions of these soils range from medium acid to neutral. They are normally more acid in the

surface than in the subsoil or subsurface soil. Base saturation is more than 50 percent to the depths of underlying rock.

HoF - Haploxerolls, mesic, very steep. This moderately extensive map unit comprises about 6.5 percent of the survey area. It is confined to the upper foothill region and consists of 6 delineations, 5 of which are located in protected draws and ravines on the easterly slopes of Ash Peaks Ridge. The sixth and largest delineation is located on the lower, southerly slopes of the Middle Fork canyon of the Kaweah River from Panther Creek upstream to the vicinity of Sugar Bowl Dome. Elevations range from about 1090 to 1950 m.

These soils have formed in residuum from granodiorite rock and in colluvium from similar kinds of rock accumulated on river and small stream canyon slopes with gradients ranging from about 50 to 70 percent. The soils are similar to the example of Haploxerolls described on page 46, including the wide range allowed in surface and subsoil characteristics. However the soil temperature regime ranges only from about 11° to 14° C.

The dominant vegetation consists of both dense chaparral and dense oak woodland as described for the Haploxerolls great group.

This map unit consists of about 70 percent Haploxerolls, mesic. The balance includes: areas of Entic and Pachic Xerumbrepts at higher elevations on northwesterly facing colluvial slopes in the Middle Fork canyon; areas of Haploxerolls, mesic, with surface slopes in excess of 75 percent; areas of Ultic Haploxeralfs on lower lying, less steep slopes of the Middle Fork canyon, and widely distributed Jointed granitic outcrops.

HoG - Haploxerolls, mesic, extremely steep. This map unit comprises about 1 percent of the survey area. It occurs in 2 delineations; one near Frys Point; the other on southerly slopes just below Moro Rock. Elevations range from about 970 to 1700 m. Portions of the unit at lower elevations are in a deep ravine northwest of Frys Point. These soils have formed in residuum and colluvium weathered from granite and granodiorite rocks. Surface slopes are in excess of 75 percent.

The soils are similar to the Haploxerolls great group described on page 46. Mean annual soil temperatures range from about 12° to 14°C.

The vegetation consists of areas of dense chaparral, principally chamise (A. fasciculatum), and areas of dense oak woodland, principally canyon live oak (Q. chrysolepis). In the higher parts of the delineation below Moro Rock, incense cedar (Calocedrus decurrens) and ponderosa pine (P. ponderosa) grow in protected ravines such as seen near Big Fern Spring on the Generals Highway.

This map unit consists of about 70 percent Haploxerolls on slopes in excess of 75 percent, 20 percent Haploxerolls on slopes ranging from about 60 to 75 percent, and 10 percent Jointed granitic outcrops.

HoaF - Haploxerolls, mesic, mafic, very steep. This map unit is very limited in extent comprising only about 0.1 percent of the survey area. It occurs as a single delineation in the headwaters of Elk Creek northwest of Panorama Point. It has a southerly aspect and ranges in elevation from about 1400 to 1620 m.

The soils have formed in residuum and colluvium from the weathering of diorite or metamorphosed diorite rocks. Surface slopes range from about 40 to 60 percent. The soils are similar in profile to the example given for Haploxerolls on page 46, but lack subsoil development. The dark colored surface soils are thick and extend to the underlying weathered rock at depths ranging from about 50 to 100 cm, or overlie parent colluvium at depths in excess of 50 cm. The textures are sandy loam or fine sandy loam. The mean annual soil temperatures range narrowly from about 12° to 13°C.

The vegetation consists of shrubs, oaks and scattered conifers. The shrubs are largely bear clover (C. foliolosa) and whiteleaf manzanita (A. viscida); the oaks are black oak (Q. kelloggii) and canyon live oak (Q. chrysolepis). The conifers are yellow pine (P. ponderosa).

This map unit consists of about 80 percent Haploxerolls, mafic, with inclusions of Ultic Haploxeralfs, mafic, and scattered outcrops of diorite or meta-diorite.

Hobf - Haploxerolls, mesic-Jointed granitic outcrop association, very steep. This map unit comprises about 0.4 percent of the survey area. It exists as a single delineation on the crest and slopes of a spur ridge connecting Ash Peaks Ridge and Frys Point. Elevations range from about 1100 to 1450 m; the lower elevations are in protected ravines or on east facing slopes. The mean annual soil temperatures range from about 12° to 14°C.

It was not practical to map the principal components of this unit separately. The rock outcrop component is irregularly distributed throughout the single delineation. The surface slopes of the soils range from about 40 to 70 percent. The side slopes of the ridge are deeply incised by a series of near parallel or slightly diverging streamways.

The soils have formed in residuum and colluvium weathered mainly from granodiorite. The Haploxerolls are similar to the example given on page 46, the Jointed granitic outcrops are similar to their description given on page

The vegetation on the soils consists mainly of a semi-dense cover of chamise (A. fasciculatum). Annual grasses and forbs or bare ground is found in the openings. In protected draws and on narrow, north-facing slopes there is a dense cover of canyon live oak (Q. chrysolepis) and some California laurel (U. californica). Chamise grows from some joints in the rock outcrops.

The Haploxerolls comprise about 55 percent of the unit; the Jointed granitic outcrop about 25 percent. Included in the unit are small areas of

both shallow and deep Typic Xerorthents, mesic, and a scattering of large, detached boulders of the parent rock.

HobG - Haploxerolls, mesic-Jointed granitic outcrop association, extremely steep. This map unit comprises about 0.6 percent of the survey area and occurs in 3 delineations. One is located northwest of Frys Point, the second is west of Amphitheater Point, and the third is northwest of Moro Rock. Elevations range from about 1100 to 1950 m. The mean annual soil temperatures range from about 10° to 14°C.

It was not practical to map the principal components to this unit separately. The surface slopes of the soils are mainly in excess of 75 percent and have westerly or southwesterly aspects, except in the delineation west of Amphitheater Point where they are easterly. The soils have formed mainly in colluvium and in some residuum both weathered from the local granitic rock. This is largely granite in the Frys Point delineation, and granodiorite in the other delineations. The Haploxerolls are similar to the example given on page 46. The Jointed granitic outcrop is similar to its description given on page

The vegetation on the soils, and growing from some rock joints, consists of a dense cover of chamise (A. fasciculatum), canyon live oak (Q. chrysolepis) and California laurel (U. californica) in the areas near Frys Point and Amphitheater Point. Canyon live oak, California laurel, some black oak (Q. kelloggii) and bear clover (C. foliolosa) are in the area near Moro Rock. The vegetation canopy obscures some of the rock outcrops.

The Haploxerolls comprise about 45 percent of the unit; the Jointed granitic outcrop about 35 percent. Included are lesser areas of both shallow and deep Typic Xerorthents, mesic, and large, detached and tumbled boulders in the Frys Point delineation. Near Moro Rock, the delineations have inclusions of Ultic Haploxeralfs, mesic, Typic Xerochrepts, mesic, and areas of Unjointed granitic outcrops.

HodG - Haploxerolls, mesic-Jointed limestone outcrop association, extremely steep. This map unit comprises about 0.4 percent of the survey area. It occurs in a single delineation on the east side of Deep Canyon just south of Marble Falls. Elevations range from about 1050 to 1700 m. The surface slopes are mainly in excess of 75 percent. Several plunging interfluves within the delineation produce both northwesterly and southeasterly aspects. The mean annual temperatures of the soil component range from about 11° to 14°C, depending upon elevation and aspect.

It was impractical to map the two dominant components of this unit separately. The Haploxerolls have formed mainly in colluvium weathered from the marblized limestone country rock. They are similar to the example described on page 46, but differ in having formed from marblized limestone parent material. Surface and subsurface or subsoil textures range from sandy loam to loam. In places, rock fragments are in excess of 35 percent by volume. The Jointed limestone outcrops (marblized, light gray limestone) present an irregular and ragged appearance with many vertical cliff-like exposures facing Deep Canyon. The outcrops are well jointed and exhibit

marks of weathering or solution-pitting. Many large, irregularly shaped boulders, spalled from the outcrops, are obscured by vegetation.

The vegetation is dense on the Haploxerolls and consists mainly of canyon live oak (Q. chrysolepis) and California Laurel (U. californica). Some black oak (Q. kelloggii) grows above about 1500 m elevations. At lower elevations, there is some chamise (A. fasciculatum), and on protected, cooler slopes, as well as at higher elevations, there is some ground cover of bear clover (C. foliolosa). Some trees and shrubs have found a foothold in joints of the limestone outcrops. Some Yucca (Yucca whipplei caespitosa) grows in near association with the limestone outcrops.

The Haploxerolls comprise about 50 percent of this map unit; the Jointed limestone outcrops about 35 percent. Included in the unit are small areas of Typic Xerochrepts, mesic, and outcrops of mica schist and granodiorite.

HoeG - Haploxerolls, mesic-Jointed mafic outcrop association, extremely steep. This map unit comprises about 0.3 percent of the survey area. It occurs in a single delineation located north of Panorama Point on the east facing slopes of Deep Canyon. The unit extends from the crest of Ash Peaks Ridge down almost to the channel of the Marble Fork. Surface slopes are mainly in excess of 75 percent. Many minor drainageways have incised the area producing a dendritic pattern of plunging interfluves having northerly and southerly aspects. Elevations range from about 1000 to 1600 m. Mean annual soil temperatures range from about 11° to 14°C depending upon elevation and aspect.

It was impractical to map the principal components of this unit separately. The soils have formed in stabilized colluvium on the slopes and in some residuum both weathered from diorite rock. The Haploxerolls are similar to the example described on page 46. Textures range from sandy loam to loam. Some areas lack significant rock fragments in the soil, others may have as much as 40 percent by volume. The Jointed mafic outcrop is similar to the unit described on page 62. Most of the outcrop occurs in irregular areas of varying size above about 1200 m elevation. Most of these are smooth exposures of low local relief.

The vegetation on the soils is a dense cover of canyon live oak (Q. chrysolepis) and California laurel (U. californica) with some shrubs at higher elevations. The latter consist mainly of chamise (A. fasciculatum) and white leaf manzanita (A. viscida). Some snowbush (C. cordulatus) and bear clover (C. foliolosa) grow along the ridge crest.

The Haploxerolls comprise about 45 percent of the unit; the Jointed mafic outcrop about 40 percent. Included are areas of Typic Xerochrepts, mesic, as well as shallow Typic Xerorthents, mesic, and small outcrops of granodiorite and mica schist.

HofF - Haploxerolls, thermic-Jointed granitic outcrop association, very steep. This map unit comprises about 1.7 percent of the survey area. It occurs in 2 delineations, one located west of Frys Point, and the other surrounding Cactus Point. The surface terrain is rough, uneven, and studded

by many large outcroppings of granitic rock - a named component of the unit. The slopes of the soil component range mainly from about 45 to 75 percent and have aspects in all quadrants of the compass. Many small drainageways deeply incise these very steep slopes. Elevations range from about 670 to 1200 m. Mean annual soil temperatures range mainly from about 15° to 17°C.

It was impractical to map the principal components of the unit separately. The soils have formed in stabilized colluvium and in residuum both weathered from granodiorite and granite. The pedon selected to characterized Haploxerolls is located in this map unit (see page 46) and is representative of the soil Surface, subsurface textures, and subsoil textures where subsoils have formed, range from loamy coarse sand to coarse sandy loam. Many areas are gravelly, cobbly, or stony; some lack coarse fragments within the profile, others have coarse fragments in excess of 35 percent by volume. Soil depths to weathered rock range from very deep to shallow. The Jointed granitic outcrops are similar to the map unit described on page 53.

The soils support a dense vegetation consisting mainly of chamise (A. fasciculatum) with some whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus). In protected ravines and along drainageways there are blue oak (Q. douglasii) and interior live oak (Q. islizenii). Canyon live oak (Q. chrysolepis) grows in the unit at higher elevations.

The Haploxerolls comprise about 45 percent of the unit and Jointed granitic outcrops about 35 percent. Included are scatterings of large, detached boulders, small areas of Typic Xerochrepts, thermic; Typic Xerorthents, thermic; and Ultic Haploxeralfs, thermic. On northerly aspects at higher elevations mesic Haploxerolls are also included.

<u>HofG - Haploxerolls, thermic-Jointed granitic outcrop association, extremely steep</u>. This map unit is very limited in extent, comprising only about 0.2 percent of the survey area. It occurs as a single delineation located west of Elk Creek on southerly and southeasterly facing slopes with gradients mainly in excess of 75 percent. Elevations range from about 975 to 1200 m. Mean annual soil temperatures range from about 15° to 16°C.

It was impractical to map the principle components of this unit separately. The soils have formed mainly in stabilized colluvium weathered from granodiorite. The Haploxerolls are similar to the example described on page 46, and except for steeper slopes, similar to map unit HofF described on page 52. Many of the outcrops are near vertical, cliff-like exposures.

The vegetation on the soils consists of a dense cover of chamise (A. fasciculatum), with clusters of canyon live oak (Q. chrysolepis) in protected sites. Some chamise and oak grow in rock joints.

The Haploxerolls comprise about 50 percent of the unit; the Jointed granitic outcrops about 40 percent. Included are: small areas of Typic Xerorthents, thermic; deep Mollisols with sandy clay loam subsoils; and a scattering of large, detached boulders.

Jg - Jointed granitic outcrop. This map unit is moderately extensive, comprising about 9 percent of the survey area. It consists of light-colored, irregularly shaped exposures and protuberances of virtually unweathered or slightly weathered granitic rock ranging from granodiorite to granite. A prominent feature of these outcrops is the frequency of both vertical and horizontal joints that separate these exposures into large, prominent blocks or strips.

To be included in this unit, outcrops must have vertical joints averaging less than 100 m apart in any joint set, that lack significant displacement of resultant rock strips or blocks where joint systems exist, The vertical joints should extend at least 2 m into the rock. The frequency of such jointing is considered to be important in the subsurface internal rock drainage of snow melt water or sheet flow of rainfall runoff across the rock surfaces.

There are numerous, separate delineations of this unit ranging in area from about 2 to more than 500 ha. They are widely distributed in the survey area from Cactus Point to Triple Divide Peak. Elevations range from about 1100 to 3850 m. Surface slopes range from nearly level to vertical. This miscellaneous area is also mapped as a dominant or subordinate part of various map units that are associations with different soils.

Included in this map unit are less than 20 percent Unjointed granitic outcrop, Granitic talus, and local soils shallow or very shallow to bedrock. A few shrubs and trees grow and survive in some joint openings at lower elevations. At higher elevations, alpine grasses and plants are not uncommon where the presence of seeping water and earth-filled joint cracks permit.

JgeF - Jointed granitic outcrop-Entic Ultic Haploxerolls, shallow, thermic association, very steep. This map unit comprises about 0.7 percent of the survey area. It is found in the foothill zone, and is mapped in 4 delineations that include, or are located near, Frys Point, Cactus Point, and Panorama Point. The very steep slopes have mainly westerly and southerly aspects; some are easterly and northerly. Slope gradients for the soils and much of the rock surfaces range from about 50 to 70 percent; in many places, the rock outcrops are nearly vertical cliffs or have slopes in excess of 75 percent. Elevations range from about 730 to 1460 m. Mean annual temperatures for the soil component of this unit range from about 15° to 17°C.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to its description given on page 53. The rock types range from granite to granodiorite. The Entic Ultic Haploxeroll component is similar to the Entic Ultic Haploxeroll taxonomic unit description on page 35, but is less than 50 cm in depth to underlying weathered granitic rock. The soils have formed in shallow residuum and shallow colluvium.

The soils in this unit support a dense cover of mainly chamise (A. fasciculatum). Included are riparian growths of interior live oak (Q.

wislizenii) and canyon live oak (Q. chrysolepis) along deeply incised stream canyons in some delineations.

Among the delineations of this unit, Jointed granitic outcrop comprises from 50 to 60 percent; the shallow Entic Ultic Haploxerolls comprise from 25 to 35 percent. Included in this unit are Entic Ultic Haploxerolls deeper than 50 cm or that have mesic soil temperature regimes. The latter are located at higher elevations on easterly or northerly slopes. Also included are shallow Typic Xerorthents and large boulders that have detached and tumbled from the nearly vertical cliff-like rock outcrops within the unit.

JghF - Jointed granitic outcrop-Haploxerolls, mesic association, very steep. This map unit is very limited in extent, comprising only about 0.1 percent of the survey area. It occurs in a single delineation located on a ridge crest east of Buck Creek and southwest of Sugar Bowl Dome. Slopes range from about 40 to 70 percent and have southerly aspects. Elevations range from about 1700 to 1800 m. The mean annual temperature for the soils in the unit is about 11°C.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to the description of this miscellaneous area on page 53. The rock type consists of granodiorite. The surfaces of the outcrops do not stand prominently above the surfaces of the soil component. The Haploxeroll component is similar to the Haploxeroll taxonomic unit description on page 46. It is limited for the most part to shallow Haploxerolls underlain either by weathered or unweathered rock at depths less than 50 cm. These soils lack subsoil (cambic horizon) development. A minor part of the Haploxerolls are deeper to the underlying rock. The soils have formed in either residuum or local colluvium.

A dense cover of whiteleaf manzanita (A. viscida) grow on the soils with clusters of canyon live oak (Q. chrysolepis) and black oak (Q. kelloggii) located in protected ravines.

The Jointed granitic outcrop comprises about 40 percent of the unit; the Haploxerolls comprise about 35 percent. An inclusion of Unjointed granitic outcrop occupies about 25 percent of the unit. It is an extremely steep cliff overlooking the lower reach of Buck Creek.

JghG - Jointed granitic outcrop-Haploxerolls, mesic association, extremely steep. This map unit comprises about 0.3 percent of the survey area. It consists of 3 delineations. Two are at or near the crest of Ash Peaks Ridge north of Frys Point, the third is southeast of Sugar Bowl Dome near where the Middle Fork Trail crosses the Kaweah River. The slopes of the rock surfaces and the soils are mainly in excess of 75 percent; aspects are southerly and easterly. Elevations range from about 1300 to 1800 m. The mean annual temperatures of the soils range from about 10° to 13°C.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to its description given on page 53. The rock type in mainly granodiorite. The Haploxeroll component is similar to the Haploxeroll taxonomic unit description given on

page 46. It is limited mainly to shallow Haploxerolls underlain by unweathered or weathered rock at depths less than 50 cm. In swales and in drainageways the soils are deeper and, in places, are very gravelly or cobbly throughout. For the most part, the Haploxerolls have formed in colluvium collected and stabilized in joints and declivities on these extremely steep slopes.

The soils support a semi-dense cover of chamise (A. fasciculatum) in the western delineations with scattered clusters of canyon live oak (Q. chrysolepis) and California laurel (U. californica). The shrub cover in the eastern delineation consists of whiteleaf manzanita (A. viscida) and greenleaf manzanita (A. patula) with scattered clusters of canyon live oak and black oak (Q. kelloggii). The oaks have also established themselves and survive in joints in the rock outcrops.

The Jointed granitic outcrops comprise from 60 to 70 percent of this unit; the Haploxerolls from 30 to 40 percent. Very minor areas of Granitic talus are included at the base of the slopes.

JgmF - Jointed granitic outcrop-Lithic Cryumbrepts, sandy-skeletal association, very steep. This map unit comprises about 0.8 percent of the survey area. It is mapped in 2 delineations in the upper watershed of Lone Pine Creek near Mt. Stewart and Lion Peak. The surface slopes, particularly of the soil component, range from about 50 to 75 percent; slopes of the outcrop surfaces are similar but include nearly vertical cliffs in places. The elevation ranges from about 2925 to 3535 m. Mean annual temperatures of the soils range from about -2° to 2°C; the lower temperatures are at high elevations and in shaded sites on northeasterly aspects.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to its description given on page 53. The rock type is mainly granodiorite. The principal joint sets strike northeasterly to southwesterly. The Lithic Cryumbrepts component is similar to the Lithic Cryumbrept taxonomic unit description given on page 66. It differs, however, from the representative pedon in having more than 35 percent by volume of rock fragments in the soil above its rock contact, and in ranging in texture from coarse sand to loamy coarse sand in its fine-earth fraction. The soils have formed principally in shallow colluvium weathered from the local country rock. Seepage of melt-water from lingering snow banks and glacierets in the north-facing cirques on Mt. Stewart variably moisten these soils during the late summer period (August-September) when soil temperatures are likely to be above 5°C. Some of these soils dry out during this time, others do not. This is reflected in the alpine vegetation.

Above Tamarack Lake, where melt-water seepage appears to be greatest, the soils support a dense cover of willow (Salix sp.). Elsewhere, the willow cover varies from semi-open to semi-dense and alpine plants such as buckwheat (Eriogonum sp.) and pussy paws (Calyptridium umbellatum) grow on drier sites.

The Jointed granitic outcrop component comprises about 60 percent of the unit; the Lithic Cryumbrepts, sandy-skeletal, about 20 percent. Included in this unit are lesser areas of Granitic talus, Granitic glacial rubble land, and Lithic Cryumbrepts with sandy, loamy, or loamy-skeletal soil material.

JgnD - Jointed granitic outcrop-Lithic Cryumbrepts, loamy association, sloping to steep. This map unit comprises about 2.5 percent of the survey area. Twelve delineations have been mapped, mainly in the alpine zone in the vicinities of Pear, Moose, and Tamarack Lakes, and in Table Meadows and the Tableland. The land surface is rough and rocky, but slopes are relatively gentle ranging from about 5 to 30 percent. Elevations range from about 2800 to 3400 m. Mean annual soil temperatures range from about -1° to 4°C; the lower temperatures are at high elevations and in shaded sites on northerly aspects.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to its description given on page 53. The rock type is mainly granodiorite. The joint system is complex. Separate joint sets intersect at obtuse and acute angles. The principal sets strike northeasterly, north, and northwesterly. Frost wedging has displaced and scattered many angular stones and boulders across the rock surfaces. The Lithic Cryumbrepts, loamy, are similar to the Lithic Cryumbrepts taxonomic unit description on page 66. The soils have formed in some shallow residuum, but mainly in colluvium or local alluvium shallowly accumulated in complex joint traces or irregular depressions in the country rock from which the soil material has weathered. Seepage of melt-water from lingering snow deposits irregularly moistens areas of these soils during the short spring/summer period. The surfaces of some of the soils are littered with angular cobbles and stones.

At the lower elevations, a scattering of lodgepole pine (Pinus contorta murrayana), western white pine (P. monticola), and occasional western juniper (Juniperus occidentalis) find foothold, along with perennial grasses, in the shallow soils or in soil-filled joint cracks in rock surfaces. The soils in most of this unit are above the krumholz line and they support only a variety of alpine shrubs and plants, many of which produce colorful flowers in season. Willow is found in the more moist sites. Many areas of the soils, where relatively moist, support a dense growth of hair grass (Deschampsia sp.) and other grasses, that collectively have developed a sodded condition. Frost heaving has modified the sod development and grass growth into irregular polygonal patterns.

The Jointed granitic outcrop comprises from 55 to 65 percent of the unit delineations; the Lithic Cryumbrepts, loamy, from about 20 to 30 percent. Included are many scattered areas of Cryaquepts in rock basins or along small, sluggish drainageways. Associated with some of these wet areas are smaller areas of organic soils. Also included are areas of Entic Cryumbrepts and loamy-skeletal Lithic Cryumbrepts.

JgnF - Jointed granitic outcrop-Lithic Cryumbrepts, loamy association, very steep. This unit comprises about 4.4 percent of the survey area. It is located partly in the subalpine zone, but mainly in the alpine zone.

Twenty separate delineations have been mapped from the vicinities of Heather Lake and Alta Meadow eastward to Lone Pine Canyon. Surface slopes range from about 35 to 75 percent. Elevations range from about 2500 to 3350 m. The lowest elevations are on a north facing slope in Lone Pine Canyon, the highest is adjacent to the Tableland north of Moose Lake. Mean annual soil temperatures range from about 0° to 4°C.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to its description given on page 53. The rock type is mainly granodiorite. The Joint system controlling outcrop fracture is complex. Joint sets strike mainly northeast and north; some strike northwest. Frost wedging has displaced and scattered many angular stones and boulders across the rock surface. The Lithic Cryumbrepts, loamy, are similar to the Lithic Cryumbrepts taxonomic unit description given on page 66. The soils have formed mainly in shallow colluvial accumulations on uneven rock surfaces and in joint traces. The parent material of these soils has weathered from the country rock. Surfaces of these soils are often littered with angular cobbles and stones.

At lower elevations, the soils support an open to very open stand of western white pine (P. monticola) and red fir (A. magnifica) and a few lodgepole pine (P. contorta murrayana). In these sites, there is some shrub understory of pinemat manzanita (A. nevadensis) and snowbush (C. cordulatus). At higher elevations, the soils support varying densities of alpine shrubs and plants. Willow (Salix sp.) grows more densely where there are seepages of water or ephemeral streamlets. Much of the soil surface is bare.

The Jointed granitic outcrop comprises from 50 to 70 percent of the map unit delineations; Lithic Cryumbrepts, loamy, from about 20 to 30 percent. Included are small areas of Cryaquepts, Granitic talus, Entic Cryumbrepts in deeper colluvium, Typic Cryofluvents, and Lithic Cryorthents.

<u>JgnG - Jointed granitic outcrop-Lithic Cryumbrepts, loamy association, extremely steep</u>. This map unit comprises about 0.7 percent of the survey area. It occurs in two delineations. One is located west of Heather Lake, the second and largest delineation is located in Buck Canyon east of Moose Lake. The surface slopes are mainly in excess of 75 percent. In Buck Canyon, portions of the outcrop component consist of rock pinnacles and nearly vertical cliffs. Elevations range from about 2680 to 3050 m. Mean annual soil temperatures range from about 1° to 3°C, depending upon elevation and aspect. The relatively cooler sites are at the highest elevations, or are on protected, northerly facing slopes at lower elevations.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop component is similar to its description given on page 53. The rock type is primarily granodiorite. Intersecting joint sets trending northeasterly and northwesterly tend to control the development and orientation of the stepped, cliff-like rock exposures in Buck Canyon. The Lithic Cryumbrepts, loamy, are similar to the Lithic Cryumbrept taxonomic unit description given on page 66, and to its

representative pedon description. The soil textures range from gravelly or cobbly loamy coarse sand to gravelly or cobbly coarse sandy loam. For the most part, these soils have formed in colluvium weathered and locally transported from the granitic country rock.

The soils support a semi-open to semi-dense cover of alpine plants, including perennial grasses. Clusters of willow (Salix sp.) grow on relatively less steep parts of the canyon slopes where seepage waters are concentrated. West of Heather Lake, the soils support a scattering of western white pine (P. monticola) and red fir (A. magnifica) with some understory of pinemat manzanita (A. nevadensis) and chinquapin (C. sempervirens).

The Jointed granitic outcrop component comprises about 65 percent of this unit. The Lithic Cryumbrepts, loamy, comprise about 25 percent. Included in the unit are: small areas of the subordinate component with surface slopes less than 75 percent; small areas of Typic Cryorthods; and Lithic Cryumbrepts with very gravelly or very cobbly loamy coarse sand or coarse sandy loam textures.

JgoF - Jointed granitic outcrop-Lithic Xerumbrepts, frigid association, very steep. This map unit comprises about 0.2 percent of the survey area. It has been mapped in 3 delineations located southeast of Wolverton and in Tokopah Valley just below Tokopah Falls. The surface slopes range from about 30 to 70 percent. Slope aspects occur in all quadrants of the compass. Some of the rock outcrop areas exist as near vertical cliffs. Elevations range from about 2130 to 2440 m. The mean annual temperatures range from about 5° to 8°C. Mean summer soil temperatures are warm.

It was impractical to map the named components of this map unit separately. The Jointed granitic outcrop is similar to its description given on page 53. the rock type is primarily granodiorite. The closely spaced joint sets are primarily oriented in a northeasterly direction. In places, finer fracturing of the rock and frost wedging has littered some of the rock surfaces with angular cobble and stone-sized blocks. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. The pedon described as representative is located in this unit. The soils have formed in colluvium and some residuum weathered from the local granodiorite rock.

The soils support a semi-dense cover of shrubs and scattered clusters of conifers. Some conifers have secured a foothold in earthfilled joints in areas of the rock outcrops. The shrubs consist of mainly greenleaf manzanita (A. patula), pinemat manzanita (A. nevadensis), with some snowbush (C. cordulatus) and chinquapin (C. sempervirens). The conifers consist of Jeffrey pine (P. jeffreyi) and red fir (A. magnifica).

The Jointed granitic outcrop component comprises from 50 to 60 percent of the map unit, lesser extents being in the Tokopah Valley delineation. The Lithic Xerumbrepts comprise about 30 percent of the unit. Included are areas of Entic Xerumbrepts formed in deeper colluvial deposits, and areas of Unjointed granitic outcrop.

JgpD – Jointed granitic outcrop-Lithic Xerumbrepts, mesic association, sloping to steep. This map unit comprises about 0.3 percent of the survey area. It has been mapped in two delineations. Both are in the Giant Forest area; one includes Sunset Rock, the other lies west of Crescent Meadow. Surface slopes range from about 5 to 30 percent with aspects in all quadrants of the compass. Elevations range from about 1830 to 2060 m. The mean annual temperature of the soils ranges from about 9° to 10°C.

It was impractical to map the named components of this unit separately. The Jointed granitic outcrop is similar to its description given on page 53. The average spacing of vertical jointing ranges mainly from about 25 to 50 m. Shallow, horizontal, but slightly curved jointing at depths of 0.5 to 1 m has produced a gentle, domed appearance to some of the outcrops. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71, but differ mainly from the representative pedon in having a mesic soil temperature regime. The soils have formed in residuum and some colluvium weathered from the local granitic rock.

The soils support a semi-open to semi-dense cover of shrubs and clusters of conifers. Open areas of soil are covered with thin litter, or support sparse grasses and forbs. The shrubs are greenleaf manzanita (A. patula) and snowbush (C. cordulatus). The conifers are Jeffrey pine (P. jeffreyi), sugar pine (P. lambertiana), incense cedar (C. decurrens), and white fir (A. concolor). Some conifers and shrubs have become established and survive in earth filled joints of the rock outcrops.

The Jointed granitic outcrop comprises 60 percent of the unit; the Lithic Xerumbrepts 20 percent. Included are smaller areas of Entic Xerumbrepts, and shallow to moderately deep, moderately coarse textured soils with weakly developed subsoils and with thin, dark colored surface soils. All parts of these latter soils have base saturation less than 60 percent.

JgpF – Jointed granitic outcrop-Lithic Xerumbrepts, mesic association, very steep. This map unit comprises about 1.2 percent of the survey area. Six delineations of the unit have been mapped from the Giant Forest area east to Mehrten Creek. The soils and outcrops, for the most part, have surface slopes ranging from 30 to 70 percent. Elevations range from about 1700 to 2680 m. At the higher elevations, areas of this map unit occupy south facing slopes in the Middle Fork canyon of the Kaweah River. Mean annual soil temperatures range from about 8° to 10.5°C. The lower temperatures are associated with the higher lying soil areas on the south facing slopes.

It was impractical to map the named components of this map unit separately. The Jointed granitic outcrop is similar to the description given on page 53. The joint system fracturing the outcrops is complex. The sets of joints provide frequent parting in the outcrops but are not as prominent as in the subalpine and alpine zones. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. They differ mainly from the representative pedon in having a mesic soil temperature regime. The soils have formed principally in stabilized colluvium and in some residuum weathered from the local granitic rock.

The soils support a semi-dense cover of shrubs, conifers, and a few oaks. Open areas of soil are thinly covered with litter or support a sparse grass and forb growth. The shrubs are mainly greenleaf manzanita (A. patula) with some pinemat manzanita (A. nevadensis) and snowbush (C. cordulatus) at higher elevations within the unit. The conifers are principally Jeffrey pine (P. jeffreyi) with some white fir (A. concolor). Scattered red fir (A. magnifica) grow at the higher elevations. Black oak (Q. kelloggii) grows at lower elevations. Some shrubs and conifers have become established and survive in large joints in the outcrop areas.

Among the delineations, Jointed granitic outcrop comprises from about 40 to 55 percent of the unit: Lithic Xerumbrepts comprise about 30 to 40 percent. Included are smaller areas of shallow and moderately deep, moderately coarse textured soils lacking subsoil development. They have thin, dark colored or pale colored surface soils and have a base saturation of less than 60 percent. Also included are small areas of Pachic Xerumbrepts that support denser conifer covers.

JgpG - Jointed granitic outcrop-Lithic Xerumbrepts, mesic association, extremely steep. This map unit comprises about 0.8 percent of the survey area. It is mapped in two delineations, both of which are traversed by portions of the High Sierra Trail along the southerly facing slopes of the Middle Fork Canyon. One lies east of Moro Rock and includes Eagle View; the other lies northwest of Little Blue Dome. Surface slopes are mainly in excess of 75 percent. Elevations range from about 1340 to 2560 m. Mean annual soil temperatures range from about 13° down to about 8°C depending upon elevation.

It was impractical to map the named components of this map unit separately. The Jointed granitic outcrop is similar to its description given on page 53. Intersecting joint sets strike northerly and northwesterly. Most exposures of the granitic rock are subdued with few prominent protuberances. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. They differ mainly from the representative pedon in having a mesic soil temperature regime. The soils have formed in stabilized colluvium weathered from the local granitic rock.

The soils support a semi-dense to dense cover of shrubs and clusters of conifers and oaks. Open areas consist of litter-covered bare ground, grasses and forbs. The shrubs consist of whiteleaf manzanita (A. viscida) with a predominance of greenleaf manzanita (A. patula) and bear clover (C. foliolosa) in portions of the unit at higher elevations. The conifers consist of yellow pine (P. ponderosa) at lower elevations, and Jeffrey pine (P. jeffreyi) and white fir (A. concolor) at higher elevations. Canyon live oak (Q. chrysolepis) is the dominant oak with black oak (Q. kelloggii) more prevalent at higher elevations. Some shrubs and conifers have become established and survive in large, joint cracks in the outcrop areas.

The Jointed granitic outcrop comprises about 60 percent of this unit; Lithic Xerumbrepts about 25 percent. Included are smaller areas of Entic Xerumbrepts, shallow, and Pachic Xerumbrepts.

Jgrf - Jointed granitic outcrop-Typic Xerorthents, shallow, mesic association, very steep. This map unit comprises about 0.5 percent of the survey area. It has been mapped in two delineations along the crests of both Ash Peaks Ridge and a spur ridge. Surface slopes of the soils and much of the outcrop range from about 60 to 75 percent; aspects are mainly southerly. Some outcrop areas are steeper and, in places, are cliff-like. Elevations range from about 1340 to 1650 m. Mean annual soil temperatures range from about 11° to 14°C, depending upon elevation.

It was impractical to map the named components of this map unit separately. The Jointed granitic outcrop is similar to its description given on page 53. Intersecting joint sets have northerly and northwesterly strikes. They are not clearly visible. Most of the cliff-like exposures follow these joint sets. The Typic Xerorthents, shallow, are similar to the Typic Xerorthents taxonomic unit description given on page 106. It differs from the representative pedon in having a mesic soil temperature regime. These soils have formed in residuum or stabilized colluvium weathered from local granitic rock. For additional information, see pp. 20-21 in Appendix I, and p. 10 in Appendix II - Section 7.0.

The soils support a semi-dense to dense cover of shrubs and widely scattered conifers and oaks. The shrubs consist mainly of chamise (A. fasciculatum) and some whiteleaf manzanita (A. viscida). The conifers are ponderosa pine (P. ponderosa); the oaks are canyon live oaks (Q. chrysolepis) found clustered in some draws. Open areas of soil support some grasses and forbs or are bare ground with an erosion pavement of fine pebbles.

The Jointed granitic outcrop comprises about 40 percent of the unit; the Typic Xerorthents, shallow, about 30 percent. Included are lesser areas of: similar soils that have loamy coarse sand textures throughout; shallow Typic Xerochrepts; and Unjointed granitic outcrop.

JgsF - Jointed granitic outcrop-Typic Xerorthents, shallow, thermic association, very steep. This map unit comprises about 0.4 percent of the survey area. It is mapped in a single delineation on the southerly and easterly slopes of Ash Peaks Ridge west of Frys Point. Slopes range mainly from about 50 to 70 percent. Cliff-like exposures of outcrops have slopes in excess of 75 percent. Elevations range from about 850 to 1280 m. Mean annual soil temperatures range from about 15° to 16°C, depending upon elevation.

It was impractical to map the named components of the unite separately. The Jointed granitic outcrop is similar to its description given on page 53. Intersecting joint sets have northerly and northeasterly strikes. The cliff-like exposures follow the northeasterly striking joint sets. The Typic Xerorthents, shallow, are similar to the Typic Xerorthents taxonomic unit description given on page 106. These soils have formed in residuum or stabilized colluvium weathered from local granitic rock. For additional information, see pp. 20-21 in Appendix I, and p. 10 in Appendix II-Section 7.0.

The soils support a semi-dense to dense cover of shrubs and scattered clusters of oaks. The shrubs are mainly chamise (A. fasciculatum) with some whiteleaf manzanita (A. viscida). The oaks are canyon live oaks (Q. chrysolepis) that grow in protected draws within the unit.

The Jointed granitic outcrop comprises about 50 percent of the unit; the Typic Xerorthents, shallow, about 30 percent. Included are lesser areas of: Entic Haploxerolls; Entic Haploxerolls, shallow; soils similar to the Typic Xerorthents that either have loamy coarse sand textures, or have a mesic soil temperature regime. The latter occur at higher elevations on northerly facing slopes.

JhuF – Jointed limestone outcrop-Ultic Haploxerolls, thermic association, very steep. This map unit comprises about 0.3 percent of the survey area. It is mapped in a single delineation on a ridge between Elk Creek and Potwisha Campground on the Marble Fork. Surface slopes range from about 50 to 75 percent. Aspects are predominantly southwesterly and northwesterly. Elevations range from about 635 to 1000 m. Mean annual soil temperatures range from about 15° to 17.5°C., depending upon elevation.

It was impractical to map the named components of this unit separately. The Jointed limestone outcrop consists of rough, irregular, craggy exposures of gray to light gray, irregularly banded, marblized limestone. The outcrops are complexly fractured, and in many places stand forth as sharply angular protuberances. The frequent jointing affords many passageways for infiltering waters. The Ultic Haploxerolls are similar to the Ultic Haploxerolls taxonomic unit description given on page 116, but include only the shallower variations formed in residuum and colluvium weathered from the marblized limestone. For additional information, see pp. 24-25 in Appendix I, and p. 12 in Appendix II - Section 7.0.

The soils support a semi-open cover of chamise (A. fasciculatum) along with scattered growths of Yucca (Yucca whippleii caespitosa). Open areas of soil support annual grasses and forbs.

The Jointed limestone outcrop comprises about 50 percent of the unit; the Ultic Haploxerolls about 25 percent. Included are lesser areas of Typic Xerorthents, shallow and moderately deep formed from marblized limestone, gabbro-diorite, and granodiorite.

Jm – Jointed mafic outcrop. This miscellaneous area map unit comprises about 0.6 percent of the survey area. It has been mapped in four delineations in the subalpine and alpine zones, distributed from the Tableland to the vicinities of Elizabeth Pass, Kaweah Gap, and Hamilton Lake. It consists of dark-colored, irregularly shaped exposures, cliffs, and protuberances of unweathered or slightly weathered, dark colored, gabbro-diorite or diorite rocks.

Elevations range from about 2620 to 3400 m. The rocks are prominently fractured by intersecting joint sets, mainly with northerly or northeasterly strikes. Northwesterly striking joint sets exist in the vicinity of Hamilton Lakes. Many lesser joints and fractures break the surface of

exposed rock into many angular stone-sized blocks. The average distance between vertical joints is substantially less than 100 m. This is considered to be an important feature in internal drainage of snow-melt waters or sheet flow from rainfall across the rock surface.

Vegetation is sparse to non-existent. Some alpine plants grow in joint cracks and small inclusions of soil bodies. In this unit, willow thickets cluster in places below talus slopes where the latter have accumulated and provide a fairly regular source of seepage waters.

Included in this unit are less than 20 percent talus from both granitic and dioritic rock. Also included are small areas of Lithic Cryumbrepts formed in local colluvium from the mafic rock.

JmxF – Jointed mafic outcrop-Lithic Cryumbrepts association, very steep. This map unit comprises about 0.2 percent of the survey area. It is mapped in two delineations near Hamilton Lake; the High Sierra Trail traverses both. Surface slopes of the soils range mainly from about 50 to 75 percent. Aspects are southerly to southwesterly. Elevations range from about 2620 to 3050 m. Mean annual soil temperatures range from about 2° to 5°C, depending upon elevation.

It was impractical to map the named components of this unit separately. The dark colored Jointed mafic outcrop is similar to its description given on page 62. The Lithic Cryumbrepts are similar to the Lithic Cryumbrepts taxonomic description given on page 66. They have formed in stabilized colluvium weathered mainly from local diorite rock. There is some admixture of colluvium from nearby granitic rock. The dark color of the soils is partly an inherited lithochromic characteristic from the diorite parent rock.

The soils support a semi-dense cover of shrubs with widely scattered conifers. The shrubs consist of willow (Salix sp.) in local areas relatively moist from seepage waters, and of snowbush (C. cordulatus) and chinquapin (C. sempervirens) on drier areas. The conifers are western juniper (Juniperrus occidentalis). Open areas of soil support various alpine plants.

The Jointed mafic outcrop comprises about 50 percent of the unit; the Lithic Cryumbrepts about 30 percent. Included are small areas of deeper Entic Cryumbrepts and talus of mixed rock composition.

Js – Jointed schistose outcrop. This miscellaneous area map unit is limited in extent. It comprises about 0.7 percent of the survey area. It is mapped separately in two delineations in the alpine zone along, or just below, the drainage divide between the Kings and Kaweah Rivers, and as a subordinant component in association with soils in the foothill zone.

It consists of barren exposures of brownish, metamorphosed sedimentary rock, mainly mica schist. Jointing is closely spaced and less prominent compared to the joint sets in granitic rock. The foliation of the rock is

mainly vertically oriented and, where parted by weathering, contributes to absorption of rain and melt water.

Vegetation is virtually nonexistent. Schistose outcrops comprise more than 80 per cent of this unit. Less than 20 percent consists of Jointed granitic outcrop and small areas of talus.

L - Lake. In the subalpine and alpine areas, small unnamed lakes larger than about 0.5 ha have been delineated and identified by the italicized symbol L. Named lakes have also been delineated and identified by name.

All lakes are water filled rock basins fed by ephemeral or established streams. For the most part, the basins have been formed by past glacial scouring. Some, such as Tamarack Lake, are partially dammed by morainal material. Most lakes are undergoing a slow process of filling with mineral detritus carried in by sheet-wash from surrounding rock surfaces and by inflowing streams. Small deltaic deposits often develop where the latter enter the lakes. Small talus cones have also partially filled some lakes in the alpine zone.

Lithic Cryorthents

This subgroup includes shallow, pale colored, somewhat excessively to excessively drained soils with only incipient profile horizonation. They form on very steep slopes in both colluvium and residuum weathered from granitic rock. Although widely distributed, they comprise only a small part of the survey area in the subalpine and alpine zones. They are not of sufficient contiguous extent to constitute a dominant component in more than one recognized map unit. Bodies of these soils are frequently found as inclusions in other map units.

These soils range in elevation from about 2650 to 3550 m. Mean annual soil temperatures range from about 0° to 4.5°C. Mean annual precipitation ranges from about 1016 to 1270 mm, most of which falls as snow during the winter. Periodic thunderstorms provide erratic rainfall increments during the summers.

The soils support a sparse cover of perennial grasses, subalpine and alpine plants and shrubs, and scattered conifers in the subalpine zone. The latter consist of western white pine (Pinus monticola), foxtail pine (Pinus balfouriana), whitebark pine (Pinus albacaulis), and red fir (Abies magnifica).

Typically, these soils are very acid and low in organic matter content. They have thin, sandy to moderately coarse textured, brown surface soils overlying similar textured, lighter colored subsurface soils that rest abruptly on slightly weathered granitic rock at depths less than 50 cm. Angular rock fragments are common in and on the surface of these soils.

Following is a profile description of a representative pedon located about 450 m east of the mouth of Emerald Lake at an elevation of about 2950 m; southwest facing slope, 55 percent; open stand of western white pine with

a semi-open understory of chinquapin: (colors are for dry soil unless otherwise noted)

A -- 0 to 5 cm; brown (10YR 5/3) very gravelly loamy coarse sand, dark brown (10YR 3/3) moist; single grain; loose, very friable to loose, nonsticky and nonplastic; very few fine roots; 35 percent pebbles be volume; extremely acid (pH 4.3); abrupt wavy boundary.

Bw1 -- 5 to 30 cm; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 3/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; 35 percent pebbles by volume; very strongly acid (pH 4.5); clear smooth boundary.

Bw2 -- 30 to 43 cm; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; 40 percent pebbles by volume; very strongly acid (pH 5.0); very abrupt wavy boundary.

2R -- 43 to 50+ cm; light gray, slightly weathered granodiorite.

The soil textures throughout the profiles of these soils range from loamy coarse sand to coarse sandy loam. They are usually very gravelly, particularly where textures are loamy coarse sands. The pebbles are angular fragments of granitic rock. Varying amounts of cobble - and stone - sized rock fragments may be present.

The surface soils range in thickness from about 3 to 25 cm; in color from brown to grayish brown. The horizons below the surface soils may be either C horizons or morphologic color B horizons. The latter have sandy textures and brighter chromas, moist or dry, in comparison to the underlying, slightly weathered granitic rock, or to an underlying C horizon above the rock contact. The chromas of the C horizons, where encountered, and that of the underlying rock are similar. Both have colors ranging from light gray to pale brown. These soils are very strongly to extremely acid.

<u>LcbF - Lithic Cryorthents-Entic Cryumbrepts association, very steep</u>. This map unit comprises about 0.4 percent of the survey area. It has been mapped in two delineations. One lies west of Tamarack Lake, the other along the survey boundary northwest of Elizabeth Pass. Surface slopes range from about 30 to 70 percent. Aspects are mainly southerly. Elevations range from about 2650 to 3550 m. Mean annual soil temperatures range from about 0° to 4.5° C, depending upon elevation.

It was impractical to map the named components in this unit separately. The Lithic Cryorthents are similar to the Lithic Cryorthents taxonomic unit description given on page 64. The soils in the delineation northwest of Tamarack Lake have formed mainly in stabilized colluvium, while those soils in the delineation northwest of Elizabeth Pass have formed in both stabilized colluvium and residuum from local rock weathering. The deeper Entic Cryumbrepts are similar to the Entic Cryumbrepts taxonomic unit description given on page 29.

These soils support an open cover of alpine plants, shrubs and scattered conifers. The shrubs grow at lower elevations in this map unit and consist primarily of chinquapin (C. sempervirens) and pinemat manzanita (A. nevadensis). The conifers are mainly western white pine (P. monticola) with occasional red fir (A. magnifica) and, at timber line, a few foxtail pine (P. balforriana) and whitebark pine (P. albacaulis). Alpine plants grow above this line. There are extensive areas of bare soil throughout the unit. There areas usually exhibit a thin erosion pavement of pebbles.

The Lithic Cryorthents comprise about 40 percent of the unit; the Entic Cryumbrepts about 35 percent. Included in the unit are: areas of shallow, sandy soil that may be nongravelly or gravelly; areas of Lithic Cryumbrepts; small bodies of talus; and scattered areas of Jointed granitic outcrop.

Lithic Cryumbrepts

This subgroup of soils includes shallow and very shallow, dark colored, well to somewhat excessively drained soils formed in granitic rock colluvium accumulated on rock surfaces and in very complex systems of jointing associated with large areas of granitic rockland. These soils are cold and moist in the winter, and may be frozen for short periods. They are cool and dry for appreciable periods in the summer.

These soils comprise about 5 percent of the survey area and are widely distributed in the subalpine and alpine zones. Elevations range from about 2300 to 3420 m. At the lower elevations, the soils are located in canyons under the influence of cold, down-canyon air drainage. Mean annual soil temperatures range from about -1°C to 6°C, depending upon elevation and aspect, and mean summer soil temperatures are less than 15°C. Mean annual precipitation ranges from about 1020 to 1270 mm, most of which falls as winter snow. Periodic and scattered rainfall may occur during the summer from thunderstorms, but it seldom moistens the soil below about 10 cm.

The soils support a variety of subalpine and alpine plants, including hair grass (Deschampsia sp.), rock brake (Cryptogramma sp.), hens and chickens (Dudleya sp.), buckwheat (Eriogonum sp.) and shrubs including willow (Salix sp.), pinemat manzanita (Arctostaphylos nevadensis), chinquapin (Castanopsis sempervirens), and snowbush (Ceanothus cordulatus). In places, where favored by fractures in the underlying rock, there are scattered conifers. These include red fir (Abies magnifica), western white pine (Pinus monticola), lodgepole pine (Pinus contorta murrayana), and occasional western juniper (Juniperus occidentalis). The cover density and kinds of plants range from open with much bare ground exposed to semi-dense, depending upon local sources of moisture. There are dense covers of willow in moist sites.

Typically, these soils are grayish brown to brown, gravelly to stony, coarse or moderately coarse textured, strongly acid, and moderately high in organic matter. They are underlain at depths less than 50 cm by slightly weathered granitic rock.

Following is a profile description of a representative pedon located about 150 m northeast of the mouth of Emerald Lake at an elevation of about

2840 m; colluvial fill in a wide fractured channel in granitic rock; south facing slope, 3 percent; mean annual soil temperature about 3.5°C: (for additional information, see Appendix I, pp. 44-45; Appendix II, p. 22-Section 7.0; colors are for dry soil unless otherwise noted)

A1 -- 0 to 5 cm; grayish brown very gravelly loamy coarse sand, very dark grayish brown, moist; very weak fine granular structure; loose, loose to very friable, nonsticky and nonplastic; many very fine and common fine roots; thin fine gravel erosion pavement on surface; strongly acid; abrupt wavy boundary.

A2 -- 5 to 23 cm; yellowish brown gravelly coarse sandy loam, very dark grayish brown, moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; few or no roots in horizon, many fine roots at rock contact; strongly acid; very abrupt smooth boundary.

2R -- 23 to 50+ cm: slightly weathered granodiorite, unjointed within the pedon.

These soils range in depth from about 10 to 50 cm to the underlying granitic rock which may be closely jointed or unjointed locally. They range in color from grayish brown, dark brown to brown when dry; dark gray, very dark grayish brown or dark brown when moist. Organic matter contents range from about 3 to 10 percent. Textures range from loamy coarse sand to coarse sandy loam. Rock fragments modifying the texture class range in size from more than 2 mm to 1 m; they range in volume percent of the soil mass from about 15 to 50 percent. The soil reaction ranges from strongly to extremely acid, and base saturation is substantially less than 50 percent throughout the soil.

LucD - Lithic Cryumbrepts, sloping to steep. This map unit is very limited in extent, comprising less than 0.1 percent of the survey area. It has been mapped as two small delineations occupying parts of two small drainages in the vicinity of Pear Lake. Surface slopes, with aspects mainly northeasterly and southwesterly, range from about 5 to 30 percent; some parts are nearly level. Elevations range from about 2800 to 2960 m. Mean annual soil temperatures range from about 1.5° to 3°C.

The soils are similar to the Lithic Cryumbrepts taxonomic unit description given on page 66. However, because of the position of the delineations of this map unit, the soils are somewhat more moist from seepage waters than usual for similar soils on steeper slopes. For this reason, the soils are somewhat darker and have higher organic matter contents than the soil of the representative pedon. Subsurface textures range from fine gravelly coarse sandy loam to very gravelly coarse sandy loam.

These soils support a semi-dense cover of grasses, shrubs and some conifers. The grasses are hair grass (Deschampsia sp.), the shrubs are willow (Salix sp.) in relatively wetter sites, and chinquapin (C.

sempervirens) on locally drier sites. The conifers are mainly lodgepole pine (P. contorta murrayana) with some red fir (A. magnifica).

The Lithic Cryumbrepts comprise about 70 percent of the unit. Included are small wet spots and meadows of Cryaquepts, deeper Entic Cryumbrepts, and scatterings of large boulders and exposures of Jointed granitic outcrop.

LucF - Lithic Cryumbrepts, very steep. This soil map unit is limited in extent, comprising only about 0.1 percent of the survey area. It is mapped in a single delineation north of Aster Lake. Surface slopes range from about 40 to 60 percent; aspects are mainly northerly. Elevations range from about 2680 to 2770 m. Mean annual soil temperatures range narrowly from about 3.5° to 4.5°C.

The soils are similar to the Lithic Cryumbrepts taxonomic unit description given on page 66. They are somewhat excessively drained. The subsurface textures are consistently very gravelly coarse sandy loams.

The soils support a semi-open cover of widely spaced, old growth conifers, and a sparse understory of subalpine plants such as lupine (Lupinus sp.). The conifers are red fir (A. magnifica) and western white pine (P. monticola).

Lithic Cryumbrepts comprise about 60 percent of the unit. Included are lesser, scattered areas of Jointed granitic outcrop, Entic Cryumbrepts, Typic Cryorthents, and both shallow and deeper soils that have thin, dark colored surface soils and are sandy textured throughout.

LueD - Lithic Cryumbrepts-Entic Cryumbrepts association, sloping to steep. This soil map unit comprises about 0.1 percent of the survey area. It has been mapped in two delineations. Both are located in the upper drainage of the Marble Fork flanking the stream channel. One is north of Aster Lake, the second is north of Table Meadows. Surface slopes are gentle, ranging from about 5 to 20 percent. Elevations are about 2700 m for the lower delineation, and about 3230 m for the higher one. Mean annual soil temperatures are about 4°C for the lower delineation and about 1°C for the higher one.

It was impractical to map the named components of this unit separately. The soils have formed in local colluvium, alluvium, and patches of ground moraine, as well as in residuum for some of the shallow soils. All parent material has been derived from the local weathering, mainly of granodiorite. The Lithic Cryumbrepts are similar to the Lithic Cryumbrepts taxonomic unit description given on page 66. The textures are commonly fine gravelly coarse sandy loam. In place, the pebble and cobble content exceeds 35 percent by volume. The Entic Cryumbrepts are similar to their taxonomic unit description given on page 29. They are also similar to the Lithic Cryumbrepts in texture.

The vegetation in the two delineations is somewhat dissimilar. The lower one supports a semi-open cover of conifers and some shrubs. The conifers are red fir (A. magnifica), western white pine (P. monticola), and lodgepole

pine (P. contorta murrayana); the shrubs are mainly willow (Salix sp.) located in relatively moist sites. Open areas are variably sodded with hair grass (Deschampsia sp.). The upper delineation is devoid of trees, but supports a cover of willow, hair grass, and other alpine plants.

The Lithic Cryumbrepts comprise about 40 percent of the unit; the Entic Cryumbrepts about 35 percent. Included are wet areas from local seepage in which there are Cryaquepts and bodies of organic soils. The latter are found in the higher delineation. Also included are small areas of deep Typic Cryofluvents adjacent to the Marble Fork streamway, and areas of Jointed granitic outcrop. Angular cobble and stone-sized rock fragments litter parts of the surface in the upper delineation.

LueF - Lithic Cryumbrepts-Entic Cryumbrepts association, very steep. This soil map unit comprises about 0.1 percent of the survey areas. It is mapped as a single delineation located on the western end of the rugged ridge extending westward from Mt. Stewart. Surface slopes range from about 30 to 60 percent; aspects are mainly westerly. Although very steep, the landscape of the unit suggests a hanging valley left by the glacial deepening of Lone Pine Creek canyon. Elevations range from about 2680 to 2960 m. Mean annual soil temperatures range from about 3° to 4.5°C, depending upon elevation.

It was impractical to map the named components of this map unit separately. The soils have formed mainly in colluvium weathered from granodiorite and locally stabilized after downslope displacement from weathering sites. The Lithic Cryumbrepts are similar to the description of the Lithic Cryumbrepts taxonomic unit given on page 66. Surface and subsurface textures are mainly very gravelly coarse sandy loams that in places are very cobbly or very stony. The Entic Cryumbrepts in this unit are similar to the description of the Entic Cryumbrepts taxonomic unit given on page 29. Surface and subsurface textures are mainly very gravelly coarse sandy loams that in places are very cobbly or very stony.

The soils support an irregular, very open to open cover of conifers and a semi-open cover of shrubs. The conifers are mainly red fir (A. magnifica) and western white pine (P. monticola). The shrub cover consists of chinquapin (C. sempervirens) and pinemat manzanita (A. nevadensis). Open areas have developed a thin, gravelly erosional pavement, if bare, or have a thin litter of leaves and twigs.

Each of the named components comprise about 40 percent of this unit. Included are small, scattered areas of Lithic Cryorthents and Typic Cryorthents. There are a few included areas of Jointed granitic outcrop.

LujD - Lithic Cryumbrepts-Jointed granitic outcrop association, sloping to steep. This map unit comprises about 0.1 percent of the survey area. It has been mapped in four delineations - three west and northwest of Elizabeth Pass, and the fourth in the Table Meadow area. Surface slopes are relatively gentle, ranging from about 5 to 30 percent; aspects are mainly southerly and westerly. The delineations are surrounded by steeper, higher lying rock surfaces. Runoff or melt-water flow tends to be slowed within

the delineations which, in turn, have become the loci for many small moist sites for alpine plants. Elevations range from about 3020 to 3400 m. Mean annual soil temperatures range from about 0° to 2°C, depending upon elevation.

It was impractical to map the named components of this unit separately. The Lithic Cryumbrepts are similar to the Lithic Cryumbrept taxonomic unit description given on page 66. The soil textures are mainly very gravelly or very cobbly coarse sandy loams or loamy coarse sands. The Jointed granitic outcrop is similar to its miscellaneous area description given on page 53. The rock type is granodiorite. The joint system governing the patterns of rock fracture is complex.

The soils support a semi-dense cover of hair grass (Deschampsia sp.) and other alpine plants. The grass develops a distinct sod that may be locally continuous or broken into connected, polygonal patterns. Willow (Salix sp.) grows in places.

The Lithic Cryumbrept component ranges from about 30 to 70 percent of the several delineations in the unit. In all but one delineation at the highest elevation, it comprises from 50 to 70 percent. The Jointed granitic outcrop also ranges from about 30 to 70 percent, being the dominant component in the delineation at the highest elevation. Included in this unit are small alpine meadows in which Cryaquepts have formed. Most of these are in the Table Meadows area. Also included are small areas of Granitic Glacial rubble land and large, scattered boulders probably positioned by glacial ice.

<u>LujF - Lithic Cryumbrepts-Jointed granitic outcrop association, very steep</u>. This map unit comprises about 0.1 percent of the survey area and is mapped in two delineations located in the Emerald Lake watershed below Alta Peak. Surface slopes of the soils range from about 30 to 60 percent. Aspects are mainly northwesterly. Elevations range from about 2800 to 3075 m. Mean annual soil temperatures range from about 1.5° to 3°C, depending upon elevation.

It was impractical to map the named components of this unit separately. The Lithic Cryumbrepts are similar to the Lithic Cryumbrept taxonomic unit description given on page 66. The soils have formed mainly in stabilized colluvium weathered from granitic rock. The surface soils range from very gravelly to gravelly loamy coarse sands or coarse sandy loams. The subsurface soils are mainly gravelly coarse sandy loams. Depths to the underlying, slightly weathered granodiorite range from about 10 to 50 cm. Melt waters from lingering snow banks in the watershed keep these soils moist for somewhat longer periods than for similar soils at higher elevations on less protected sites. The Jointed granitic outcrop is similar to the miscellaneous area description of Jointed granitic outcrop given on page 53. The joint system that fractures the outcrops has joint sets striking northeasterly and northwesterly, the former being the most prominent.

The soils support a semi-dense to dense cover of Willow (Salix sp.) and other subalpine and alpine plants. Grasses and herbaceous plants grow on small included meadow areas.

the Lithic Cryumbrepts component of this unit comprise about 50 percent of the lower lying delineation, and about 30 percent of the higher lying delineation in the watershed. The Jointed granitic outcrop component, conversely, comprises about 30 percent of the lower delineation and about 50 percent of the higher delineation. Included are small areas of Cryaquepts, Entic Cryumbrepts that are wet from seepage water, Granitic talus, and Unjointed granitic outcrop. Also included are very small areas of thin organic soils overlying rock, and a small lake in the higher delineation (Parsons Pond).

Lithic Xerumbrepts

This subgroup of soils includes shallow and very shallow, well to excessively drained, dark colored soils formed in locally derived colluvium accumulated on rock surfaces, ledges, and in joints of granitic outcrops. The soils are cool to cold and moist in the winter and are seldom frozen below the surface. They are warm and dry for appreciable periods in the summer.

The soils comprise about 3 percent of the survey area and are widely distributed in the mixed conifer and red fir zones. Elevations range from about 1220 to 2680 m. Mean annual soil temperatures range from about 6° to 14°C; mean summer soil temperatures range from about 15° to 20°C. Mean annual precipitation ranges from about 890 to 1200 mm, much of which falls as winter snow. Periodic rainfall may occur during the summer from thunderstorms, but it seldom moistens the soil below about 10 cm.

The soils support semi-open to semi-dense covers of conifers, hardwood, and shrubs. At higher elevations, the conifers are red fir (Abies magnifica) and Jeffrey pine (Pinus jeffreyi). At middle and lower elevations, the conifers are white fir (Abies concolor), Jeffrey pine, sugar pine (Pinus lambertiana), ponderosa pine (Pinus ponderosa), and incense cedar (Calocedrus decurrens). The conifers exhibit less vigorous growth because of the shallowness of the soils. The hardwoods are at lower elevations and are mainly black oak (Quercus kelloggii). At the higher and middle elevations, the shrubs consist of pinemat manzanita (Arctostaphylos nevadensis), greenleaf manzanita (Arctostaphylos patula), snowbush (Ceanothus cordulatus), and chinquapin (Castanopsis sempervirens). At middle elevations, pinemat manzanita and chinquapin disappear, and at lower elevations, snowbush disappears and whiteleaf manzanita (Arctostaphylos viscida) is mixed with greenleaf manzanita and some bear clover (Chamaebatia foliolosa). Annual grasses and forbs grow in open areas of the soil, particularly at lower elevations.

Typically, these soils are very dark grayish brown loamy coarse sands and coarse sandy loams, strongly acid, and moderately high to high in organic matter content. They are underlain at depths of 50 cm or less by slightly weathered granitic rock.

The following profile description is of a representative pedon located 635 m south 10° east of the west end of the Woverton parking area at an elevation of 2250 m; slope - 50 percent; aspect - west; mean annual soil temperature about 6.5°C; semi-dense cover of pinemat and greenleaf manzanita, scattered Jeffrey pine, leaf litter on areas of bare ground: (For additional information, see Appendix I, pp. 11-12; Appendix II, p. 6-Section 7.0; colors are for dry soil unless otherwise noted)

0 -- 1 to 0 cm; brown to dark brown litter of Jeffrey pine needles, catkin and twigs; rests on:

A1 -- 0 to 6 cm; dark grayish brown gravelly loamy coarse sand, very dark grayish brown moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; common fine roots; strongly acid; abrupt smooth boundary.

A2 -- 6 to 12 cm; dark grayish brown loamy coarse sand, very dark brown moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; strongly acid; very abrupt wavy boundary.

2R -- 12 to 100+ cm; light gray, slightly weathered granitic rock.

These soils range in depth from about 10 to 50 cm to the underlying granitic rock. The rock may be closely jointed or unjointed locally. It is mainly granodiorite. Soil colors range from dark grayish brown to brown when dry; dark gray to dark brown when moist. The surface soils are darker colored, the subsurface soils above the rock contact are somewhat lighter and browner, particularly in the relatively deeper soils. Textures range from loamy coarse sand to coarse sandy loam. Rock fragments modifying the texture class range in size from more than 2 mm to 1 m. They range in volume percent of the soil mass from about 15 to 50 percent. Soil reaction ranges from medium to very strongly acid, and base saturation is substantially less than 50 percent throughout the soil.

LxmF - Lithic Xerumbrepts, mesic, very steep. This soil map units is very limited in extent, comprising less than 0.1 percent of the survey area. It is mapped in a single delineation northeast of Moro Rock at an elevation of about 1950 m. Surface slopes range from about 30 to 50 percent and have northerly and easterly aspects. The mean annual soil temperature is about 10°C.

These soils are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. They differ from the representative pedon in having a warmer mean annual soil temperature and warmer mean summer soil temperatures. Depths to underlying granitic rock range from about 30 to 50 cm; textures are mainly fine gravelly loamy coarse sand. Organic matter content is moderate.

The soils support a semi-dense cover of shrubs and conifers. The shrubs are mainly greenleaf manzanita (A. patula); the conifers are Jeffrey pine

(P. jeffreyi), sugar pine (P. lambertiana), and incense cedar (C. decurrens).

The Lithic Xerumbrepts, mesic, comprise about 85 percent of the map unit. Included are small areas of Entic Xerumbrepts, mesic, Entic Xerumbrepts, shallow and mesic, and Jointed granitic outcrop.

LxnF - Lithic Xerumbrepts, frigid-Jointed granitic outcrop association, very steep. This map unit is limited in extent, comprising about 1 percent of the survey area. It is mapped in four separate delineations; two below Tharp's Rock, high on the canyon slopes of the Middle Fork; two in the vicinity of Wolverton - one northeast of Red Fir Meadow, the other west of Long Meadow. The surface slopes of the soils range from about 40 to 70 percent. Aspects are southerly in the Middle Fork canyon; near Wolverton they are easterly, northerly, and westerly. Elevations range from about 2190 to 2680 m. Mean annual soil temperatures range from about 5.5° to 7.5°C, depending upon elevation and aspect. The higher elevations and relatively lower soil temperatures are associated with the two delineations in the Middle Fork canyon.

It was impractical to map the named components of this unit separately. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. Soil depths are commonly deeper than shown for the representative pedon. The Jointed granitic outcrop is similar to the description given for this miscellaneous unit on page 53.

The soils support a dense to semi-open cover of shrubs and a semi-open cover of conifers. Litter covered bare ground is common in the more open areas. The shrubs consist mainly of pinemat manzanita (A. nevadensis), greenleaf manzanita (A. patula) and chinquapin (C. sempervirens). The conifers include a mixture of white fir (P. concolor), Jeffrey pine (P. jeffreyi), and some red fir (A. magnifica) on the Middle Fork canyon sites, but are dominantly red fir near Wolverton with some Jeffrey pine, white fir, and lodgepole pine (P. contorta murrayana).

The Lithic Xerumbrepts comprise from 50 to 60 percent of the several delineations in the unit; the Jointed granitic outcrop from 20 to 30 percent. For the most part, the latter is distributed mainly in small, separate areas throughout the unit. Included are lesser areas of Pachic Xerumbrepts, Entic Xerumbrepts, and Entic Xerumbrepts, shallow. All are in a frigid soil temperature class.

LxoD - Lithic Xerumbrepts, mesic-Jointed granitic outcrop association, sloping to steep. This map unit is very limited in extent, comprising about 0.1 percent of the survey area. It is mapped in two delineations, one west of General Sherman Tree, the other east of Kaweah Camp. Slopes are relatively gentle, ranging from about 5 to 30 percent. Aspects are easterly. The unit ranges in elevation from about 1980 to 2100 m. Mean annual soil temperatures range from about 9° to 10°C.

It was impractical to map the named components of this unit separately. The Lithic Xerumbrepts are similar to the soils described in the Lithic

Xerumbrepts taxonomic unit on page 71. The mean annual soil temperatures are warmer than for the representative pedon described, and depths to the underlying rock range from about 10 to 50 cm. Soil textures are mainly coarse sandy loams or fine gravelly coarse sandy loams. The Jointed granitic outcrop is similar to the description of this miscellaneous area given on page 53. The joint sets causing the close fracturing of the rock have a northeasterly strike.

The soils support semi-dense covers of shrubs and semi-open covers of trees, both conifers and hardwoods. The shrubs consist of greenleaf manzanita (A. patula) and snowbush (C. cordulatus). The trees are mainly conifers. These consist of white fir (A. concolor), Jeffrey pine (P. jeffreyi), and sugar pine (P. lambertiana). Black oak (Q. kelloggii) is present. Leaf and twig littered bare ground exist in open areas.

The Lithic Xerumbrepts comprise about 60 percent of the unit; the Jointed granitic outcrop about 20 percent. Included are small areas of: Pachic Xerumbrepts; shallow Entic Xerumbrepts: and medium acid, moderately coarse textured soils shallow over weathered rock with thin, dark colored surface soils and brighter colored subsoils. All are in a mesic soil temperature class.

<u>LxoF – Lithic Xerumbrepts, mesic-Jointed granitic outcrop association, very steep</u>. This map unit comprises about 1.7 percent of the survey area. It has been mapped in six separate delineations located: below Bear Paw Meadow; in the vicinities of Sugar Bowl and Little Blue Domes; below Panther Gap; and south of Kaweah Camp. Slopes range from about 40 to 70 percent. Aspects are mainly southerly, except near Kaweah Camp where they are westerly. Elevations range from about 1780 to 2800 m. The higher elevations are on warmer, south facing slopes in the Middle Fork canyon, the lower elevations are in protected ravines. Mean annual soil temperatures range from about 8° to 10.5°C, depending upon elevation and aspect.

It was impractical to map the named components of this unit separately. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. In this unit, the soils include only those with a mesic soil temperature regime. They range in depth from about 15 to 50 cm and have coarse sandy loam textures throughout that are gravelly or cobbly in places. The soils have formed principally in stabilized colluvium weathered from the local granitic rock, commonly granodiorite. The Jointed granitic outcrop is similar to its description given on page 53. The principal joint sets controlling the rock fracture have northeasterly and northwesterly strikes.

The soils support a semi-dense to dense cover of shrubs, with a semi-open to open overstory of conifers and some oak. The shrubs consist of greenleaf manzanita (A. patula), snowbush (C. cordulatus), and bear clover (C. foliolosa) at lower elevations. In places, there are thickets of bitter cherry (Prunus emarginata). The conifers include white fir (A. concolor), Jeffrey pine (P. jeffreyi), sugar pine (P. lambertiana), and a scattering of red fir (A. magnifica) at higher elevations. The oaks include black oak (Q. kelloggii) and canyon live oak (Q. chrysolepis).

The Lithic Xerumbrepts comprise from 30 to 40 percent of this unit among the delineations; the Jointed granitic outcrop from 25 to 40 percent. Included are lesser areas of Entic Xerumbrepts, shallow; Pachic Xerumbrepts; and shallow to moderately deep soils with weakly developed subsoils underlying thin, dark colored surface soils. These latter have less than 60 percent base saturation throughout. All included soils have mesic soil temperature regimes.

LxpD - Lithic Xerumbrepts-Pachic Xerumbrepts association, mesic, sloping to steep. This map unit is very limited in extent, comprising less than 0.1 percent of the survey area. It has been mapped in a single delineation located west of the General Sherman Tree on relatively gentle slopes above the Marble Fork at an elevation of about 1930 m. Slopes range from about 10 to 30 percent with mainly westerly or northwesterly aspects. Mean annual soil temperatures range from about 9° to 9.5°C.

The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. In this unit, these soils have a cool mesic soil temperature regime and are moderately coarse textured. Soil depths to the underlying, hard rock range from about 15 to 50 cm. The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. These soils also have a cool mesic soil temperature regime, moderately coarse textures, and are deeper than 50 cm to underlying weathered rock. They have formed in residuum as well as colluvium accumulated in swale positions.

The soils support a semi-open cover of shrubs, conifers, and a few oaks. The shrubs are mainly greenleaf manzanita (A. patula). The conifers are white fir (A. concolor), sugar pine (P. lambertiana), incense cedar (C. decurrens), Jeffrey pine (P. jeffreyi) and occasional sequoia (Sequoiadendron gigantea). The oaks are black oak (Q. kelloggii). Open areas are thinly littered bare ground or included rock surfaces.

The Lithic Xerumbrepts comprise about 35 percent of this unit; the Pachic Xerumbrepts about 30 percent. Included are lesser areas of shallow and moderately deep soils with weakly developed subsoils underlying thin, dark colored surface soils. These soils have base saturations less than 50 percent. Also included are scattered areas of Jointed granitic outcrop.

Pachic Haplumbrepts

This subgroup of soils includes moderately deep to very deep, dark colored, well to moderately well drained soils. They have formed in colluvium from granitic rock sources that has accumulated in ravines and draws where seepage waters from springs or melt-waters from lingering snow banks keep the soils moist during most of the summer period.

The soils are very limited in extent, occurring as a dominant component in only one soil map unit within the survey area, but are well distributed as inclusions in more extensive map units of Pachic Xerumbrepts. They are recognized mainly on the upper slopes of the Middle Fork canyon between

Panther Creek and Lone Pine Creek. Elevations range from about 2200 to 2750 m. Mean annual soil temperatures range from about 5° to 7°C. Mean annual precipitation ranges from about 1050 to 1200 mm, most of which falls as snow.

The soils support a dense cover of shrubs of perennial plants, and a semi-open, clustered cover of conifers and deciduous trees. The shrubs are mainly willow (Salix sp.), the perennial plants include grasses, flowering plants, bracken fern, and lupine. The conifers are mainly red fir (Abies magnifica). The deciduous trees are mainly aspen (Populus tremuloides).

Typically, the soils are usually moist. The surface soils are dark colored and relatively high in organic matter to depths in excess of 50 cm, moderately coarse textured, and acid in reaction. The substratum is similar in texture, but decreases in organic matter content and becomes lighter colored with a few mottles in places.

Following is a profile description of a representative pedon located about 610 m north of the southwest corner of section 36, T. 15 S., R. 30 E., MDB&M, west of Mehrten Creek at an elevation of about 2550 m.; pedon is part of an inclusion in a map unit of Pachic Xerumbrepts, frigid, dense growth of grasses, flowering plants, willow and aspen: (Colors are for dry soil unless otherwise noted).

0 -- 2 to 0 cm; dark brown, partially decomposed leaves and twigs resting on:

A1 -- 0 to 8 cm; very dark grayish brown (10YR 3/2) coarse sandy loam, black (10YR 2/1) moist; moderate medium granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; strongly acid; clear smooth boundary.

A2 -- 8 to 38 cm; brown (10YR 5/3) coarse sandy loam, very dark brown (10YR 2/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; medium acid; clear wavy boundary.

Bw -- 38 to 75 cm; yellowish brown (10YR 5/4) coarse sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; medium acid; gradual smooth boundary.

C -- 75 to 150+ cm; pale brown (10YR 6/3) coarse sandy loam, brown (10YR 4/3) moist ; massive; slightly hard, very friable, nonsticky and nonplastic; few medium distinct strong brown mottles; 10 percent pebbles by volume; medium acid.

These soils range in depth from about 80 to more than 150 cm to underlying weathered rock. They are not dry in all parts for as many as 45 consecutive days during most summers. Dry surface soil colors range from very dark grayish brown to brown; moist colors range from black to very dark brown. Dry subsoil colors range from brown to yellowish brown; moist colors

range from brown to dark brown. The substratum ranges in dry colors from brown to light grayish brown; moist colors range from brown to yellowish brown. Mottling may or may not be present in the substratum. Textures range from loamy coarse sand to coarse sandy loam, and may be gravelly or cobbly in places. Base saturation is less than 50 percent throughout the profile.

PhxF – Pachic Haplumbrepts, frigid-Pachic Xerumbrepts, frigid-Jointed granitic outcrop association, very steep. This map unit comprises about 0.5 percent of the survey area. It has been mapped in two delineations. One is located east of Alta Meadow, the other lies east of Bear Paw Ranger Station. Surface slopes range from about 30 to 60 percent; aspects are southerly. Elevations range from about 2200 to 2750 m. Mean annual soil temperatures range from about 4° to 7°C.

The Pachic Haplumbrepts are similar to the Pachic Haplumbrepts taxonomic unit description given on page 75. The soils have formed in colluvium weathered from granodiorite rock. They are kept in a moist state by seepage waters for longer periods during summer than other associated soils, and have relatively less steep slopes. The associated Pachic Xerumbrepts, also formed in mainly local colluvium, are similar to the soils described in the Pachic Xerumbrepts taxonomic unit given on page 79. These soils have steeper slopes and are not significantly affected by local seepage waters. The Jointed granitic outcrop is similar to its description given on page . Joint sets in the rock areas have northerly and northeasterly strikes.

The soils support a dense cover of shrubs, flowering plants, and clusters of deciduous trees and conifers. Because of their more moist character, the Pachic Haplumbrepts support willow (Salix sp.), a variety of flowering plants, perennial grasses, bracken fern, lupine, aspen (P. tremuloides), and a scattering of red fir (A. magnifica). The Pachic Xerumbrepts support greenleaf manzanita (A. patula) and red fir. Some shrubs and conifers have established themselves and survive in earth-filled joints in the areas of rock outcrop.

The Pachic Haplumbrepts comprise about 45 percent of the map unit; the Pachic Xerumbrepts about 35 percent; and the Jointed granitic outcrop about 20 percent.

Pachic Ultic Haploxerolls

This subgroup of soils includes moderately deep to very deep, well to somewhat excessively drained soils that have thick, dark colored surface soils. The soils are moderately leached. They have formed in colluvium and some residuum weathered from granitic rock. Below Bear Paw Ranger Station, some of these soils have formed in cobbly ground moraine.

The soils are limited in extent and are located on the south-facing slopes of the Middle Fork canyon. They range in elevation from about 1300 to 1950 m. Mean annual soil temperatures range from about 9° to 13°C, depending upon elevation. Mean annual precipitation ranges from about 800 to 1050 mm, increasing in amount with increasing elevation. Most of the

precipitation falls as rain at the lower elevations; more falls as snow at the higher elevations.

The soils support a semi-dense to dense cover of hardwoods with some shrubs and scattering of conifers. The hardwoods are mainly canyon live oak (Quercus chrysolepis). Some black oak (Quercus kelloggii) grows at higher elevations. The shrubs are whiteleaf manzanita (Arctostaphylos viscida) at lower elevations and greenleaf manzanita (Arctostaphylos patula) at higher elevations. The conifers are principally ponderosa pine (Pinus ponderosa) and incense cedar (Calocedrus decurrens).

Typically, the soils have thick, dark colored, moderately coarse textured surface soils, moderately high in organic matter to depths in excess of 50 cm, overlying weathered or unweathered rock, or a lighter colored, moderately coarse textured substratum of colluvial material. The soils are normally dry for extended periods in the summer. They are similar to Pachic Xerumbrepts, but have base saturations in excess of 50 percent.

Following is a profile description of a pedon of these soils located at an elevation of about 1340 m along the old Crescent Creek trail east of Moro Rock; dense cover of canyon live oak; slope - 50 percent: (colors are for dry soil unless otherwise noted).

01 -- 2 to 1 cm; layer of dried oak leaves and twigs.

02 -- 1 to 0 cm; dark brown layer of decomposing oak leaves and twigs; rests on:

A1 -- 0 to 5 cm; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; slightly acid; clear wavy boundary.

A2 -- 5 to 55 cm; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; medium acid; abrupt wavy boundary.

2Cr/R -- 55 to 70+ cm; light gray, weathered granodiorite grading to unweathered to rock within several centimeters.

These soils range in depth from 52 to more than 150 cm. At depths less than 150 cm, they are underlain by weathered or unweathered granitic rock. In places, the shallower soils have formed in residuum, but in most instances they have formed in colluvium that has migrated from upslope, or have formed in morainal material. Rock fragments are often present and frequently comprise more than 35 percent of the soil volume. The organic matter content in the thick surface soils ranges from about 1 to 5 percent. In the deeper soils, it drops to less than 1 percent at depths below about 70 cm. Textures of the fine earth fraction of these soils range from sandy loam to coarse sandy loam. Reactions range from medium to slightly acid. Base saturation ranges from about 50 to 75 percent.

PuhF - Pachic Ultic Haploxerolls, mesic, very steep. This map unit comprises about 1.2 percent of the survey area. It has been mapped in four delineations. Two are located east of Moro Rock on the upper slopes of the Middle Fork canyon below Crescent Meadow. The other two are located below Bear Paw Ranger Station in the upper reach of the Middle Fork canyon. Slopes range from about 40 to 75 percent, and aspects are southerly. Elevations range from about 1340 to 1950 m. Mean annual soil temperatures range from about 9° to 13°C.

These soils are the same as the Pachic Ultic Haploxerolls described in the taxonomic unit description given on page 77. The pedon description, the range of soil property characteristics, and the characteristic vegetation associated with these soils applies to this singular soil map unit.

The Pachic Ultic Haploxerolls comprise about 80 percent of the unit. Included are lesser areas of similar soils having depths to underlying rock less than 50 cm, and irregularly distributed exposures of Jointed granitic outcrop, Unjointed granitic outcrop, and large, detached boulders. Many of the granitic outcrops are located along small streamways.

Pachic Xerumbrepts

This subgroup of soils includes moderately deep to very deep, well to somewhat excessively drained soils that have thick, dark colored surface soils. The soils are strongly leached. They have formed in residuum, colluvium, and in morainal material that has its source in granitic rocks. The granitic rocks are mainly granodiorite, but includes granite in places.

These soils are extensive, comprising about 21 percent of the survey area. They are located in the middle mountain zone where they are mainly dominant components of many soil map units. Elevations range from about 1340 to 2750 m. At lower elevations these soils are located in canyons where cool air drainage prevails. At the highest elevations, they are on relatively warm, south facing slopes. Mean annual soil temperatures range from about 5° to 13°C, depending upon elevation and aspect. Mean annual precipitation ranges from about 800 to 1300 mm. At the lower elevations the precipitation falls as both rain and snow; at the higher elevations more than half falls as snow.

The soils support a semi-dense to dense cover of conifers and some oak. In many areas, there is a significant understory of shrubs, but other areas lack such an understory. At middle to upper elevations, the conifers are mainly white fir (Abies concolor), red fir (ABies magnifica), Jeffrey pine (Pinus jeffreyi), and sugar pine (Pinus lambertiana). Sequoia (Sequoiadendron gigantea) is confined to middle elevations and relatively gentle slopes. At the lower elevations the conifers are largely ponderosa pine (Pinus ponderosa) and incense cedar (Calocedrus decurrens). The oaks grow at middle to lower elevations. They are black oaks (Quercus kelloggii). At middle to high elevations, the shrubs are greenleaf manzanita (Arctostaphylos patula), snowbush (Ceanothus cordulatus), and

chinquapin (Castanopsis sempervirens). At the lowest elevations there is some whiteleaf manzanita (Arctostaphylos viscida).

Typically, these soils are dark grayish brown to brown coarse sandy loams, slightly acid and moderately high in organic matter content. They are underlain by weathered granitic rock residuum or by colluvium from granitic rock sources at depths ranging from 50 to more than 100 cm.

Following is a profile description of a representative pedon located about 350 m northeast of the Crescent Meadow Road-Huckleberry Meadow Trail junction at an elevation of about 2048 m on a southwest facing slope of 25 percent; vegetation - semi-dense old growth cover of white fir with a widely scattered understory of chinquapin; colors are for dry soil unless otherwise noted: (For additional information, see Appendix I, pp. 9-10, 15-17, 18-19; Appendix II, p. 5, 8, 9 - Section 7.0).

O1 -- 10 to 2 cm; very dark brown litter of white fir needles.

O2 -- 2 to 0 cm; very dark brown, well decomposed white fir needles; rests on:

A1 -- 0 to 8 cm; brown coarse sandy loam, dark brown moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and medium roots; slightly acid; abrupt smooth boundary.

A2 -- 8 to 38 cm; yellowish brown loamy coarse sand, dark brown, moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; slightly acid; clear wavy boundary.

A3 -- 38 to 57 cm; yellowish brown loamy coarse sand, dark brown moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; few medium, common very fine and coarse roots; slightly acid; clear wavy boundary.

AC - 57 to 100 cm; light yellowish brown loamy coarse sand, dark brown moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine, medium and coarse roots; strongly acid; abrupt irregular boundary.

Cr -- 100 to 120+ cm; light gray, well weathered granitic rock.

These soils range in depth from 50 cm to more than 150 cm to weathered granitic rock. Dry colors for the surface soils (A horizons) range from grayish brown to yellowish brown; moist colors range from very dark grayish brown to dark brown. Organic matter content in the upper part of the soil ranges from 1 to 12 percent; below 50 to 70 cm, the organic matter content diminishes to less than 1 percent; Textures range from loamy coarse sand to coarse sandy loam. Rock fragments range from less than 15 to more than 35 percent of the soils' volume. Throughout the profiles of these soils, the reactions range from slightly acid to strongly acid, the more acid reactions

occurring deeper in the soils. The base saturation of these soils is less than 50 percent for most or all of the horizons.

Pxad - Pachic Xerumbrepts, sandy-skeletal, frigid, sloping to steep. This soil map unit comprises about 0.1 percent of the survey area. It is mapped as a single delineation along the Marble Fork at Lodgepole. The campground and visitor facilities are located within it. Surface slopes are gentle, but somewhat irregular, ranging about 5 to 25 percent and include nearly level areas smoothed for campsites and parking areas. Elevations range narrowly from about 2040 to 2100 m. The mean annual soil temperature is about 7°C. The area is influenced by cool air drainage down the Marble Fork canyon.

The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts described in their taxonomic unit on page 79. These soils have textures that are sandy, but have rock fragments that occupy more than 35 percent of the soil volume. Except where cleared, the surfaces of these soils are very cobbly or very stony. They have formed in deep accumulations of colluvium, stream alluvium, and ground moraine. Their temperature regime is frigid; mean summer soil temperatures are warm.

These soils support a semi-open cover of conifers and some shrubs. The conifers are Jeffrey pine (P. jeffreyi), lodgepole pine (P. contorta murrayana), white fir (A. concolor) and red fir (A. magnifica). The shrubs are mainly greenleaf manzanita (A. patula). Some riparian vegetation borders the Marble Fork.

The Pachic Xerumbrepts, sandy-skeletal, comprise about 75 percent of this unit. Included are lesser areas of: similar soils dominated by loamy-skeletal material; stony riverwash; Jointed granitic outcrops; and Granitic talus.

PxbD - Pachic Xerumbrepts, coarse-loamy, frigid, sloping to steep. This soil map unit comprises about 0.7 percent of the survey area. It is mapped in three delineations located in the vicinities of Panther Meadow and Wolverton. Surface slopes range from about 5 to 30 percent with aspects in all quadrants of the compass. Elevations range from about 2070 to 2680 m. Mean annual soil temperatures range from about 4.5° to 5°C depending upon elevation. Cool air drainage affects the temperature at the lower elevations. The soils have formed in colluvium and residuum derived from granitic rock, and in some morainal material low in rock fragment content.

The Pachic Xerumbrepts of this unit are similar to the Pachic Xerumbrepts described in their taxonomic unit given on page 79, but differ from the representative pedon in having coarse sandy loam textures throughout.

The soils support a semi-dense cover of conifers with a limited understory of shrubs and some herbaceous plants. The conifers are mainly red fir (A. magnifica) with some white fir (A. concolor), Jeffrey pine (P. jeffreyi) and occasional sugar pine (P. lambertiana). The shrubs are chinquapin (C. sempervirens) and greenleaf manzanita (A. patula). Lupine (Lupinus ssp.) grows in places.

The Pachic Xerumbrepts, coarse loamy, comprise about 60 percent of this unit. Included are lesser areas of similar soils with slopes in excess of 30 percent, and with rock fragments comprising more than 35 percent of the soil volume. Also included are: Aquepts in a few small meadows, including Panther Meadow; sloping stringers of soils with thin surface horizons formed in deep, sandy colluvium; and a scattering of granitic outcrops.

PxbF – Pachic Xerumbrepts, coarse-loamy, frigid, very steep. This soil map unit comprises about 3 percent of the survey area. It has been mapped in eight separate delineations that are distributed from the Wolverton area southeasterly to the vicinity of Bear Paw Meadow and the lower east facing slopes of Lone Pine Creek Canyon. Surface slopes range from about 40 to 70 percent with aspects in all quadrants of the compass. Elevations range from about 2195 to 2560 m. Mean annual soil temperatures range from about 5.5° to 7.5°C, depending upon elevation and aspect.

The Pachic Xerumbrepts are similar to the description of the Pachic Xerumbrepts taxonomic unit given on page 79. The soils have formed in both colluvium and residuum weathered from granitic rock. Depth to underlying weathered rock is usually in excess of 150 cm. The texture of these soils is commonly coarse sandy loam throughout with less than 15 percent rock fragments by volume. The soil temperature regime is frigid.

The soils support a semi-open to semi-dense cover of conifers. Where more open there is a semi-dense cover of shrubs. The conifers consist of red fir (A. magnifica) and white fir (A. concolor). The shrubs consist of chinquapin (C. sempervirens), snowbush (C. Cordulatus), and some greenleaf manzanita (A. patula). In places, there are willow thickets (Salix sp.).

The Pachic Xerumbrepts, coarse loamy, comprise about 75 percent of this unit. Included are lesser areas of: similar soils with more than 35 percent by volume of rock fragments: small wet meadows, such as Red Fir Meadow, consisting of Aquepts; and a scattering of granitic outcrops.

PxcD – Pachic Xerumbrepts, coarse-loamy, mesic, sloping to steep. This soil map unit comprises about 0.6 percent of the survey area. It has been mapped in six separate delineations; five are located in the Giant Forest area; one is located adjacent to Lower Bearpaw Meadow. Surface slopes range from about 5 to 30 percent. Elevations range from about 1920 to 2160 m. Mean annual soil temperatures range from about 8° to 9°C.

These soils are similar to the Pachic Xerumbrepts taxonomic unit described on page 79. They have formed in residuum and, in local accumulations of colluvium, both weathered from granitic rock. Soil depths to the underlying weathered rock range from about 75 cm to more than 150 cm. The texture throughout the soil profiles is coarse sandy loam with less than 35 percent rock fragments by volume. The soil temperature regime is mesic.

The soils support a semi-dense cover of conifers with a varied understory of ferns (Pteridium sp.) and lupine (Lupinus sp.) Much of the forest floor lacks an understory of plants and is litter covered. The conifers consist

of white fir (A. concolor), Jeffrey pine (P. jeffreyi), sugar pine (P. lambertiana), sequoia (S. gigantea), and some incense cedar (C. decurrens).

The Pachic Xerumbrepts, coarse-loamy, comprise about 60 percent of the unit. Included are lesser areas of: similar soils with loamy coarse sands dominant in their profiles; other moderately coarse textured soils with thin, dark colored surface horizons and brighter colored subsoils that have less than 50 percent base saturation; Entic Xerumbrepts; shallow Entic Xerumbrepts; and Aquepts in scattered wet meadow sites.

PxcF – Pachic Xerumbrepts, coarse-loamy, mesic, very steep. This soil map unit comprises about 9.5 percent of the survey area. It has been mapped in eight separate delineations located in the Giant Forest area and along much of the upper parts of the Middle Fork canyon eastwardly to Bear Paw Meadow. Some of these delineations are complexly shaped and fairly extensive; some are located in protected sites on the lower slopes of the Middle Fork canyon. Surface slopes range from about 40 to 75 percent. In the Giant Forest area, aspects of these slopes are in all quadrants of the compass. They are southerly, northwesterly or northeasterly on the Middle Fork canyon slopes. Elevations ranges from about 1340 to 2390 m. Mean annual soil temperatures range from about 8° to 13°C, depending upon elevation and aspect.

The soils are similar to the Pachic Xerumbrepts taxonomic unit described on page 79. They have formed in residuum and colluvium weathered from granitic rock, and in morainal material in the vicinity of Bearpaw Meadow. Depth to underlying weathered rock ranges from about 60 cm to more than 150 cm. These soils have a coarse sandy loam texture throughout and a mesic soil temperature regime.

The soils support a semi-dense cover of conifers, some oaks and some shrubs. At elevations below about 1900 m, the conifers are mainly ponderosa pine (P. ponderosa), white fir (A. concolor), and incense cedar (C. decurrens). The oaks are black oak (Q. kelloggii), and canyon live oak (Q. chrysolepis). The shrubs are bear clover (C. foliolosa), greenleaf manzanita (A. patula), and some whiteleaf manzanita (A. viscida). Above about 1900 m, the conifers are mainly white fir, Jeffrey pine (P. jeffreyi), sugar pine (P. lambertiana), and sequoia (S. gigantea). Some red fir (A. magnifica) grows at the highest elevations. The shrubs are greenleaf manzanita, snowbush (C. cordulatus), and chinquapin (C. castanopsis).

The Pachic Xerumbrepts, coarse-loamy, comprise about 60 percent of the unit. Included are lesser areas of: similar soils with more than 35 percent rock fragments; similar soils with loamy coarse sand textures throughout; moderately coarse textured, moderately deep to deep soils with thin, dark colored surface soils and bright colored subsoils that have less than 50 percent base saturation; Lithic Xerumbrepts; and Jointed granitic outcrops.

PxdF – Pachic Xerumbrepts, loamy-skeletal, frigid, very steep. This soil map unit comprises about 0.6 percent of the survey area. It has been mapped in six delineations - one in the upper watershed of Mehrten Creek, four in Buck Canyon above the High Sierra Trail, and one in Valhalla below Hamilton

Lake. Surface slopes range from about 40 to 75 percent. Aspects are mainly northwesterly or southeasterly. Elevations range from about 2250 to 2800 m. Mean annual soil temperatures range from about 4° to 7.5°C, depending upon elevation.

These soils are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. Importantly, these soils are very gravelly or very stony throughout, having more than 35 percent of the soil volume occupied by rock fragments. The fine earth fraction of the soil is mainly coarse sandy loam. The soils have formed in stabilized colluvium weathered from granitic rock and locally transported. They have a frigid temperature regime.

The soils support a semi-dense vegetation cover. On northwesterly slopes it is dominantly conifers and some shrubs. On southeasterly slopes it is dominantly shrubs with an open stand of conifers. The conifers are red fir (A. magnifica) and white fir (A. concolor). The shrubs are greenleaf manzanita (A. patula), pinemat manzanita (A. nevadensis) and some chinquapin (C. sempervirens). In places, there are willow (Salix sp.) and flowering plants. These latter are associated with inclusions of Pachic Haplumbrepts in the unit.

The Pachic Xerumbrepts, loamy-skeletal, comprise about 70 percent of the unit. Included are lesser areas of: Pachic Haplumbrepts; Lithic Xerumbrepts; Granitic talus; scattered large boulders; and Jointed granitic outcrops. The latter are exposed in part by several avalanche chutes, particularly in Buck Canyon, that transect delineations of the unit.

PxeD – Pachic Xerumbrepts, loamy-skeletal, mesic, sloping to steep. This soil map unit comprises about 0.3 percent of the survey area. It is mapped in two delineations located at the junction of Lone Pine Creek and Hamilton Creek, and southwest of this junction along the Kaweah River in the upper reaches of the Middle Fork canyon. These soils have formed in a glacially widened and deepened canyon in morainal material, local alluvium, and granitic rock debris more than 10 m thick from local mass wasting. Surface slopes are relatively gentle, but irregular, ranging from about 5 to 20 percent. Elevations range from about 1830 to 2040 m. Mean annual soil temperatures range from about 9° to 10°C.

The soils are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. They are very deep with coarse sandy loam textures throughout in a matrix of pebble to stone-sized rock fragments that occupy more than 35 percent of the soil volume. The soil temperature regime is mesic.

The soils support a semi-dense to dense cover of conifers and some shrubs. The conifers are white fir (A. concolor), sugar pine (P. lambertiana), and incense cedar (C. decurrens). The shrubs are greenleaf manzanita (A. patula) with some willow (Salix sp.) and other shrubs in places.

The Pachic Xerumbrepts, loamy-skeletal, comprise about 80 percent of this unit. Included are lesser areas of: similar soils with sandy textures in the rock fragment matrix; riverwash gravel and stones; and Granitic talus.

PxeF – Pachic Xerumbrepts, loamy-skeletal, mesic, very steep. This soil map unit comprises about 0.4 percent of the survey area. It has been mapped in two delineations, one at the mouth of Lone Pine Creek canyon, the other along the upper levels of the inner gorge of the Middle Fork canyon below Bearpaw Meadow. Surface slopes range from about 50 to 75 percent. Aspects are southerly or southeasterly. The soils have formed in colluvially modified morainal veneer on the canyon slopes. Elevations range from about 1950 to 2190 m. Mean annual soil temperatures are about 8° to 9°C.

The soils are similar to the Pachic Xerumbrepts taxonomic unit described on page 79. They are moderately deep to deep, have a coarse sandy loam texture throughout in a matrix of pebble to stone-sized rock fragments that occupy more than 35 percent of the soil volume. The soil temperature regime is a cool mesic.

The soils support a semi-dense cover of conifers, oak, and some shrubs. The conifers are Jeffrey pine (P. jeffreyi) throughout the unit with white fir (A. concolor) growing in association in the delineation at the mouth of Lone Pine Creek canyon. The oaks are black oak (Q. kelloggii) that also grow in shrub form in places. The shrubs are greenleaf manzanita (A. patula), and a ground cover of bear clover (C. foliolosa) in the lower delineation.

The Pachic Xerumbrepts, loamy-skeletal, comprise about 60 percent of the unit. Included are areas of Jointed and Unjointed granitic outcrops, Lithic Xerumbrepts, and Granitic talus.

PxeG - Pachic Xerumbrepts, loamy-skeletal, mesic, extremely steep. This soil map unit comprises about 0.8 percent of the survey area. It has been mapped in a single delineation located in the middle reach of Buck Creek canyon. Surface slopes are mainly in excess of 75 percent. Aspects are northwesterly and southeasterly. The soils have formed in colluvially modified morainal material, from granitic rock sources, veneered on the canyon slopes. Elevations range from about 1890 to 2440 m. Mean annual soil temperatures are 8° to 9.5°C.

These soils are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. They are moderately deep to very deep, have a coarse sandy loam texture throughout in a matrix of pebble to stone-sized rock fragments that occupy more than 35 percent of the soil volume. The soil temperature regime is a cool mesic.

These soils support a semi-dense cover of shrubs and an open to semi-open stand of conifers on the southeasterly slopes and a semi-dense cover of conifers and some shrubs on the northwesterly slopes. The shrubs are mainly greenleaf manzanita (A. patula). The conifers are Jeffrey pine (P. jeffreyi), white fir (A. concolor), and sugar pine (P. lambertiana).

The Pachic Xerumbrepts, loamy-skeletal, comprise about 80 percent of the unit. About 80 percent of these soils have slopes in excess of 75 prevent; about 20 percent have slopes less than 75 percent. Included are lesser areas of Lithic Xerumbrepts, Jointed granitic outcrop, and Granitic talus.

PxgF - Pachic Xerumbrepts, coarse-loamy, frigid-Jointed granitic outcrop association, very steep. This map unit comprises about 0.5 percent of the survey area. It has been mapped in two delineations located between Wolverton and Panther Peak. The slopes of the soils range from about 40 to 60 percent with mainly northerly aspects. The soils have formed in residuum and some colluvium weathered from granitic rock. Elevations range from about 2310 to 2620 m. The mean annual soil temperatures range from about 5° to 7°C. Mean summer soil temperatures are warm.

It was impractical to map the named components of this unit separately. The Pachic Xerumbrepts, coarse-loamy, are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. The soils are deep to underlying weathered rock and have a coarse sandy loam texture throughout. Rock fragments occupy less than 35 percent of the soil volume. The Jointed granitic outcrop is similar to its description given on page 53. The outcrops are widely scattered and generally less than 1 ha in area.

The soils support a semi-dense cover of red fir (A. magnifica) and white fir (A. concolor). There is little or no shrub understory. Open areas of soil are covered with a litter of conifer needles and twigs.

The Pachic Xerumbrepts comprise about 60 percent of this unit; Jointed granitic outcrop about 25 percent. Included are lesser areas of Entic Xerumbrepts; Aquepts, frigid; and large detached boulders.

PxhD - Pachic Xerumbrepts, coarse-loamy, mesic-Jointed granitic outcrop association, sloping to steep. This map unit comprises about 0.4 percent of the survey area. It has been mapped in four separate delineations. Three are located in the Giant Forest area in the vicinity of Circle Meadow; the fourth lies between Crescent Meadow and Log Meadow. The soils have formed mainly in residuum weathered from granodiorite. Surface slopes of the soils range from 5 to 30 percent with aspects in all quadrants of the compass. Elevations range from about 2040 to 2255 m. Mean annual soil temperatures range from 8° to 9°C.

It was impractical to map the named components of this unit separately. The Pachic Xerumbrepts are similar to the description of the Pachic Xerumbrepts taxonomic unit description given on page 79. The soils are moderately deep to deep, underlain by weathered granitic rock. Unlike the representative pedon, the textures of these soils are coarse sandy loams throughout. Pebble and cobble-size rock fragments occupy less than 35 percent of the soil volume. The Jointed granitic outcrop is similar to its description given on page 53. Joint sets fragmenting the outcrops have a northeasterly strike. They intersect a less prominent set with an easterly strike.

The soils support a semi-dense cover of conifers and some shrubs. The conifers are mainly white fir (A. concolor), with lesser amounts of Jeffrey pine (P. jeffreyi), sugar pine (P. lambertiana), and sequoia (S. gigantea). Some red fir (A. magnifica) grows at the higher elevations. The shrubs are scattered and consist of snowbush (C. cordulatus) and greenleaf manzanita (A. Patula). Open areas of soil are forest litter covered. Some conifers and shrubs have become established and survive in earth-filled joint cracks in the granitic outcrops.

The Pachic Xerumbrepts comprise about 50 percent of the unit; the Jointed granitic outcrop from 20 to 25 percent. Included are lesser areas of: Lithic Xerumbrepts; Entic Xerumbrepts; Xerumbrepts having a brighter colored, but similar textured subsoil; and coarse sandy loam soils with thin, dark colored surface soils overlying brighter colored subsoils and having base saturations less than 50 percent.

PxhF - Pachic Xerumbrepts, coarse-loamy, mesic-Jointed granitic outcrop association, very steep. This map unit comprises about 1.8 percent of the survey area. It has been mapped in six delineations. Two are in the Moro Rock and Log Meadow areas; four are on the upper slopes of the Middle Fork canyon from Panther Creek to the Sugar Bowl Dome. The soils have formed mainly in stabilized colluvium weathered from granitic rock and locally moved. Surface slopes of the soils range from 30 to 70 percent. Aspects are mainly southeast or southwest, reflecting interfluve slopes to the incised local drainageways tributary to the Middle Fork of the Kaweah River. Elevations range from about 1770 to 2400 m. Mean annual soil temperatures range from about 8° to 10.5°C, depending upon elevation and aspect.

It was impractical to map the named components of this unit separately. The Pachic Serumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. The soils are deep to very deep. They differ

from the representative pedon in having coarse sandy loam textures throughout. The percent of soil volume occupied by rock fragments is less than 35. The soil temperature regime is a cool mesic. The Jointed granitic outcrop is similar to its description given on page .

The soils support a semi-dense to dense cover of conifers and shrubs. Conifers are dominant except in the delineation below Panther Peak. The conifers consist of white fir (A. concolor), Jeffrey pine (P. jeffreyi), incense cedar (C. decurrens), some red fir (A. magnifica) at highest elevations, and sequoia (S. gigantea) in the Moro Rock-Log Meadow area. The shrubs consist of greenleaf manzanita (A. patula), snowbush (C. cordulatus), and chinquapin (C. sepervirens).

The Pachic Xerumbrepts comprise about 50 percent of the unit; the Jointed granitic outcrop about 30 percent. The latter occur in many small areas distributed throughout the unit, except in the delineation east of Sugar Bowl Dome. There, they are more extensive. Included in this unit are: lesser areas of similar soil with rock fragments occupying more than 35 percent of the soil volume; Lithic Xerumbrepts; and deep soils with thin, dark colored surface soils overlying brighter colored, similarly textured subsoils, and having a base saturation less than about 50 percent.

PxhG - Pachic Xerumbrepts, coarse-loamy, mesic-Jointed granitic outcrop association, extremely steep. This map unit comprises about 0.9 percent of the survey area. It has been mapped in two delineations. One lies in the upper watershed of Panther Creek. The other flanks the Marble Fork of the Kaweah River north and east of Sunset Rock. Surface slopes of the soils are mainly in excess of 75 percent. On the Panther Creek watershed, the slope aspects are easterly. Along the Marble Fork, they are northerly and northwesterly. The soils have formed in stabilized colluvium from the weathering of granitic rock. Elevations range from about 1585 to 2500 m. Mean annual soil temperatures range from about 8° to 11.5°C, depending upon elevation and aspect.

It was impractical to map the named components of this map unit separately. The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. The soils are deep to very deep. Most of them differ from the representative pedon in having coarse sandy loam textures throughout. The percent of soil volume occupied by rock fragments is less than 35. The soil temperature regime is a cool mesic. The Jointed granitic outcrop is similar to its description given on page 53. It is widely and fairly somewhat uniformly distributed throughout the delineations. Individual outcrops are 1 ha or less in extent.

The soils support a semi-dense cover of conifers and shrubs. The conifers consist of white fir (A. concolor), Jeffrey pine (P. jeffreyi) sugar pine (P. lambertiana), and incense cedar (C. decurrens). The shrubs consist of greenleaf manzanita (A. patula), and snowbush (C. cordulatus).

The Pachic Xerumbrepts comprise about 60 percent of the unit; the Jointed granitic outcrop about 25 percent. About 30 percent of the Pachic Xerumbrepts have more than 35 percent of their volume occupied by rock

fragments. Also included are lesser areas of Lithic Xerumbrepts, and deep soils formed in the local colluvium that have thin, dark colored surface soils overlying brighter colored subsoils, and that have base saturation less than 50 percent. About 30 percent of the soils in this unit have surface slopes less than 75 percent.

PxjF - Pachic Xerumbrepts, loamy-skeletal, frigid-Jointed granitic rock outcrop association, very steep. This map unit comprises about 0.8 percent of the survey area. It is mapped as a single delineation located on the northerly facing slopes of Marble Fork canyon above Lodgepole. Surface slopes of the soils range from about 30 to 70 percent. The soils have formed mainly in thick, stony morainal material occurring as part of a prominent lateral moraine north of Wolverton, and as ground moraine veneered on the canyon slopes. Elevations range from about 1950 to 2440 m. Mean annual soil temperatures range from about 5° to 8°C. Cool air drainage down the Marble Fork canyon and northerly aspects keep the soil temperatures low at the lower elevations.

It was impractical to map the named components of this unit separately. The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. They differ from the representative pedon in having coarse sandy loam textures throughout, and in having more than 35 percent of the soils' volume occupied by cobbly and stony rock fragments. The soil temperature regime is frigid. Mean summer soil temperatures are warm. The Jointed granitic outcrop is similar to its description given on page 53. Joint sets fracturing the rock have northeast and northwest strikes.

The soils support a semi-dense cover of conifers and shrubs. The conifers are somewhat mixed and include white fir (A. concolor), red fir (A. magnifica), Jeffrey pine (P. jeffreyi), and lodgepole pine (P. controta murrayana). The latter is found mainly on the lower slopes close to the Marble Fork stream. Shrubs consist of greenleaf manzanita (A. patula), and chinquapin (C. sempervirens).

The Pachic Xerumbrepts, loamy-skeletal, comprise about 60 percent of the unit; the Jointed granitic outcrop about 20 percent. Included are lesser areas of Pachic Xerumbrepts, coarse loamy, and Entic Xerumbrepts. A sloping to steep, bench-like area of the named soil component of this unit is also included.

PxmF - Pachic Xerumbrepts, coarse-loamy, frigid-Lithic Xerumbrepts, frigid-Jointed granitic outcrop association, very steep. This map unit comprises about 0.3 percent of the survey area. It has been mapped in a single delineation northeast of Little Blue Dome. The soils have formed mainly in local colluvial accumulations of material weathered and moved locally from the associated areas of granitic outcrop. Surface slopes of the soils range from about 40 to 70 percent. Aspects are mainly southeasterly. Elevations range from about 2310 to 2560 m. Mean annual soil temperatures range from about 4° to 7°C, depending upon elevation.

The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. They are moderately deep to deep to underlying, well weathered rock and differ from the representative pedon in having coarse sandy loam textures throughout their profiles. Rock fragments occupy less than 35 percent of the soils' volumes. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. These soils are shallow to underlying, slightly weathered rock. They differ from the representative pedon in having coarse sandy loam textures. Rock fragments comprise less than 35 percent of the soils' volumes. Both the Pachic and Lithic Xerumbrepts have frigid soil temperature regimes. Mean summer soil temperatures are warm. The Jointed granitic outcrop is similar to its description given on page 53. The joint system fragmenting the rock has joint sets striking northeasterly and northerly, as well as northwesterly.

The soils support a dense cover of shrubs, mainly greenleaf manzanita (A. patula), and open to semi-open stands of white fir (A. concolor) with some Jeffrey pine (P. jeffreyi).

The Pachic Xerumbrepts, coarse loamy, and Lithic Xerumbrepts each comprise about 35 percent of this unit; the Joint granitic outcrop about 25 percent. Lesser areas of Granitic talus are included.

PxnD – Pachic Xerumbrepts-Lithic Xerumbrepts association, mesic, sloping to steep. This soil map unit is very limited in extent, comprising less than 0.1 percent of the survey area. It has been mapped in a single delineation located east of Sunset Rock in the vicinity of Pinewood Village. The soils have formed in residuum as well as in some colluvium accumulated in swale positions. The parent materials have been weathered from granitic rock. The surface slopes range from about 10 to 30 percent. Aspects are northerly. Elevations range from about 1860 to 1920 m. The mean annual soil temperature for both kinds of soil is about 9°C.

It was impractical to map the named components of this unit separately. The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. These soils differ from the representative pedon in having coarse sandy loam textures throughout. They are deeper than 50 cm to underlying, well weathered rock. The Lithic Xerumbrepts are similar to the Lithic Xerumbrepts taxonomic unit description given on page 71. These soils differ from the representative pedon in having coarse sandy loam textures. They are less than 50 cm deep to underlying slightly weathered rock. The soil temperature regimes for both soils are cool mesic.

The soils support a semi-open cover of conifers and a few oaks and shrubs. The conifers are white fir (A. concolor), sugar pine (P. lambertiana), incense cedar (C. decurrens), and occasional sequoia (S. gigantea) on the deeper soils. The oaks are black oak (Q. kelloggii), and the shrubs are greenleaf manzanita (A. patula).

The Pachic Xerumbrepts comprise about 35 percent of this unit; the Lithic Xerumbrepts about 30 percent. Included are lesser areas of moderately deep and shallow soils with weakly developed, brighter colored subsoils

underlying thin, dark colored surface soils. Their base saturation is less than 50 percent.

PxoD - Pachic Xerumbrepts-Xeric Haplohumults association, mesic, sloping to steep. This soil map unit comprises about 1.9 percent of the survey area. It has been mapped in three separate delineations located in the Giant Forest area. The soils have formed mainly in residuum weathered from granitic rock. Some have formed in local colluvium accumulated in swales. The surface slopes range from about 10 to 30 percent. The terrain is rolling with aspects of gentle hillslopes in all quadrants of the compass. Elevations range from about 1950 to 2320 m. Mean annual soil temperatures are about 8° to 9°C.

The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. The representative pedon is located in this unit. The soils are deep to very deep to underlying weathered rock. Soil textures range from loamy coarse sand to coarse sandy loam or sandy loam. Pebble to stone-sized rock fragments occupy less than 35 percent of the soils' volumes. The Xeric Haplohumults are similar to the Xeric Haplohumults taxonomic unit description given on page 99. The representative pedon is located in this unit. (For additional information, see Appendix I, pp. 1-3; and Appendix II, p. 2 - Section 7.0). The soil temperature regimes for both soils are cool mesic.

The soils support a semi-dense cover of conifers with a varied understory of shrubs and ferns. The conifers are principally white fir (A. concolor) with some sugar pine (P. lambertiana), Jeffrey pine (P. jeffreyi), and important stands of sequoia (S. gigantea). There are occasional red fir (A. magnifica) at the higher elevations. The shrubs, mainly greenleaf manzanita (A. patula), are widely scattered; the ferns (Pteridium sp.) grow where the conifer cover is denser or additional local moisture is available.

The Pachic Xerumbrepts comprise about 35 percent of the unit; the Xeric Haplohumults about 30 percent. Included are: widely scattered, lesser areas of Aquepts, mesic, in meadow sites; Entic Xerumbrepts; and other similar soils with bright colored subsoils, lacking significant clay accumulation, that have either thin, dark colored surface soils, or have dark colored, moderately coarse textured surface soils that are thicker, but not thicker than 50 cm. Both of the latter inclusions have base saturations less than 50 percent.

PxoF - Pachic Xerumbrepts-Xeric Haplohumults association, mesic, very steep. This soil map unit comprises about 0.9 percent of the survey area. It has been mapped in a single delineation west of Sunset Rock on the upper slopes of Marble Fork canyon. The soils have formed in colluvium and residuum weathered from granitic rock. The surface slopes range from about 30 to 60 percent. Their aspects are mainly westerly, but some have a northerly direction. Elevations range from about 1390 to 1980 m. Mean annual soil temperatures range from about 9° to 12°C, depending upon elevation and aspect as well as upon position in protected, cooler ravines.

The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. These soils are deep to very deep. Soil textures range from loamy coarse sand to coarse sandy loam or sandy loam. Rock fragments occupy less than 35 percent of the soils' volumes. The Xeric Haplohumults are similar to the Xeric Haplohumults taxonomic description given on page 99. (For additional information see Appendix I, pp. 1-3; and Appendix II, p. 2 - Section 7.0). The soil temperature regime for both soils is cool mesic.

The soils support a semi-dense cover of conifers with a minor understory of shrubs and some deciduous trees. The conifers consist of white fir (A. concolor), Jeffrey pine (P. jeffreyi), sugar pine (P. lambertiana), incense cedar (C. decurrens), and sequoia (S. giganteum) growing at their lowest elevations in the area. The shrubs consist of greenleaf manzanita (A. patula), and patches of bear clover (C. foliolosa). The deciduous trees are mainly black oak (Q. kelloggii) and mountain dogwood (Cornus nutallii).

The Pachic Xerumbrepts comprise about 40 percent of this unit; the Xeric Haplohumults about 35 percent. Included are lesser areas of Xeric Haplohumults with either rock fragments occupying more than 35 percent of the soil volume, or with loam to sandy clay loam subsoil textures. Also included are deep soils with base saturation less than 60 percent and with thin, dark colored surface soils overlying bright colored, similar textured subsoils.

<u>PxoG - Pachic Xerumbrepts-Xeric Haplohumults association, mesic, extremely steep</u>. This soil map unit comprises about 0.5 percent of the survey area. It is mapped in a single delineation located on the extremely steep canyon slopes of the Marble Fork adjacent to Marble Falls. The soils have formed in residuum and stabilized colluvium weathered mainly from granodiorite. The surface slopes are in excess of 75 percent. Many near-parallel drainageways tributary to the Marble Fork flute the westerly facing slope of this unit, producing additional southwesterly and northwesterly aspects. Elevations range from about 1280 to 1950 m. Mean annual soil temperatures range from about 10° to 12.5°C, depending upon elevation, aspect, and cool air drainage down the Marble Fork canyon.

The Pachic Xerumbrepts are similar to the Pachic Xerumbrepts taxonomic unit description given on page 79. The soils are deep to very deep to the underlying weathered rock. Soil textures range from loamy coarse sand to coarse sandy loam. Rock fragments occupy less than 35 percent of the soil volume. The Xeric Haplohumults are similar to the Xeric Haplohumults taxonomic unit description given on page 99. The soils are very deep. Textures are coarse sandy loam throughout. (For additional information, see Appendix I, pp. 1-3; and Appendix II, p. 2 - Section 7.0). The soil temperature regime for both soils is mesic.

The soils support a semi-dense to dense cover of hardwoods and irregularly distributed, open to semi-open stands of conifers. There are some shrubs. The hardwoods consist of canyon live oak (Q. chrysolepis) and black oak (Q. kelloggii). The conifers consist of ponderosa pine (P. ponderosa), white fir (A. concolor), and incense cedar (C. decurrens). The

shrubs are bear clover (C. foliolosa), whiteleaf manzanita (A. viscida), and greenleaf manzanita (A. patula).

The Pachic Xerumbrepts comprise about 45 percent of the unit; the Xeric Haplohumults about 40 percent. Included are lesser areas of moderately deep soils with base saturation less than 60 percent, and thin, dark colored surface soils overlying bright colored, similarly textured subsoils. Also included are scattered outcrops of jointed granitic rock, and outcrops of jointed, marbleized limestone in the near vicinity of Marble Falls.

Sf - Schistose felsenmeer. This miscellaneous area map unit comprises about 0.3 percent of the survey area. It is mapped in two delineations outlining remnant areas of mica schist located along the crest of the watershed boundary between the Kaweah and Kings Rivers. One is located in Elizabeth Pass, the other along the crest northwest of Lion Lake. These delineations lie above the upper limits of the Pleistocene ice field development on either side of the drainage divide and have not been affected by direct glacial action. The land surface is virtually barren and consists of a jumble of frost-riven, brownish colored channers, flags, and stone-sized fragments of mica schist. The surface is less chaotic and relatively smoother than the Granitic felsenmeer elsewhere. Voids between rock fragments are smaller, but afford ready passageways for infiltration of precipitation and melt-water.

Included in this unit are areas of talus and jointed outcrops of schistose rock. The Schistose felsenmeer comprises more than 85 percent of the unit.

Typic Cryofluvents

This subgroup of soils includes deep to very deep, well drained soils formed in stratified alluvium laid down on gentle gradients by small streams as irregular, narrow floodplains or fans in the subalpine zone. The parent material has washed from adjacent upland soils formed from the weathering of granitic rock, mainly granodiorite. The soils are very limited in extent. They have been recognized in two separate map units and exist as minor inclusions in a few others. Elevations range from about 2710 to 2895 m. Mean annual soil temperatures range from about 3° to 4.5°C. Mean summer soil temperatures are cool to cold. Mean annual precipitation ranges from about 1200 to 1300 mm, more than half of which falls as snow.

The soils support a varied vegetation. At the lower elevations, it consists of a semi-open to open cover of conifers with grass and shrubs. At the higher elevations ,the cover is herbaceous plants, grass, and some shrubs. The conifers consist of red fir (A. magnifica) and lodgepole pine (P. contorta murrayana). The grasses and herbaceous plants are short hair grass (Deschampsia sp.) and lupine (Lupinus sp.). The shrubs are willow (Salix sp.).

Typically, these soils are very acid and have formed in stratified alluvium. The surface soils are thin, dark colored and coarse or moderately coarse textured. The subsurface and substratum to depths in excess of 150

cm consist of alternating layers of dark colored, moderately coarse textured material and light colored, sandy material. The darker colors correlate with higher amounts of organic matter. Pebble, cobble and stone content varies from place to place. Some areas lack rock fragments, others have much more than 35 percent by volume.

Following is a profile description of a representative pedon located about 10 m from the edge of Emerald Lake in a small fan deposit on the east side of the Lake; slope about 5 percent northwest; dense cover of willow: (Colors are for dry soil unless otherwise noted).

0 -- 3 to 0 cm; dark brown, slightly decomposed willow leaves and twigs; very abrupt smooth boundary.

A -- 0 to 3 cm; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; very strongly acid (pH 5.0); very abrupt wavy boundary.

2C -- 3 to 6 cm; pale brown (10YR 6/3) fine gravelly sand, brown (10YR 5/3) moist; single grain; loose, very friable to loose, nonsticky and nonplastic; few fine roots; very strongly acid (pH 4.5); very abrupt wavy boundary.

3Ab to 8C -- 6 to 68 cm; sequence of 6 alternating horizons very similar to the A and 2C horizons above and ranging in thickness from 3 to 20 cm, the Ab horizons being the thinnest; medium and fine roots present; very strongly acid; very abrupt wavy boundary.

9Ab -- 68 to 75 cm; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few fine and medium roots; very strongly acid (pH 5.0); very abrupt wavy boundary.

10C -- 75 to 150 cm; light brownish gray (10YR 6/2) fine gravelly sand, grayish brown (10YR 5/2) moist; single grain; loose, loose, nonsticky and nonplastic; strongly acid (pH 5.5).

The thicknesses of the buried surface soils (Ab horizons) range from about 2 to 10 cm. The number of buried surface soils, or layers containing alluviated organic matter and intercalated C horizons, varies within short distances. The A horizon textures range from fine sandy loam to coarse sandy loam or loamy coarse sand. The C horizon textures are loamy sand, loamy coarse sand, or sand. Rock fragments, ranging from pebble to stone size, are commonly present, but from place to place, range from less than 10 percent to more than 35 percent of the soil volume. The soils range from very strongly acid to strongly acid and have base saturations less than 50 percent.

TcfB - Typic Cryofluvents, nearly level. This soil map unit is very limited in extent. It compromises less than 0.1 percent of the survey area and is located in a single delineation nearly surrounding an alpine meadow

on a bench above and northeast of Tamarack Lake. These very deep soils have formed in very gravelly and cobbly alluvium washed from surrounding talus areas, rock outcrop areas, and areas of sloping to steep soils. The surface slopes range from about 1 to 5 percent, dropping gently downward toward the meadow. Shallow stream channels incise the surface in places. The elevation of this unit is about 2895 m. The mean annual soil temperature is about 3°C. Mean summer soil temperatures are cool to cold.

The soils of this unit are similar to the Typic Cryofluvents taxonomic unit description given on page 93. They are, however, much more gravelly and cobbly than the representative pedon. Textures are very gravelly and cobbly throughout. In places, they are extremely gravelly. Parts of the unit remain moist longer than others through seepage of melt-water from lingering snow banks. The soil temperature regime is cryic.

The soils support a semi-dense cover of lupine (Lupinus sp.) and grasses, including hair grass (Deschampsia sp.). Bare areas are usually covered with pebble and cobble-sized granitic rock fragments.

The Typic Cryofluvents compromise about 90 percent of the unit. Included in the unit are scattered large boulders and small, irregular areas of angular stones placed by avalanche action.

TcfD - Typic Cryofluvents, sloping to steep. This soil map unit is very limited in extent, compromising less than 0.1 percent of the survey area. It is mapped in a single delineation located between Emerald and Aster Lakes. These very deep soils formed in moderately coarse to coarse alluvium and in local slope wash deposited in irregular rock basins along the creek draining Emerald Lake. Surface slopes range from about 5 to 20 percent. Elevation within the unit ranges from about 2770 to 2820 m. The mean annual soil temperature is about 3.5°C. Mean summer soil temperatures are cool.

The Typic Cryofluvents are similar to the Typic Cryofluvents taxonomic unit description given on page 93. Soil textures include fine sandy loam, coarse sandy loam, and fine gravelly sand. Rock fragments occupy less than 35 percent of the soil volume.

The soils support a semi-dense cover of herbaceous plants, grasses and shrubs, with scattered stands of conifers. The plants and grasses are mainly lupine (Lupinus sp.) and hair grass (Deschampsia sp.). The shrubs are willow (Salix xp.), and the conifers are red fir (A. magnifica) and lodgepose pine (P. contorta murrayana). The south part of the unit has been cleared in places for campsites.

Typic Cryofluvents comprise only about 45 percent of the unit. The remainder consists of lesser areas of: deep, sandy soils with thin, dark colored surface soils; Cryaquepts; Lithic Cryumbrepts and Entic Cryumbrepts locally formed in colluvium; and Jointed granitic outcrop.

Typic Cryorthents

This subgroup includes light colored, shallow to very deep, minimally horizonated soils formed mainly in residuum from granitic rock weathering. Some have formed in colluvial or morainal material. These soils are well to excessively drained, well leached, and acid in reaction.

The soils are limited in extent, comprising about 1.9 percent of the survey area. They are mapped separately or in association with other soils or miscellaneous areas on ridge crests and mountain slopes in the subalpine and alpine zones in the vicinities of Emerald Lake, Alta Peak, Tharps Rock, Moose Lake, Buck Creek canyon, Elizabeth Pass, and Mt. Stewart. They also exist as inclusions in other soil map units. Elevations range from about 2600 to 3590 m. Mean annual soil temperatures range from about 0° to 4°C. Mean summer soil temperatures are cool to cold. Mean annual precipitation ranges from about 1100 to 1300 mm, most of which falls as winter snow. Precipitation from periodic summer thunderstorms may randomly moisten the upper parts of the soil during the summer.

The soils support a sparse cover of perennial grasses, subalpine and alpine plants and shrubs. Scattered conifers grow in the subalpine zone. The shrubs include willow (Salix sp.) and chinquapin (Castanopsis sempervirens). The conifers consist of western white pine (Pinus monticola), foxtail pine (Pinus balfouriana), white bark pine (Pinus albacaulis), and red fir (Abies magnifica). Much of the soil is barren of vegetation and exhibits an erosion pavement of fine gravel.

Typically, these soils are strongly acid and very gravelly. They have thin, slightly darkened surface soils overlying somewhat brighter colored, very gravelly sandy subsoils, or layers of lighter colored, moderately coarse textured parent material that, in turn, rests on deeply weathered granitic rock.

Following is a profile description of a representative pedon located on the ridge crest between Emerald and Pear Lakes at an elevation of about 3080 m; open stand of stunted western white pine, scattered chinquapin and a few alpine plants; colors are for dry soil unless otherwise noted: (For additional information, see Appendix I, pp. 50-51; and Appendix II, p. 25 Section 7.0)

A -- 0 to 5 cm; pale brown gravelly loamy coarse sand, dark brown moist; single grain; loose, loose, nonsticky and nonplastic; few very fine roots; 30 percent fine pebbles by volume; strongly acid; abrupt wavy boundary.

Bw -- 5 to 43 cm; very pale brown very gravelly loamy coarse sand, yellowish brown moist; very weak fine granular structure; soft, very friable; nonsticky and nonplastic; common very fine, fine and medium, roots; 45 percent fine pebbles by volume; strongly acid; clear wavy boundary.

C -- 43 to 61 cm; light gray very gravelly loamy coarse sand, brown moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium, roots; 40 percent fine pebbles by volume; strongly acid; abrupt wavy boundary.

Cr -- 61 to 75+ cm; light gray, well weathered granitic rock; can be excavated by hand with difficulty.

These soils range in depth form about 25 to 100 cm to well weathered parent rock or unweathered underlying rock; those soils formed in morainal material have depths in excess of 150 cm.

The thickness of the surface soils ranges from about 10 to 30 cm. Surface soil colors range from light brownish gray to grayish brown. The organic matter content averages less than 1.5 percent in the upper 25 cm. Subsurface colors range from light gray to light yellowish brown. The brighter chroma color is associated with sandy textures. Textures range from coarse sands to coarse sandy loams. Fine pebbles, pebbles, cobbles and stones are common and range from about 10 to 75 percent by volume; most of the soils have more that 35 percent. The soils are strongly acid to extremely acid throughout their profiles.

TcoF - Typic Cryorthents, very steep. This soil map unit comprises about 0.8 percent of the survey area. It is mapped in four delineations located in the subalpine and alpine zones. Two are on Alta Peak and associated ridges; one is in the upper reach of Buck Creek canyon; and one is on the survey boundary-drainage divide northwest of Elizabeth Pass. The soils have formed mainly in sandy residuum weathered from granitic rock. On steeper parts of the unit, and in Buck Creek canyon, the soils have formed in colluvium and morainal material. The surface slopes range from about 30 to 60 percent. Slopes less than 30 percent are included near ridge crests. Elevations range from about 2600 to 3590 m; aspects range from southwest to southeast. Parts of the unit at the lower elevations are in a protected canyon subject to cool air drainage downslope. Mean annual soil temperatures range from about 0° to 4°C. Mean summer soil temperatures are cool to cold.

The Typic Cryorthents are similar to the Typic Cryorthents taxonomic unit description given on page 96. Soil depths to underlying weathered rock range from about 55 to more than 150 cm; the deeper soils are associated with steeper slopes cloaked with stabilized colluvium or morainal material. The soil temperature regime is cryic.

The soils support little vegetation. In subalpine areas, there are sparse growths of red heather (Phyllodoce breweri), pussy paws (Calyptridium umbellatum), chinquapin (C. sempervirens), some willow (Salix sp.), and scattered, open suppressed growth stands of western white pine (P. monticola) or foxtail pine (P. balfouriana), red fir (A. magnifica), and some whitebark pine (P. albacaulis) at the krumholz. In the alpine zone, there are very sparse growths of alpine plants.

The Typic Cryorthents comprise about 75 percent of the unit. Included in the unit are lesser areas of Lithic Cryorthents, Jointed granitic outcrop, and, in places, Granitic talus and Granitic felsenmeer.

TcpF - Typic Cryorthents-Entic Cryumbrepts association, very steep. This soil map unit comprises about 0.1 percent of the survey area. It is mapped in a single delineation west of Tharp's Rock. The soils have formed mainly in ground moraine, as well as in some residuum and colluvium weathered from local granitic rock. The morainal material reflects past action of short Pleistocene ice tongues working downslope from a minor ice field on the upper, southerly slopes of Alta Peak ridge. The surface slopes of the soils range from about 30 to 65 percent. The aspect is southwesterly. Elevations range from about 2800 to 3050 m. Mean annual soil temperatures range from about 2° to 4°C. Mean summer soil temperatures are cool.

It was impractical to map the named components of this unit separately. The Typic Cryorthents are similar to the Typic Cryorthents taxonomic unit description given on page 96. The textures throughout these soils range from coarse sand to coarse sandy loam. Rock fragments of pebble and cobble size occupy more than 35 percent of the soil volume. The Entic Cryumbrepts are similar to the Entic Cryumbrepts taxonomic unit description given on page 29. The dark colored surface soils range in thickness from about 40 to 60 cm. Textures throughout these soils are coarse sandy loams with more than 35 percent by volume of rock fragments. The soil temperature regime for both soils is cryic.

The soils support an open to semi-open stand of conifers, some showing significant growth suppression toward the higher elevations of the unit. There is also a sparse shrub cover and some alpine plants. The conifers consist of red fir (A. magnifica) and western white pine (P. monicola). The shrubs are chinquapin (C. sempervirens) and some willow (Salix sp.).

The Typic Cryorthents comprise about 30 percent of the unit; the Entic Cryumbrepts about 30 percent. Included in this unit are lesser areas of Lithic Cryumbrepts, Jointed granitic outcrops, scattered large boulders, and deep, moderately coarse textured, but very gravelly or stony soils that have thin, dark colored surface soils overlying a brighter colored subsoil. Base saturation is less than 50 percent.

TcrF - Typic Cryorthents-Granitic felsenmeer association, very steep. This map unit comprises about 0.3 percent of the survey area. It is mapped in two delineations. One is located south of Moose Lake, the other on the ridge west of Mt. Stewart. The soils have formed in residuum and local colluvium weathered from granitic rock. Surface slopes of the soils range from about 30 to 70 percent. Aspects are mainly easterly near Moose Lake, but are southerly near Mt. Stewart. Elevations range from about 2865 to 3200 m. Mean annual soil temperatures range from about 1° to 3°C. Mean summer soil temperatures are cool to cold.

It was not practical to map the named components of this map unit separately. The Typic Cryorthents are similar to the Typic Cryorthents taxonomic unit description given on page 96. The soils have coarse sandy

textures throughout and more than 35 percent of the soil volume is occupied by pebble and cobble-sized rock fragments. The soil temperature regime is cryic. The Granitic felsenmeer is similar to its description given on page

The soils support sparse vegetation consisting of scattered alpine plants, clusters of shrubs, and clustered, but open stands of conifers. The shrubs consist of chinquapin (C. sempervirens) and willow (Salix sp.). The conifers are western white pine (P. monticola), red fir (A. magnifica), and whitebark pine (P. albacaulis).

The Typic Cryorthents and Granitic felsenmeer comprise about 30 percent each of the map unit. Jointed granitic outcrop, comprising about 20 percent of the unit, is treated as an inclusion. Also included are lesser areas of Granitic talus, Lithic Cryorthents, and Entic Cryumbrepts.

TcsF - Typic Cryorthents-Jointed granitic outcrop association, very steep. This map unit is very limited in extent. It comprises less than 0.1 percent of the survey area. It is mapped in a single delineation near Moose Lake on southeasterly facing slopes dropping into Buck Creek canyon. The surface slopes on the soils range from about 30 to 50 percent. Elevations range from about 2925 to 3170 m. Mean annual soil temperatures range from about 1.5° to 2°C. Mean summer soil temperatures are cool.

The Typic Cryorthents are similar to the Typic Cryorthents taxonomic description given on page 96. The soils are similar to the representative pedon, but have more coarse gravel and cobble content reflecting the ground moraine parent material. The soil temperature regime is cryic. The Jointed granitic outcrop is similar to its description given on page 53. The joint sets fracturing the rock have mainly a northeast strike.

The soils support a semi-open cover of shrubs with a scattered, open stand of repressed conifers. The shrubs are chinquapin (C. sempervirens) and some willow (Salix sp.). The conifers are western white pine (P. monticola).

The Typic Cryorthents comprise about 55 percent of the map unit; the Jointed Granitic outcrop about 30 percent. Included in this unit are lesser areas of Entic Cryumbrepts and Granitic glacial rubble land.

Xeric Haplohumults

This subgroup includes very deep soils with dark colored surface horizons and reddish colored subsoil horizons. They have formed in both colluvium and residuum weathered from granitic rock, mainly granodiorite. The soils are well drained, well leached, and acid in reaction. They have moderately coarse textures throughout and have formed on relatively more stable parts of the local landscape.

These soils are somewhat limited in extent, comprising about 1.7 percent of the survey area. They are mapped separately and in association with

other soils in the Giant Forest area, and are located in the middle and lower parts of the middle mountain, lower conifer zone. Elevations range from about 1280 to 2190 m. Mean annual soil temperatures range from about 9° to 13°C. Mean annual precipitation, occurring both as rain and as snow in the late fall to spring, ranges from about 850 to 1250 mm. Periodic, random thunderstorms can moisten the upper parts of the soil in places during the summer. Moisture penetration under these conditions seldom penetrates below about 20 cm of the mineral soil.

The soils support a semi-dense to dense cover of high site quality conifers with some shrub understory. There are a few hardwood trees. The conifers consist of white fir (A concolor), Jeffrey pine (Pinus jeffreyi), sugar pine (P lambertiana), and sequoia (Sequoiadendron giganteum). At lowest elevations, there are ponderosa pine (Pinus ponderosa) and incense cedar (Calocedrus decurrens). The hardwood trees are black oak (Quercus kelloggii) and mountain dogwood (Cornus nuttallii); canyon live oak (Quercus chrysolepis) grows at the lower elevations. The shrubs consist of greenleaf manzanita (Arctostaphylos patula); at lower elevations these are associated with some bear clover (Chamaebatia foliolosa) and whiteleaf manzanita (Arctostaphylos viscida). In relatively moist areas, there are abundant ferns (Pteridium sp.).

Typically, these soils have a thick, dark brown, coarse sandy loam, neutral to slightly acid surface soil overlying a very thick, strong brown to reddish brown, similarly textured, slightly acid to medium acid subsoil that grades into well weathered granitic parent material at depths in excess of 200 cm.

Following is a profile description of a representative pedon located about 35 m northeast of a turnout on Crystal Cave Road, 0.65 km from its junction with the Generals Highway; elevation - 1658 m; slope - 30 percent; aspect - west; vegetation - white fir, sugar pine, incense cedar, no understory; colors are for dry soil unless otherwise noted: (For additional information, see Appendix I, pp. 1-6; Appendix II, pp. 2-3 - Section 7.0).

01 -- 5 to 2 cm; dark brown conifer needles, twigs, and bark fragments.

02 -- 2 to 0 cm; very dark brown decomposed conifer needles, twigs and bark fragments; rests very abruptly on:

A1 -- 0 to 6 cm; dark brown coarse sandy loam, very dark brown moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; common very fine roots; neutral (pH 6.7); very abrupt boundary.

A2 -- 6 to 24 cm; dark brown coarse sandy loam, dark brown moist; weak medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; few fine, common very fine roots; neutral (pH 6.7); clear wavy boundary.

AB -- 24 to 53 cm; brown coarse sandy loam, reddish brown moist; weak medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; many fine, common medium, few coarse roots; slightly acid (pH 6.5); clear wavy boundary.

BA -- 53 to 83 cm; strong brown coarse sandy loam, dark reddish brown moist; massive; slightly hard to hard; friable, slightly sticky and slightly plastic; common very fine, fine and medium roots, few coarse roots; slightly acid (pH 6.4); abrupt wavy boundary.

Bt1 -- 83 to 120 cm; strong brown coarse sandy loam, reddish brown moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; clay films as bridges between sand grains and as irregular pore fill; slightly acid (pH 6.2); clear wavy boundary.

Bt2 -- 120 to 162 cm; reddish brown and strong brown coarse sandy loam, reddish brown moist; massive; very hard, firm, slightly sticky and slightly plastic; few fine roots; clay films as bridges between sand grains and as irregular pore fill; medium acid (pH 5.8); gradual wavy boundary.

BC1 -- 162 to 237 cm; light brown coarse sandy loam, strong brown moist; massive; medium acid (pH 5.7); diffuse boundary.

BC2 -- 237 to 300 cm; light yellowish brown coarse sandy loam, reddish yellow moist; massive;

Well weathered granitic rock underlies these soils are depths ranging from about 65 to more than 300 cm. The surface soils range in color from brown to dark grayish brown; the subsoils from strong brown to reddish brown. Surface textures range from coarse sandy loam to loam; subsoil textures from coarse sandy loam to sandy clay loam. Pebble or cobble-size rock fragments occupy less than 35 percent of the soil volume. The soil reaction ranges from neutral to medium acid, but the base saturation is usually less than 50 percent in the surface soils, and less than 35 percent in the lower subsoils.

ThuF - Xeric Haplohumults, mesic, very steep. This soil map unit comprises about 0.2 percent of the survey area. It is mapped in two separate delineations along Ash Peaks Ridge near Panorama Point. The soils have formed in residuum and local colluvium weathered from granitic rock. The surface slopes of the soils range from about 30 to 60 percent with easterly and southerly aspects. Elevations range from about 1280 to 1710 m. Mean annual soil temperatures range from about 10° to 13°C.

The Xeric Haplohumults are similar to the Xeric Haplohumults taxonomic unit description given on page 99. However, these soils differ from the representative pedon in having sandy clay loam to clay loam subsoils. In addition, they are moderately deep to deep to the underlying weathered granitic rock. Depths range from about 60 to 150 cm.

These soils support a semi-dense cover of oak, shrubs, and a few conifers. The oaks are mainly canyon live oak (Q. chrysolepis) with some black oak (Q. kelloggii). The shrubs are chamise (A. fasciculatum), whiteleaf manzanita (A. viscida) and bear clover (C. foliolosa). The conifers are ponderosa pine (P. ponderosa). open areas support annual grasses and forbs.

The Xeric Haplohumults comprise about 60 percent of this unit. Included in the unit are areas of Ultic Haploxeralfs, mesic, with clay loam subsoils and with clay subsoils. In addition, there are scattered exposures of Jointed granitic outcrop.

Typic Xerochrepts

This subgroup includes shallow to moderately deep, well to excessively drained soils having weak subsoil development which have formed in residuum and colluvium weathered from granitic, gabbro-dioritic, or metamorphic sedimentary rocks. They are limited in extent, and are found in the foothills of the survey area at elevations ranging from about 600 to 1200 m. Mean annual precipitation ranges from about 680 to 810 mm. Mean annual air temperatures range from about 13° to 16°C. The soils have a thermic temperature regime and a xeric moisture regime.

These soils support a semi-open to dense cover of shrubs and hardwood trees; open areas support annual grasses and forbs. The shrubs consist mainly of chamise (Adenostema fasciculatum), and buck brush (Ceanothus cuneatus). The hardwoods are mainly blue oak (Quercus douglasii), interior live oak (Quercus wislizenii), and California buckeye (Aesculus californica).

Typically, these soils have brown, moderately coarse to medium textured, slightly acid surface soils that are low to very low in organic matter, and that grade into yellowish brown, similarly textured subsoils underlain by weathered parent rock at about 100 cm.

Following is a profile description of a representative pedon located in the southeast part of the southern Elk Creek study watershed unit at an elevation of about 725 m; open cover annual grasses and forbs, scattered chamise and hardwoods: (Colors are for dry soil unless otherwise noted)

A1 -- 0 to 5 cm; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; hard, very friable, nonsticky and slightly plastic; many fine and very fine roots; slightly acid; abrupt wavy boundary.

A2 -- 5 to 15 cm; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly acid; clear smooth boundary.

AB -- 15 to 43 cm; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; slightly acid; abrupt wavy boundary.

Bt -- 43 to 75 cm; yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/6) moist; moderate coarse angular blocky structure; very hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; few fine roots; slightly acid; clear smooth boundary.

BC -- 75 to 90 cm; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt irregular boundary.

Cr -- 90 to 120+ cm; gray to light gray , well weathered gabbro-diorite; rock structure visible; can be excavated with difficulty.

These soils range in depth from about 25 to 100 cm to the underlying weathered parent rock. Dry colors of the surface soil range from yellowish brown to brown, moist colors from dark yellowish brown to dark grayish brown; dry subsoil colors range from brown to dark yellowish brown, moist colors from dark brown, strong brown to dark yellowish brown. Surface and subsoil textures range from loam to coarse sandy loam, generally without coarse fragments. The soils formed in residuum or colluvium from gabbro-diorite and metamorphic rocks have relatively finer textures. Reaction ranges from slightly acid in the surface soil to medium acid in the subsoil. Base saturation is more than 60 percent in some part of the subsoil.

TxcaF - Typic Xerochrepts, shallow, thermic, very steep. This unit comprises about 0.2 percent of survey area and consists of two delineations along Shepherds Saddle Road west of the Ash Mountains Headquarters. Elevations range from about 675 to 930 m. The soils have formed in granitic residuum or metamorphic igneous rock residuum of the Ash Mountain complex. Dominant surface slopes range from 45 to 60 percent and in places the soil have been severely eroded.

The soils are similar in profile to the representative pedon for Typic Xerochrepts except that depths to the weathered parent rock range from about 30 to 50 cm and textures are sandy loams rather the loam.

The soils support a semi-dense to dense cover of shrubs; annual grasses and forbs grow in open areas. The shrubs consist mainly of chamise (A. fasciculatum) with some buck brush (C, cuneatus).

The Typic Xerochrepts, shallow, comprise about 85 percent of this unit. Included are lesser areas of deeper Typic Xerochrepts similar to the representative pedon and Ultic Haploxeralfs that are the dominant soils in adjacent map units.

TxcbG - Typic Xerochrepts, shallow, thermic, schistose-Jointed schistose outcrop association, extremely steep. This map unit comprises about 0.1 percent of the survey area and consists of one delineation near Shepherds Saddle. Elevations range from about 900 to 1100 m. The soils have formed in residuum and colluvium from mica schist and are in association with jointed schistose outcrops. Dominant surface slopes are greater than 75 percent. Mean annual soil temperatures range from about 15° to 15.5°C.

It was impractical to map the named components of this unit separately. The soils are similar to the Typic Xerochrepts taxonomic unit description given on page 102. They differ from the representative pedon in that depths to the weathered parent rock range from about 25 to 50 cm, and the parent rock is schist rather than gabbro-diorite. The Jointed schistose outcrop is similar to its description given on page 63. The soils support a semi-open cover of chamise (A. fasciculatum) with annual grasses and forbs in open areas. Some chamise grows in earth-filled joints in the outcrops.

The Typic Xerochrepts, shallow, schistose, comprise about 65 percent of the unit; the Jointed schistose outcrop about 20 percent. Inclusions in this unit are Typic Xerochrepts, shallow, derived from granitic rock residuum.

TxcdF - Typic Xerochrepts, thermic, schistose-Jointed schistose outcrop association, very steep. This map unit comprises less than 0.1 percent of the survey areas and is mapped as a single delineation northwest of the Potwisha Campground across the Marble Fork of the Kaweah River. The soils have formed in residuum from mica schist and exist in intimate association with mica schist rock outcrops. Surface slopes of the soils range from about 45 to 75 percent; aspects are southerly and northeasterly. Elevation is about 790 m; mean annual soil temperature is about 16.5°C.

It was impractical to map the named components of this unit separately. The soils are similar to the Typic Xerochrepts taxonomic unit description given on page 102, but differ from the representative pedon in having formed in residuum weathered from mica schist rather that gabbro-diorite. The Jointed schistose outcrop is similar to its description given on page 63.

The soils support a semi-open cover of woodland, a few shrubs, and annual grasses and forbs in open areas and as understory with the hardwoods. The hardwoods consist of blue oak (Q. douglasii) with some interior live oak (Q. wislizeni). The shrubs are chamise (A. fasciculatum).

The Typic Xerochrepts comprise about 50 percent of the unit; the Jointed schistose out crop about 25 percent. Included in the unit are lesser areas of: shallow Typic Xerochrepts; Ultic Haploxerolls derived from mica schist or marblized limestone residuum; and outcrops of marblized limestone.

TxcmF - Typic Xerochrepts-Ultic Haploxeralfs association, thermic, mafic, very steep. This map unit comprises about 1 percent of the survey area and consist of a single delineation flanking both sides of the Marble Fork of the Kaweah River north of the Potwisha Campground. A trellis pattern of tributaries has produced parallel sets of interfluve ridges on each side of the River. Surface slopes range from about 45 to 75 percent; aspects lie in all quadrants of the compass. Elevations range from about 730 to 1340 m. Mean annual soil temperatures range from about 15° to 17°C.

The named component soils of this unit are impractical to separate at this level of mapping. The Typic Xerochrepts are derived from quartz diorite residuum and are similar in profile to their representative pedon (see page 102.) except that textures are coarse sandy loam throughout and depths to weathered parent rock are somewhat shallower. The Ultic Haploxeralfs are similar to their representative pedon (see page 108.) except that depths range from about 60 to 90 cm.

These soils support a semi-dense cover of shrubs with annual grasses and forbs as a sparse understory or providing a dense cover in open areas. Hardwoods grow in the ravines and along the Marble Fork. The shrubs consist mainly of chamise (A. fasciculatum) with some buck brush (C. cuneatus) and chaparral whitethorn (Ceanothus leucodermis). The sequestered hardwoods consist of blue oak (Q. douglasii), interior live oak (Q. wislizenii), canyon live oak (Quercus chrysolepis), and California buckeye (A. california); sycamore (Platanus racemosa) grow along the Marble Fork.

The Typic Xerochrepts comprise about 45 percent of the unit; the Ultic Haploxeralfs about 40 percent. Included in this unit are: lesser areas of Ultic Haploxerolls along streams channels under hardwood cover; and scattered outcrops of granitic rock.

TxcuF - Typic Xerochrepts, thermic-Ultic Haploxerolls, thermic-Jointed limestone outcrop association, very steep. This map unit comprises about 0.3 percent of the survey area. It is mapped as a single delineation north of the Ash Mountain National Park Headquarters that is deeply incised by a tributary stream to the Kaweah River. The parent rock within this unit consists of a complex os marbleized limestone, mica schist, gabbro-diorite, and some quartz diorite. Surface slopes of the soils range from about 45 to 75 percent; aspects are mainly southeasterly and northwesterly. Elevations range from about 490 to 650 m. Mean annual soil temperatures range from about 17° to 18°C, depending upon elevation and aspect.

It was impractical to map the named components in this unit separately. The Typic Xerochrepts are similar to the Typic Xerochrepts taxonomic unit description on given page 102. These soils have formed mainly from marblized limestone and mica schist; their depths range from about 60 to 90 cm. The Ultic Haploxerolls are similar to the Ultic Haploxerolls taxonomic unit description described on page 116. Most of these latter

soils have formed from marbleized limestone and have depths ranging from about 50 to 75 cm (for additional information, see Appendix I, pp 28-29; and Appendix II, p 12 - Section 7.0). The Jointed limestone outcrop consists of light gray to gray, banded and fractured marbleized limestone exposures. They are individually less than 1 ha in extent and irregular in surface relief.

The soils support a semi-open cover hardwoods with annual grasses and forbs in open areas and beneath the trees. The hardwoods are mainly blue oak (Q. douglasii) with some interior live oak (Q. wislizenii) and California buckeye (A. californica). Yucca plants (Yucca whipplei caespitosa) are associated with the marble outcrops.

The Typic Xerochrepts comprise about 35 percent of the unit; the Ultic Haploxerolls about 30 percent. Included are: lesser areas of Ultic Haploxerolls and Mollic Haploxeralfs formed from gabbro-diorite; and outcrops of intrusive igneous rock.

Typic Xerorthents

This subgroup includes shallow to moderately deep, light-colored, well drained soils formed in residuum or colluvium weathered from intrusive acid igneous or basic igneous rock. The soils are limited in extent in the foothill zone and occur at elevations ranging from about 480 to 900 m. The soil temperature regime is thermic and the soil moisture regime is xeric.

The vegetation cover on these soils is semi-dense to dense chaparral that consists mainly of chamise (Adensotoma fasciculatum) and some whiteleaf manzanita (Arctostaphylos viscida). In places, there is a sparse understory of annual grasses and forbs.

Typically, these soils have a moderately thick, brown surface horizon that grades abruptly into light yellowish brown parent material. The latter grades abruptly into similarly colored, weathered granitic or gabbro-dioritic rock.

Following is a profile description of a representative pedon located near Shepherds Saddle; elevation - 963 m, slope - 45 percent; aspect-south; dense chaparral; colors are for dry soil unless otherwise noted: (for additional information, see Appendix I, pp 20-21; Appendix II, p 10 - Section 7.0).

A1 -- 0 to 12 cm; brown coarse sandy loam, dark yellowish brown moist; moderate granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine roots; slightly acid; abrupt wavy boundary.

A2 -- 12 to 30 cm; brown coarse sandy loam, dark brown moist; weak granular structure; slightly hard, very friable, nonsticky and

nonplastic; common fine, few coarse roots; slightly acid; abrupt wavy boundary.

C -- 30 to 42 cm; light yellowish brown coarse sandy loam, olive brown moist; massive; slightly hard, friable, nonsticky and nonplastic; very few fine and coarse roots; slightly acid; abrupt irregular boundary.

Cr -- 42 to 60 cm; light yellowish brown well weathered granite; rock fabric clearly visible; very hard, firm; few weathered joint planes accommodate few fine roots; excavates with difficulty.

In residuum, depths to underlying weathered rock range from about 25 to 75 cm; in colluvium, the soil depth is 1 m or more. In places, rock fragments occupy more than 35 percent of the soil volume, particularly where textures are sandy. The soils are neutral to slightly acid; base saturation is more that 75 percent throughout the profiles.

TxoaF - Typic Xerorthents, shallow, thermic, very steep. This soil map unit comprises about 0.5 percent of the survey area. It has been mapped in two delineations, one near Shepherds Saddle, the other on the Elk Creek drainage. Surface slopes range from 30 to 75 percent; aspects are mainly southerly. Elevations range from about 900 to 1340 m. Mean annual soil temperatures range from about 15° to 16°C.

The soils have formed in both residuum and colluvium weathered from granite or granodiorite. The Typic Xerorthents, shallow, are similar to the Typic Xerorthents taxonomic unit description given on page 106. The presentative pedon is located in this map unit.

The soils support a semi-dense to dense cover of chaparral that consists mainly of chamise (A. fasciculatum) with some whiteleaf manzanita (A. viscida). Annual grasses and forbs grow in open areas or as sparse understory in the chaparral.

The Typic Xerorthents, shallow, comprise about 60 percent of this unit. Included are lesser areas of: Typic Xerorthents on slopes less than 30 percent and more than 75 percent; Typic Xerochrepts, Ultic Haploxerolls, and scattered granitic rock outcrops and detached boulders.

TxobF - Typic Xerorthents, thermic, very steep. This soil map unit comprises about 0.6 percent of the survey area. It is mapped in a single delineation north of the Ash Mountain National Park Headquarters. Surface slopes range from 30 to 75 percent and are generally south facing. Many deep ravines incise these slopes. Elevations range from about 610 to 850 m. Mean annual soil temperatures range from about 16° to 18°C.

The soils have formed in residuum and colluvium weathered from granite. The Typic Xerorthents are similar to the Typic Xerorthents taxonomic unit description given on page 106. These soils differ from the representative pedon in being deeper than 50 cm to weathered granite. Where formed in

thick colluvium on lower slopes, the soils have rock fragments (pebble to stone-size) occupying from about 10 to more than 35 percent of the soil volume.

The soils support a semi-dense to dense cover of chaparral with some hardwoods in the ravines. The shrubs are mainly chamise (A. fasciculatum). The hardwoods are blue oak (Quercus douglasii) and canyon live oak (Quercus chrysolepis). Annual grasses and forbs grow in open areas.

The Typic Xerorthents comprise about 70 percent of the map unit. Included are lesser areas of: Ultic Haploxerolls on more stable land surfaces near the southern-most tip of the delineation; outcrops of granitic rock; and large, detached boulders.

TxocF - Typic Xerorthents, thermic, mafic, very steep. The soil map unit comprises about 0.3 percent of the survey area. It is mapped in a single delineation between Frys Point and Cactus Point. The soils have formed in residuum and colluvium from the weathering of a gabbro-diorite component of the Ash Mountain geologic complex that is deeply incised by small streams tributary to the Kaweah river. Surface slopes range from 30 to 75 percent with aspects in all directions. Elevations range from about 670 to 700 m. Mean annual soil temperatures range from about 16° to 17°C, depending upon aspect.

The Typic Xerorthents are similar to the Typic Xerorthents taxonomic unit description given on page 106. However, these soils are deeper than 50 cm to weathered rock where formed in residuum.

The soils support a semi-dense to dense cover of chaparral with annual grasses and forbs as a sparse understory, or as denser cover in open areas. Hardwoods grow in parts of the deep ravines. The shrubs are mainly chamise (A. fasciculatum); hardwoods are canyon live oak (Quercus chrysolepis).

The Typic Xerorthents, mafic, comprise about 75 percent of the unit. Included are lesser areas of: Typic Xerorthents, mafic, that are shallow; Typic Xerorthents that have formed in residuum from granodiorite; Jointed mafic outcrop; and Jointed limestone outcrop.

Ultic Haploxeralfs

This subgroup includes moderately deep to very deep, brownish to reddish colored, moderately well leached soils with distinct subsoil development. The soil have formed from granitic, basic igneous, or metamorphic rock residuum. They comprise about 5 percent of the survey area with delineations located: west of, and in the vicinity of Ash Mountain National Park Headquarters; from Potwisha to Hospital Rock; along the General Highway in the vicinity of Hospital Rock to Deer Ridge; and along the Middle Fork Trail. These soils also exist as inclusions in map units of other soils. Elevations range from about 490 to 1480 m. At

the higher elevations, the soils are on south facing slopes. Mean annual soil temperatures range from about 12° to 19°C, depending upon elevation and aspect. Mean annual precipitation ranges from about 570 mm at the lower elevations to about 940 mm at the higher elevations. Most of the precipitation falls as rain during the winter months.

The vegetation on these soils is either semi-open to dense shrubs, or semi-open hardwoods with a dense ground cover of annual grasses and forbs. The shrubs consist mainly of chamise (Adenostema fasciculatum) with some whiteleaf manzanita (Arctostaphylos viscida), buck brush (Ceanothus cuneatus), flannel bush (Fremontia californica), and scattered poison oak (Rhus diversiloba). The hardwoods are mainly blue oak (Quercus douglasii) with some interior live oak (Quercus wislinzenii), buckeye (Aesculus californica), California laurel (Umbellularia californica), and big leaf maple (Acer macrophyllum) in protected sites.

Typically, these soils have light brown coarse sandy loam, slightly acid surface soils overlying thick, reddish yellow to yellowish red, medium acid, sandy clay loam subsoil that grade into well weathered granitic rock at depths of about 150 cm.

Following is a profile description of a representative pedon located along the Shepherd Saddle Road, WNW of Ash Mountain National Park Headquarters; elevation - 610 m; slope - 41 percent, southeast; vegetation - blue oak, annual grasses and forbs; colors are for dry soil unless otherwise noted: (For additional information, see Appendix I, pp 22-23; Appendix II, p 11; see also - Appendix I, pp. 28-31, 38-39, 42-43; Appendix II, pp. 14-15, 19, 21 - Section 7.0).

A -- 0 to 12 cm; light brown coarse sandy loam, dark brown moist; massive - weak granular structure in upper 3 cm; hard, friable, slightly sticky and nonplastic; few very fine roots; slightly acid; clear wavy boundary.

AB -- 12 to 28 cm; light reddish brown coarse sandy loam, reddish brown moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; medium acid; clear wavy boundary.

BA -- 28 to 47 cm; reddish yellow coarse sandy loam, yellowish red moist; very weak medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; very few very fine roots; few clay bridges binding sand grains; medium acid; clear wavy boundary.

Bt1 -- 47 to 108 cm; yellowish red sandy clay loam, reddish brown moist; weak medium angular blocky structure; very hard, friable to firm, sticky and slightly plastic; very few fine roots; common thin reddish brown clay films in pores and as bridges binding sand grains; medium acid; clear wavy boundary.

Bt2 -- 107 to 150 cm; reddish yellow sandy clay loam, yellowish red moist; massive; very hard, friable to firm, sticky and slightly

plastic; clay films bridging and binding sand grains; clear wavy boundary.

Cr -- 150 to 160+ cm; reddish stained, well weathered granodiorite.

In places, there is a thin litter of plant debris on the mineral surfaces of these soils. The soils range in depth from about 60 to more than 150 cm to weathered underlying rock. Surface soil colors are light brown, light reddish brown, yellowish brown and brown; when moist, they are dark brown to very dark grayish brown, and reddish brown in places. Organic matter content in the surface soils is commonly less than 1 percent. Where greater than 1 percent, the surface soils are thin. Surface soil textures range from coarse sandy loam to loam. Few pebbles or cobbles are present. Surface soil reaction ranges from slightly acid to medium acid. The subsoil colors are reddish yellow, reddish brown, yellowish brown, strong brown or brown. When moist, they are dark red, yellowish red, reddish brown, or dark brown. Subsoil textures range from sandy clay loam to clay. Pebbles and cobbles usually occupy less than 20 percent of the soil volume, except where these soils have formed on mica schist. There, the rock fragments occupy from 20 to 40 percent of the soil volume. The subsoil reaction ranges from medium acid to strongly acid. Base saturation of the soils is usually less than 60 but greater than 35 percent, particularly in the subsoil.

UhaF - Ultic Haploxeralfs, fine-loamy, thermic, very steep. This soil map unit comprises about 0.8 percent of the survey area. It is mapped in two separate delineations in the foothill zone. They are located in the near vicinity of the south entrance to the Park, and along the road to Shepherds Saddle. The soils have formed in residuum and colluvium weathered from granitic rock, mainly granodiorite. The surface slopes range from about 30 to 60 percent with southerly, westerly, and easterly aspects. Elevations range from about 490 to 855 m. Mean annual soil temperatures range from about 16° to 18.5°C.

The Ultic Haploxeralfs, fine-loamy, are similar to the Ultic Haploxeralfs taxonomic unit description given on page 108. The representative pedon for this taxon is located within this map unit. Surface textures are coarse sandy loam or sandy loam. Surface soil colors are brown to grayish brown. The texture of the distinctly developed subsoils include loams, sandy clay loam, and clay loam. Subsoil colors range from strong brown to yellowish red. Depth to underlying weathered rock ranges from about 65 to 150 cm. Some parts of the unit are deeper where the soils have developed in accumulated colluvial material.

The soils support a semi-open cover of woodland and associated grass. The woodland consists mainly of blue oak (Q. douglasii); the grass cover is mainly annual grasses and forbs.

The Ultic Haploxeralfs, fine-loamy, comprise about 60 percent of the unit. Included are: lesser areas of shallow Entic Ultic Haploxerolls; moderately deep Typic Xerochrepts; moderately deep to deep Mollisols with either heavy sandy loam or clay loam subsoils underlying thick, dark colored

surface soils; Ultic Haploxeralfs formed from mica schist; and occasional Jointed granitic outcrops.

UhbF - Ultic Haploxeralfs, fine-loamy, thermic, mafic, very steep. This soil map unit comprises about 1.1 percent of the survey area. It is mapped in three delineations in the foothill zone. One is located south of Shepherds Saddle, another lies along the Generals Highway between Ash Mountain National Park Headquarters and Potwisha. The third lies between Potwisha and Hospital Rock. These soils have formed is residuum and colluvium from a variety of parent rocks, geologically identified as part of the Ash Mountain Complex. These are mainly diorites, metamorphosed diorites, and quartz diorites. Included are septa of marbleized limestone and mica schist. The surface slopes range from 30 to 75 percent. Elevations range from about 500 to 1075 m. Mean annual soil temperatures range from about 15° to 18°C.

The Ultic Haploxeralfs, mafic, are similar to the Ultic Haploxeralfs taxonomic unit description given on page 108. Many of the variations described in the taxonomic unit are located in this map unit. The soils are moderately deep to deep. Surface textures range from fine sandy loam to coarse sandy loam and loam. In many places, the surface soils are thick, dark colored, and have more than 1 percent organic matter. However, they lack sufficient structural development to be classed as Mollisols.

The soils support both semi-open woodland cover and associated grasses, and semi-dense shrub cover. The woodland cover consists mainly of blue oak (Q. douglasii) with some interior live oak (Q. wislizenii) and buckeye (A. californica). Yucca (Yucca shipplei caespitosa) is associated with soils on marbleized limestone or diorite. The grass cover consists of annual grasses and forbs. The shrub cover is principally chamise (A. fasciculatum) with some whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus).

The named component of this unit comprises about 60 percent of the unit. Included are lesser areas of similar soils that differ in having coarse-loamy, loamy-skeletal, and fine particle-size classes comprising their subsoils. Other inclusions are: Mollisols with normal as well as over thickened surface soils; outcrops of diorite, quartz diorite, mica schist, and marbleized limestone; and areas of severely eroded soils.

UhcF - Ultic Haploxeralfs, fine-loamy, thermic, schistose, very steep. This soil map unit comprises about 1.5 percent of the survey area. It is mapped in two delineations, one located on the west facing slopes of Marble Fork canyon north of Potwisha, the other along the Generals Highway in the vicinity and north of Hospital Rock. The soils have formed in residuum and colluvium weathered from fractured mica schist. Surface slopes range from about 30 to 70 percent. Aspects are westerly, southwesterly, southerly, and southeasterly. Elevations range from about 650 to 1310 m. Mean annual soil temperatures range from about 15° to 17.5°C.

The Ultic Haploxeralfs, schistose, are similar to the Ultic Haploxeralfs taxonomic unit description given on page 108. The soils are moderately deep to very deep to underlying weathered mica schist. Surface textures range

from fine sandy loam to loam. Subsoil textures range from gravelly loam to gravelly sandy clay loam or gravelly clay loam. Rock fragments are angular and consist of mica schist or aplite. Surface soil colors are brown to grayish brown; subsoil colors are reddish brown. (For additional information, see Appendix I, pp. 42-43; and Appendix II, p. 21.-Section 7.0).

The soils support a semi-open cover of woodland and associated grass, and a semi-dense to dense cover of shrubs in many places. The woodland cover is mainly blue oak (Q. douglasii) with some interior live oak (Q. wislizenii), buckeye (A. californica), California laurel (U. californica), and occasional big leaf maple (A. macrophyllum) in protected sites. The grasses are mainly annual grasses and forbs. The shrubs are mainly chamise (A. fasciculatum) with some whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus).

The Ultic Haploxeralfs, schistose, comprise about 70 percent of the unit. Included in the unit are lesser areas of similar soils with very gravelly clay loam and clayey subsoils, as well as similar soils that are shallow to the underlying weathered and fractured mica schist. Also included are: small areas of Mollisols formed from diorite rock parent material; Ultic Haploxeralfs, fine-loamy, formed from granitic rock parent material that have surface slopes less than 30 percent; a few granitic outcrops such as Hospital Rock; and an outcrop of quartzite.

UhdF - Ultic Haploxeralfs, fine, thermic, schistose, very steep. This soil map unit comprises about 0.2 percent of the survey area. It is mapped in a single delineation south of Shepherds Saddle. These moderately deep to deep soils have formed in residuum and some colluvium weathered from mica schist. The surface slopes range from about 30 to 60 percent. Aspects are mainly easterly. Elevations range from about 670 to 1000 m. Mean annual soil temperatures range from about 15° to 17°C, depending upon elevation.

The Ultic Haploxeralfs in this unit are similar to the Ultic Haploxeralfs taxonomic unit description given on page 108. They differ from the representative pedon in having loam surface soils and heavy clay loam to clay subsoils. In places, the subsoils have angular, cobble-sized fragments of parent rock that occupy from 10 to 40 percent of the soil volume.

The soils support a semi-dense cover of shrubs, principally chamise (A. fasciculatum) and some buck brush (C. cuneatus), and a few, scattered blue oak (Q. douglasii). Annual grasses and forbs grow in open areas of the soils.

The Ultic Haploxeralfs, fine, comprise about 75 percent of this unit. Included are lesser areas of: similar soils with light clay loam subsoils; and deep, similar appearing soils that are Mollisols formed in material weathered from diorite.

UheD - Ultic Haploxeralfs-Entic Ultic Haploxerolls association, thermic, sloping to steep. This soil map unit comprises about 0.4 percent of the survey area. It is mapped as a single delineation on the gentler terrain south of Sycamore Spring. The soils are moderately deep to deep, and have

formed mainly in residuum weathered from granitic rock, mainly granodiorite. The surface slopes range from about 5 to 30 percent. The relief is rolling to hilly with westerly, southerly and easterly aspects. Elevations range from about 520 to 670 m. Mean annual soil temperatures range from about 17° to 18°C, depending upon elevation and aspect.

The Ultic Haploxeralfs are similar to the representative pedon in the Ultic Haploxeralfs taxonomic unit description given on page 108. Depths to the underlying weathered parent rock range from about 70 to 150 cm. The Entic Ultic Haploxerolls are similar to the description of the Entic Ultic Haploxerolls taxonomic unit given on page 35. These soils range in depth from about 70 to 125 cm to underlying weathered parent rock. They differ from the representative pedon mainly in lacking an appreciable O horizon.

The soils support a semi-open cover of woodland associated with grass. The woodland cover consists mainly of young and old growth blue oak (Q. douglasii). The grass cover consists of annual grasses and forbs.

The Ultic Haploxeralfs comprise about 50 percent of the unit; the Entic Ultic Haploxerolls about 25 percent. Included in the unit are: lesser areas of Entic Ultic Haploxerolls that are less than 50 cm in depth to the weathered rock; other moderately deep Mollisols that have brighter colored, coarse sandy loam subsoils or more strongly developed sandy clay loam or heavy loam subsoils. The named components of this unit also occupy sites with slopes steeper than 30 percent along several rocky, local stream valleys that cut through the unit.

<u>UheF - Ultic Haploxeralfs-Entic Ultic Haploxerolls association, thermic, very steep</u>. This soil map unit comprises about 0.2 percent of the survey area. It is mapped in a single delineation within which is located the Ash Mountain Park headquarters. The soils have formed in both residuum and colluvium weathered from granitic rock, mainly granodiorite. The surface slopes range from about 30 to 60 percent. Aspects ar mainly southerly. Elevations range from about 490 to 790 m. Mean annual soil temperatures range from about 16.5° to 18.5°C, depending upon elevation.

The Ultic Haploxeralfs are similar to the Ultic Haploxeralfs taxonomic unit description given on page 108, and are like the representative pedon. They are moderately deep to very deep to underlying weathered granitic rock. The Entic Ultic Haploxerolls are similar to the Entic Ultic Haploxerolls taxonomic unit description given on page 35, and are similar to the representative pedon. They are moderately deep to deep to the underlying weathered granitic rock.

The soils support a semi-open cover of woodland associated with grass. Some shrubs are also associated. The woodland cover consists mainly of blue oak (Q. douglasii) with some interior live oak (Q. wislizenii) and buckeye (A. californica). The grass cover consists of annual grasses and forbs. The shrubs are chamise (A. fasciculatum), whiteleaf manzanita (A. viscida) and buck brush (C, cuneatus).

The Ultic Haploxeralfs and Entic Ultic Haploxerolls each make up about 30 percent of this map unit. The remaining 40 percent consists of inclusions of: similar soils with surface slopes less than 30 percent; Ultic Haploxeralfs with pebble and cobble-size rock fragments occupying more than 35 percent of the subsoil volume; Entic Ultic Haploxerolls with depths less than 50 cm to weathered rock; and other Mollisols with sandy clay loam subsoils, or with brighter colored, coarse sandy loam subsoils.

UhfF - Ultic Haploxeralfs-Haploxerolls association, mesic, very steep. This soil map unit comprises about 0.3 percent of the survey area. It is mapped in a single delineation on the south facing slopes of the Middle Fork canyon west of the junction of Mehrten Creek with the Middle Fork of the Kaweah River. The soils have formed in colluvium and residuum weathered from granodiorite rock. Surface slopes range from about 40 to 60 percent. Elevations range from about 1460 to 1585 m. Mean annual soil temperatures range from about 12° to 13°C.

The Ultic Haploxeralfs are similar to the soils outlined in the Ultic Haploxeralfs taxonomic unit description given on page 108. The soils are moderately deep to very deep, and have subsoil textures ranging from coarse sandy loam to sandy clay loam. They resemble the pedon described in Appendix I, pp. 38-39 - Section 7.0. The latter is located on a similar site in the Middle Fork canyon, but at a lower elevation. It has a thermic soil temperature regime and it therefore somewhat warmer, on the average, than the soils in this unit. For additional information, see Appendix II, p. 19. - Section 7.0. The Haploxerolls in this unit are similar to the soils outlined in the Haploxerolls taxonomic unit description given on page 46.

The soils support a dense cover of shrubs with scattered clusters of hardwoods and a few conifers. The shrubs consist of buck brush (C. cuneatus), whiteleaf manzanita (A. viscida), and bear clover (C. foliolosa). The hardwoods are principally canyon live oak (Q. chrysolepis) and some black oak (Q. kelloggii). The few conifers are ponderosa pine (P. ponderosa).

The Ultic Haploxeralfs comprise about 50 percent of the unit; the Haploxerolls about 45 percent. Included are scattered, small areas of severely eroded similar soils and Jointed granitic outcrop.

UhgF - Ultic Haploxeralfs-Typic Xerochrepts association, mesic, very steep. This soil map unit comprises about 0.9 percent of the survey area. It is mapped in three delineations. Two are along the crest of Ash Peaks Ridge; the third is on the lower part of Deer Ridge northeast of Potwisha. The soils have formed in colluvium and residuum weathered for granodiorite. The surface slopes range from about 40 to 70 percent. Subordinate interfluves along the two ridges produce aspects for these slopes in all quadrants of the compass. Elevations range from about 975 to 1675 m. Mean annual soil temperatures range from about 11° to 14.5°C, depending upon elevation and aspect.

The Ultic Haploxeralfs are similar to the soils described in the Ultic Haploxeralfs taxonomic unit given on page 108. They differ mainly from the representative pedon in having a mesic soil temperature regime. Soil depths range from moderately deep to very deep. The Typic Xerochrepts are similar to the soil described in the Typic Xerochrepts taxonomic unit given on page 102. However, these soils differ from the representative pedon in having formed in residuum or colluvium weathered from granitic rock, and in having a mesic soil temperature regime. These soils are moderately deep to deep.

The soils support a semi-dense to dense cover of shrubs with irregular clusters of hardwoods. The shrubs consist of chamise (A. fasciculatum), with some whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus) at lower elevations, and deer brush (C. integerrimus) and some bear clover (C. foliolosa) at the higher elevations. The hardwoods are canyon live oak (Q. chrysolepis).

The Ultic Haploxeralfs comprise about 40 percent of the unit; the Typic Xerochrepts about 35 percent. Included in the unit are many small areas of severely eroded similar soils, particularly northeast of Potwisha and on the easterly, lower flank of Deer Ridge. Also included are many small areas of Jointed granitic outcrop.

<u>UhhF - Ultic Haploxeralfs-Typic Xerochrepts association, thermic, very steep</u>. This soil map unit comprises about 3.5 percent of the survey area. It is mapped in six fairly large delineations distributed from the flanks of Ash Peaks Ridge easterly to Panther Creek on the lower slopes of the Middle Fork canyon. One of the smaller delineations is located near the Ash Mountain National Park Headquarters. These soils have formed in colluvium and residuum weathered from granitic rock. Surface slopes range from about 30 to 70 percent. The terrain is intricately patterned by parallel or spreading interfluves related to the larger streams draining the unit. As a result, the slopes within the unit have aspects in all quadrants and cardinal points of the compass. Elevations range from about 490 to 1465 m. Mean annual soil temperatures range from about 15° to 18.5°C, depending upon elevation and aspect.

The Ultic Haploxeralfs are similar to the soils outlined in the Ultic Haploxeralfs taxonomic unit description given on page 108. These soils range in depth from moderately deep to very deep and tend to occupy relatively more stable parts of the terrain. They are similar to the representative pedon, and to the pedon described in Appendix I, pp. 39-40, and in Appendix II, p. 19 - Section 7.0. The Typic Xerochrepts are similar to the soils outlined in the Typic Xerochrepts taxonomic unit description given on page 102. The soils are moderately deep to deep and differ from the representative pedon in having formed in colluvium or residuum weathered from granitic rock. Surface and subsoil textures range narrowly from sandy loam to coarse sandy loam. The subsoils are recognized by their brighter colors and, in places, by very slight accumulation of translocated clay.

The soils support a semi-dense to dense cover of shrubs with clusters of oak in protected sites. The shrubs are mainly chamise (A. fasciculatum),

with some whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus). The oak is canyon live oak (Q. chrysolepis). In open areas there are growths of annual grasses and forbs.

The Ultic Haploxeralfs comprise about 35 percent of this unit; the Typic Xerochrepts about 30 percent. Included in the unit are lesser areas of: shallow Typic Xerochrepts; shallow Entic Haploxerolls; Ultic Haploxerolls; Haploxerolls with only slightly weathered rock at depths less than 50 cm; other Mollisolls with sandy clay loam or clay loam subsoils; areas of severely eroded soils; and scattered large boulders or outcrops of granitic rock.

Ultic Haploxerolls

The soils in this subgroup are moderately deep to very deep, with dark colored, moderately coarse or medium textured, moderately leached surface soils overlying brighter colored, similar textured subsoils. These soils have formed in colluvium and residuum weathered from mica schist, amphibolitic schist, marbleized limestone, quartzite, and granodiorite. They comprise about 1.8 percent of the survey area. They are mapped separately and in association with other soils or miscellaneous areas. They also occur as inclusions in yet other soil map units. These soils are located on steep to extremely steep slopes in the vicinities of Marble Falls, Deer Ridge, Amphitheater Point, Potwisha, and Hospital Rock. Elevations range from about 760 to 1770 m. Mean annual soil temperatures range from about 11° to 17.5°c. Mean annual precipitation ranges from about 760 to 1010 mm which falls as rain and some snow from late autumn to early spring. Most of the precipitation falls as rain; snow does not linger long on the ground. Soil temperature regimes are mesic or thermic; the soil moisture regime is xeric.

The vegetation on these soils consists of a semi-dense to dense shrub-woodland cover. The shrubs are mainly chamise (Adenostema fasciculatum) with varying amounts of whiteleaf manzanita (Arctostaphylos viscida), buck brush (Ceanothus cuneatus), flannel bush (Fremontia californica), poison oak (Rhus diversiloba), mountain mahogany (Cercocarpus betuloides), and bear clover (Chamaebatia foliolosa) at higher elevations. The woodland cover is principally canyon live oak (Quercus shrysolepis) with varying amounts of California laurel (Umbellularia californica), and buckeye (Aesculus californica). Annual grasses and forbs grow in open areas.

Typically, these soils have a moderately thick, dark brown to brown, gravelly loam surface soil, slightly acid in reaction. It overlies a yellowish brown, slightly acid, gravelly loam subsoil that grades into underlying brown, gravelly loam parent material weathered from mica schist.

Following is a profile description of a representative pedon located about 45 m northwest of Amphitheater Point parking area; elevation - 1340 m; slope - 80 percent; aspect - southwest; vegetation - flannel bush, poison oak, mountain mahogany, annual grasses and forbs; colors are for dry soil unless otherwise noted: (For additional information, see Appendix I, pp. 40-

41; Appendix II, p. 20; see also Appendix I, pp. 24-25, 36-37; and Appendix II, pp. 12, 18 - Section 7.0).

0 -- 2.5 to 0 cm; dark brown, partly decomposed shrub leaves, grass and forb parts; rests on:

A -- 0 to 27 cm; dark brown gravelly loam, very dark gray moist; moderate fine and medium granular structure; slightly hard, very friable, nonsticky and very slightly plastic; few fine, medium and coarse roots; 30 percent by volume angular pebbles and cobbles of mica schist; slightly acid; abrupt wavy boundary.

AB -- 27 to 47 cm; brown gravelly loam, dark brown moist; weak medium angular blocky structure; slightly hard, very friable, nonsticky and very slightly plastic; few fine and very fine roots; 30 percent by volume angular pebbles and cobbles of mica schist; slightly acid; abrupt wavy boundary.

Bw -- 47 to 100 cm; yellowish brown gravelly loam, yellowish brown moist; weak coarse angular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, medium and coarse roots; 30 percent by volume angular pebbles and cobbles of mica schist; slightly acid; clear wavy boundary.

C -- 100 to 150+ cm; brown gravelly loam, yellowish brown moist; massive; colluvium grades to weathered mica schist below 150 cm.

These soils range in depth from 65 cm to more than 150 cm. Surface colors range from brown to grayish brown, and are yellowish brown in places; moist colors range from dark brown to very dark gray. Surface soil textures include sandy loam, fine sandy loam, coarse sandy loam and loam. Pebble and cobble-size rock fragments occupy from less than 10 to about 40 percent of the soil volume. The structure is granular, ranging from weak to moderate in strength of development. Organic carbon content ranges from about 1 to 5 percent. The thickness of the surface soils range from about 20 to 50 cm.

Subsoil colors range from brown to yellowish brown; moist colors range from dark brown to dark yellowish brown. Textures and rock fragment content are similar to the surface soils. The subsoil may be structureless or have blocky structure. The organic carbon content is less than 1 percent. The subsoil grades into structureless material, similar in texture, which, in turn, grades to weathered parent rock, or the subsoil rests clearly or abruptly on weathered parent rock.

<u>UhjG - Ultic Haploxerolls, mesic, schistose, extremely steep</u>. This soil map unit comprises about 0.9 percent of the survey area. It is mapped in two delineations, one located on the flanks of Deer Ridge, and the other in the vicinity of Amphitheater Point. The soils have formed in thick colluvial accumulations and in residuum weathered from mica schist and some amphibolitic schist. The surface slopes are in excess of 75 percent. The slopes have aspects in all compass quadrants. Elevations range from about 880 to 1700 m. Mean annual soil temperatures range from about 11° to 15°C,

depending upon elevation and influenced strongly by aspect at the lower elevations.

The Ultic Haploxerolls are similar to the soil outlined in the Ultic Haploxerolls taxonomic unit description given on page 116. The representative pedon is located in this map unit. Marblized limestone and granitic rock have little influence as parent material sources for these soils.

The soils support a dense cover of shrubs and woodland. The shrubs consist largely of chamise (A. fasciculatum) with varying amounts of whiteleaf manzanita (A. viscida), flannel bush (F. californica), mountain mahogany (C. betuloides), and poison oak (R. diversiloba). The woodland cover consists mainly of canyon live oak (Q. chrysolepis) with some California laurel (U. californica) and buckeye (A. californica).

The Ultic Haploxerolls comprise about 70 percent of the unit. Included are lesser areas of: similar soils that are shallow to well weathered or slightly weathered mica schist; similar soils formed from granitic rock and having slopes less than 75 percent; the Jointed granitic outcrops.

<u>UhkG - Ultic Haploxerolls, mesic, schistose-Jointed schistose outcrop association, extremely steep</u>. This map unit comprises about 0.8 percent of the survey area. It lies in a single delineation located on the extremely steep, south facing slopes west of Marble Falls. The soils have formed in colluvium and residuum on the hillslopes weathered from mica schist. The slopes of the soils are in excess of 75 percent. Incisement of the unit by many small streams draining to the Marble Fork have produced both parallel and converging sets of interfluves which provide an array of slopes facing northeasterly, southeasterly, south, and southwesterly. Elevations range from about 825 to 1700 m. Mean annual soil temperatures range from about 11° to 15°C, depending upon elevation and aspect.

The Ultic Haploxerolls are similar to the soils outlined in the Ultic Haploxerolls taxonomic unit description give on page 116. Soil depths range for moderately deep to very deep. Soil textures include sandy loams and loams. Most of the soils have pebble and cobble-size rock fragments of mica schist occupying from 10 to 40 percent of the soil volume. The Jointed schistose outcrop is similar to its description given on page 63.

The soils support a varied cover of semi-dense to dense shrubs and hardwoods. The shrubs consist mainly of chamise (A. fasciculatum) with some whiteleaf manzanita (A. viscida) and buck brush (C. cuneatus). At the highest elevations, there is a dense ground cover of bear clover (C. foliolosa) and some deer brush (Ceanothus integerrimus). The woodland cover consists mainly of canyon live oak (Q. chrysolepis). At the highest elevations, there are black oak (Quercus kelloggii) and ponderosa pine (Pinus ponderosa). Open areas in the unit support annual grasses and forbs.

The Ultic Haploxerolls comprise about 50 percent of the unit; the Jointed schistose outcrop about 25 percent. Included in the unit are lesser areas of: similar soils that are less than 50 cm to the weathered mica schist;

outcrops of marblized limestone; and at the highest elevations on less slopes there are small areas of leached Mollisolls that have a developed clay loam subsoil and Xeric Haplohumults, both under a dense cover of bear clover.

UhnG - Ultic Haploxerolls-Typic Xerochrepts association, thermic, schistose, extremely steep. This soil map unit comprises about 0.6 percent of the survey area. It is mapped as a single delineation located along part of the Generals Highway north of Hospital Rock. The soils are moderately deep to deep and have formed on hillslopes in colluvium and residuum weathered from mica schist, amphibolitic schist, and some quartzite. The surface slopes of the soils are in excess of 75 percent. The surface of the unit is modified by a few parallel and some converging interfluves that produce a fluted relief with mainly southerly, southeasterly, and easterly aspects for these extremely steep slopes. Elevations range from about 850 to 1700 m. Mean annual soil temperatures range from about 15° to 16°C, depending upon elevation. The predominantly southerly aspects of the slopes have raised the elevation at which the warm soil temperature regime exists.

The Ultic Haploxerolls are similar to the soils outlined in the Ultic Haploxerolls taxonomic unit description given on page 116. They differ from the representative pedon in having soil depths ranging from about 55 to 125 cm. Soil textures range from sandy loam to fine sandy loam throughout, and angular pebble or cobble-sized rock fragments occupy less than 35 percent of the soil volume. The Typic Xerochrepts are similar to the soils outlined in the Typic Xerochrepts taxonomic unit description given on page 102. These soils differ from the representative pedon in having formed in colluvium or residuum weathered from mica schist, quartzite, or amphibolitic schist. Soil depths range from about 55 to 100 cm. Soil textures range from sandy loam to fine sandy loam throughout. Rock fragments occupy less than 35 percent of the soil volume.

The soils support a semi-open to semi-dense cover of woodland associated with grass. The woodland cover consists of blue oak (Quercus douglasii) and canyon live oak (Q. chrysolepis) with some California laurel (U. californica) and buckeye (A. californica). At higher elevations there is some black oak (Quercus kelloggii). The grass cover in open areas consists of annual grasses and forbs.

The Ultic Haploxerolls comprise about 45 percent of the unit; the Typic Xerochrepts about 30 percent. Included in the unit are lesser areas of: similar soils that are less than 50 cm deep to underlying weathered rock, including quartzite in places; other similar soils that have more than 35 percent rock fragments occupying the soils' volumes; other similar Mollisols that have sandy clay loam developed subsoils; and a few exposures of Jointed schistose outcrop.

Ultic Palexeralfs

This subgroup includes moderately deep to very deep, well drained soils on hillslopes that have thin, loamy surface soils overlying thick, clayey subsoils. They have formed in residuum and some colluvium weathered from

gabbro-diorite rock. They are limited in extent and are located along the middle and lower reaches of Elk Creek. They are mapped on very steep slopes in association with other soils. Elevations range from about 640 to 975 m. Mean annual soil temperatures range from about 15° to 17°C, depending upon elevation. Mean annual precipitation ranges from about 760 to 890 mm, nearly all of which falls as rain from late autumn to early spring. Aside from occasional thunder showers, there is no precipitation during the summer period. The soil temperature regime is thermic; the soil moisture regime is xeric.

The vegetation on these soils is mainly shrubs. The cover is dense. The shrubs are chamise (Adenostema fasciculatum) and buck brush (Ceanothus cuneatus) with some whiteleaf manzanita (Arctostaphylos viscisda), holly leaf coffee berry (Ramnus crocea illicifolia), and poison oak (Rhus diversiloba). Open areas support sparse annual and perennial grasses and forbs.

Typically, these soils have thin, brown, structureless loam surface soil overlying a thick, dense, strong brown, heavy clay loam subsoil with blocky structure that has a base saturation less that 75 percent in all parts. This grades into brown, structureless sandy loam parent material that, in turn, rests on well weathered gabbro-diorite.

Following is a profile description of a <u>representative</u> pedon located on the west side of Elk Creek Trail, approximately 823 m west of the Marble Fork bridge on the Generals Highway;elevation - 756 m; slope - 37 percent; aspect - east, vegetation - chamise, hollyleaf coffee berry, sparse annual and perennial grasses; colors are for dry soil unless otherwise noted: (For additional information, see Appendix I, pp. 32-33; Appendix II, p. 16 - Section 7.0).

A -- 0 to 15 cm; brown loam, dark brown moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; slightly acid; clear wavy boundary.

Bt1 -- 15 to 54 cm; strong brown heavy clay loam, strong brown moist; strong coarse angular blocky structure; very hard, firm, sticky and plastic, few fine and medium roots; continuous thin to moderately thick clay films on ped faces - dark reddish brown moist; slightly acid; clear wavy boundary.

Bt2 -- 54 to 90 cm; brown heavy clay loam, dark brown moist; strong coarse angular blocky structure; extremely hard, very firm, sticky and plastic, very few very fine roots; continuous thin to moderately thick clay films on ped faces - dark reddish brown moist; slightly acid; abrupt wavy boundary.

BCt -- 90 to 125 cm; yellowish brown gravelly loam, dark yellowish brown moist; weak medium and coarse angular blocky structure; very hard, firm, sticky and slightly plastic; very few fine roots; 20 percent gravel by volume; common thin clay films on ped faces - dark brown moist; slightly acid; abrupt wavy boundary.

C -- 125 to 150+ cm; brown gravelly sandy loam, dark yellowish brown moist; massive; hard, friable, slightly sticky and nonplastic; slightly acid; grades to weathered gabbro-diorite with depth.

These soils range in depth from about 55 to more than 150 cm to the weathered parent rock. There may be a thin duff layer of shrub leaves in places under the plant canopy. The surface soils are brown loams or clay loams. Moist colors range from dark brown to very dark grayish brown. Granular structure may be present in some surface soils, but most are structureless (massive). Surface soil thickness range from about 5 to 22 cm. The subsoil is a strong brown to reddish brown heavy clay loam to clay. The structure is moderate to strong angular blocky. In places it is weakly prismatic parting to angular blocky. Subsoil thickness ranges from about 40 to 100 cm. Angular gravel of cobble-sized rock fragments within the soil range from nil to 30 percent of the soil volume.

UpaF - Ultic Palexeralfs-Ultic Haploxeralfs association, thermic, very steep. This soil map unit comprises about 0.4 percent of the survey area. It is mapped in two delineations along the middle and lower reaches of Elk Creek in the foothill zone. These moderately deep - to very deep soils have formed in residuum and colluvium weathered from gabbo-diorite rock. The surface slopes range from about 30 to 60 percent. Complex interfluve patterns within the unit from incision by small streams results in a variety of slope aspects. Most are southerly or easterly. Elevations range from about 640 to 975 m. Mean annual soil temperatures range from about 15° to 17.5°C, depending upon elevation.

The Ultic Palexeralfs are like the soils outlined in the Ultic Palexeralfs taxonomic unit description given on page 119. The representative pedon is located in this map unit. The Ultic Haploxeralfs are like the soils outlined in the Ultic Haploxeralfs taxonomic unit description given on page 108. These soils differ from the representative pedon in properties related to their formation in material weathered from gabbro-diorite. See Appendix I, pp. 30-31, and Appendix II, p. 15 - Section 7.0, for such a soil located in this unit.

The soils support dense shrub cover. There are a few openings devoid of shrubs in which annual grasses and forbs grow along with a scattering of perennial grasses. The shrubs are mainly chamise (A. fasciculatum) and buck brush (C. cuneatus), with some hollyleaf coffee berry (R. crocea illicifolia), whiteleaf manzanita (A. viscida), and poison oak (R. diversiloba).

The Ultic Palexeralfs comprise about 35 percent of this map unit; the Ultic Haploxeralfs about 30 percent. Included in the unit are lesser areas of: Typic Xerochrepts; shallow Typic Xerorthents; Entic Ultic Haploxerolls; and other Mollisols with loam surface textures and clay loam subsoils.

Ut - Unjointed granitic outcrop. This miscellaneous area covers about 3 percent of the survey area. Delineations include a number of important landmarks such as Moro Rock, Sugarbowl Dome, and Little Blue Dome.

The unit is characterized by smooth outcrops of granitic rock, mainly granodiorite, with 100 m or more between vertical joints 2 m, or greater, in depth. Sheet jointing parallel to the surface is common. The rock surfaces are only slightly weathered and, in places, retain evidence of glacial polish.

Most rainfall, or meltwater flow onto these rock exposures, runs off and accumulates in adjacent land types or flows directly to lakes or to tributaries of the Middle or Marble Forks of the Kaweah river.

Included in this map unit are less than 20 percent Jointed granitic outcrop, Granitic talus, and shallow or very shallow soils.

6.0 Ultra-detailed Soil Maps of the Intensive Study Areas - Acid Precipitation, Sequoia National Park.

Within the Soil Resource Inventory Area, Sequoia National Park, Central Part, three representative areas were selected by the Park Service and its research cooperators for long-term studies and monitoring of ecologic effects of local acid precipitation.

To support these studies, ultra-detailed (Order 1) soil maps were made for each of the selected areas during the reconnaissance soil mapping for this project. Enlarged images of selected parts of 1973 Park Service aerial photos covering these areas were used as field sheets for mapping.

Normally, map units for Order 1 soil surveys are consociations or complexes of phases of soil series. Since most of the soils studied in these three areas do not meet criteria for currently recognized soil series in the National Cooperative Soil Survey, nor do the units recognized cover sufficient area to provide required minimum extent for establishing new series (800 ha), the map units were kept as phases of subgroups in Soil Taxonomy - a valid recognition. The phases are similar to those recognized in the Reconnaissance Soil Map of the project area, but are more narrowly defined. In addition, the map units have fewer inclusions and these comprise less than about 15 percent of the unit. Except for one map unit of an association of miscellaneous areas in the Emerald Lake Area, all map units are consociations or complexes.

The close relationship of the soil map units in the study areas to those on the reconnaissance soil map for the project area permits comparison and reasonable projection, or transfer of results obtained in the study areas, to other parts of the project area as well as to other parts of the Sierra Nevada where comparable soils exist.

The three study areas mapped are:

1. Elk Creek Area - Two small watersheds (North and South) in the foothill zone near Elk Creek under dense chaparral cover; about 10 ha; 680 to 800 m elevation; map scale - 1:4165. (For map - see Section 11.0).

2. Log Meadow Area - Part of Crescent Creek watershed in a mixed conifer-sequoia zone; consists of two sub-water-sheds - Log Creek and Tharps Creek; about 60 ha; 2070 to 2400 m elevation; map scale- 1:4160. (For map - see Section 11.0).

3. Emerald Lake Area - Emerald Lake watershed in a subalpine and alpine zone; about 120 ha; 2788 to 3415 m elevation; map scale 1:3145. (For maps - see Section 11.0).

6.1 Table 3. Ultra-detailed Soil Maps. Guide to the map units, their areas and proportionate extents in the selected study areas - Elk Creek, Log Meadow, and Emerald Lake.

ELK CREEK AREA

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
TaC	Typic Xerochrepts, 5 to 15 slopes	0.1	1.0
TaD	Typic Xerochrepts, 15 to 30 percent slopes	0.3	3.0
TaE	Typic Xerochrepts, 30 to 45 percent slopes	0.4	4.0
ToD	Entic Ultic Haploxerolls, 15 to 30 percent slopes	0.3	3.0
ToE	Entic Ultic Haploxerolls, 30 to 45 percent slopes	0.7	7.0
UaC	Ultic Haploxeralfs, 5 to 15 percent slopes	0.1	1.0
UaD	Ultic Haploxeralfs, 15 to 30 percent slopes	0.5	5.0
UaE	Ultic Haploxeralfs, 30 to 45 percent slopes	0.9	9.0
UaF	Ultic Haploxeralfs, 45 to 75 percent slopes	0.1	1.0
UaoE	Ultic Haploxeralfs-Entic Ultic Haploxerolls complex, 30 to 45 percent slopes	0.3	3.0
UbC	Ultic Palexeralfs, 5 to 15 percent slopes	0.4	4.0
UbD	Ultic Palexeralfs, 15 to 30 percent slopes	1.8	18.0
UbE	Ultic Palexeralfs, 30 to 45 percent slopes	2.4	24.0
UbEe	Ultic Palexeralfs, eroded, 30 to 45 percent slopes	0.1	1.0
UbaE	Ultic Palexeralfs-Ultic Haploxeralfs complex, 30 to 45 percent slopes	0.6	6.0
UbaF	Ultic Palexeralfs-Ultic Haploxeralfs complex 45 to 75 percent slopes	1.0	10.0
	TOTAL	10.0	100.0

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
Aq	Aquepts, 0 to 2 percent slopes	0.7	1.1
CaB	Cumulic Haplumbrepts, 5 to 15 percent slopes	0.3	0.5
LaC	Lithic Xerumbrepts, very shallow, 5 to 15 percent slopes	0.3	0.5
LaD-R	Lithic Xerumbrepts, very shallow-Rock outcrop complex, 15 to 30 percent slopes	0.3	0.5
LaE-R	Lithic Xerumbrepts, very shallow-Rock outcrop complex, 30 to 45 percent slopes	1.0	1.6
LaF-R	Lithic Xerumbrepts, very shallow-Rock outcrop complex, 45 to 75 percent slopes	0.6	1.0
LabC	Lithic Xerumbrepts, very shallow and shallow, 5 to 15 percent slopes	0.6	1.0
LabE	Lithic Xerumbrepts, very shallow and shallow, 30 to 45 percent slopes	1.0	1.6
LabE-R	Lithic Xerumbrepts, very shallow and shallow-Rock outcrop complex, 30 to 45 percent slopes	1.5	2.4
LabF	Lithic Xerumbrepts, very shallow and shallow, 45 to 75 percent slopes	0.9	1.4
LabF-R	Lithic Xerumbrepts, very shallow and shallow-Rock outcrop complex, 45 to 75 percent slopes	1.2	1.9
LbC-R	Lithic Xerumbrepts, shallow-Rock outcrop complex, 5 to 15 percent slopes	0.2	0.3
LbD	Lithic Xerumbrepts, shallow, 15 to 30 percent slopes	0.4	0.6
LbD-R	Lithic Xerumbrepts, shallow-Rock outcrop complex, 15 to 30 percent slopes	0.4	0.6
LbE	Lithic Xerumbrepts, shallow, 30 to 45 percent slopes	0.8	1.3
LbE-R	Lithic Xerumbrepts, shallow-Rock outcrop complex, 30 to 45 percent slopes	1.2	1.9
LbF-R	Lithic Xerumbrepts, shallow-Rock outcrop complex, 45 to 75 percent slopes	0.7	1.1
PaC	Pachic Xerumbrepts, moderately deep, 5 to 15 percent slopes	0.1	0.2
PaC-R	Pachic Xerumbrepts, moderately deep-Rock outcrop complex, 5 to 15 percent slopes	0.5	0.8
PaD	Pachic Xerumbrepts, moderately deep, 15 to 30 percent slopes	0.9	1.4
PaE	Pachic Xerumbrepts, moderately deep, 30 to 45 percent slopes	9.9	15.7
PaE-R	Pachic Xerumbrepts, moderately deep-Rock outcrop complex, 30 to 45 percent slopes	2.5	4.0
PaF	Pachic Xerumbrepts, moderately deep, 45 to 75 percent slopes	1.7	2.7
PaF-R	Pachic Xerumbrepts, moderately deep-Rock outcrop complex, 45 to 75 percent slopes	0.6	1.0
PaLD-R	Pachic Xerumbrepts, moderately deep-Lithic Xerumbrepts, shallow-Rock outcrop complex, 15 to 30 percent slopes	0.4	0.6
PbC	Pachic Xerumbrepts, deep, 5 to 15 percent slopes	7.5	11.9

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
PbD	Pachic Xerumbrepts, deep, 15 to 30 percent slopes	12.3	19.6
PbDf	Pachic Xerumbrepts, deep, 15 to 30 percent slopes, fluted	2.4	3.8
PbE	Pachic Xerumbrepts, deep, 30 to 45 percent slopes	7.1	11.3
PbF	Pachic Xerumbrepts, deep, 45 to 75 percent slopes	0.3	0.5
PbFf	Pachic Xerumbrepts, deep, 45 to 75 percent slopes, fluted	0.9	1.4
R	Rock outcrop	0.2	0.3
R-LaD	Rock outcrop-Lithic Xerumbrepts, very shallow complex, 15 to 30 percent slopes	0.7	1.1
R-LaE	Rock outcrop-Lithic Xerumbrepts, very shallow complex, 30 to 45 percent slopes	0.9	1.4
R-LaF	Rock outcrop-Lithic Xerumbrepts, very shallow complex, 45 to 75 percent slopes	0.5	0.8
R-LbF	Rock outcrop-Lithic Xerumbrepts, shallow complex, 45 to 75 percent slopes	0.3	0.5
TeD	Xeric Haplohumults, 15 to 30 percent slopes	1.1	1.7
	TOTAL	62.9	100.0

EMERALD LAKE AREA

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
CqB	Cryaquepts, 0 to 5 percent slopes	0.2	0.2
EaD	Entic Cryumbrepts, moderately deep, wet, 15 to 30 percent slopes	0.7	0.6
EbF	Entic Cryumbrepts, deep, 45 to 75 percent slopes	0.3	0.2
EcF	Entic Cryumbrepts, deep, cobbly, 45 to 75 percent slopes	2.9	2.4
F-K	Felsenmeer-Stony colluvial land association	1.1	0.9
G	Glacial rubble land	2.9	2.4
K	Stony colluvial land	2.1	1.8
LcF	Lithic Cryumbrepts, very shallow, 45 to 75 percent slopes	0.5	0.4
LcF-R	Lithic Cryumbrepts, very shallow-Rock outcrop complex, 45 to 75 percent slopes	4.7	3.9
LdF	Lithic Cryumbrepts, very shallow, stony, 45 to 75 percent slopes	4.4	3.7
LdF-R	Lithic Cryumbrepts, very shallow, stony-Rock outcrop complex, 45 to 75 percent slopes	1.3	1.1
LeC-R	Lithic Cryumbrepts, shallow-Rock outcrop complex, 5 to 15 percent slopes	1.3	1.1
LeD	Lithic Cryumbrepts, shallow, 15 to 30 percent slopes	0.2	0.2
LfqC	Lithic Cryumbrepts, shallow, wet-Histic Lithic Cryaquepts complex, 5 to 15 percent slopes	0.1	<0.1

SYMBOL	MAP UNIT NAME	HECTARES	PERCENT OF AREA
Rj	Rock outcrop, jointed	36.1	30.2
R-LcE	Rock outcrop-Lithic Cryumbrepts, very shallow complex, 30 to 45 percent slopes	1.9	1.6
R-LcF	Rock outcrop-Lithic Cryumbrepts, very shallow complex, 45 to 75 percent slopes	23.2	19.4
R-LeF	Rock outcrop-Lithic Cryumbrepts, shallow complex, 45 to 75 percent slopes	2.2	1.8
Ru	Rock outcrop, unjointed	6.3	5.3
T	Talus	16.9	14.1
T-LeF	Talus-Lithic Cryumbrepts, shallow complex, 45 to 75 percent slopes	0.7	0.6
TdoF-R	Typic Cryorthods-Lithic Cryorthents-Rock outcrop complex, 45 to 75 percent slopes	3.0	2.5
TfB	Typic Cryofluvent, 0 to 5 percent slopes	0.1	<0.1
ToC	Typic Cryorthents, shallow, 5 to 15 percent slopes	0.1	<0.1
ToF	Typic Cryorthents, shallow, 45 to 75 percent slopes	0.6	0.5
TpD-R	Typic Cryorthents, moderately deep-Rock outcrop complex, 15 to 30 percent slopes	0.3	0.3
TrF	Typic Cryorthents, moderately deep, very cobbly, 45 to 75 percent slopes	1.5	1.3
TrF-R	Typic Cryorthents, moderately deep, very cobbly-Rock outcrop complex, 45 to 75 percent slopes	0.3	0.2
TsD	Typic Cryorthents, deep, cobbly, 15 to 30 percent slopes	1.0	0.8
	Water area (Emerald Lake and Parsons Pond)	2.7	2.3
	TOTAL	119.6	100.0

6.2 SOIL MAP UNIT DESCRIPTIONS - STUDY AREAS

6.21 Elk Creek Study Area

Typic Xerochrepts

This subgroup includes moderately deep, well drained soils, that are high in exchangeable bases and that have formed in gabbro-diorite residuum. The mean annual soil temperature is about 17°C, and the difference between mean winter and mean summer soil temperature is greater than 5°C. These soils are moist during the late fall, winter and spring, and dry during the summer.

These soils support a variety of annual grasses, forbs and chamise. In the Elk Creek Study Area, they are located on ridge crests or on hill slopes where past erosion or mass wasting has exposed deeply weathered gabbro-diorite that is now only weakly altered by soil forming processes. For this reason, Typic Xerochrepts lack the well developed clay loam and clay argillic horizons of adjacent Ultic Haploxeralf and Ultic Palexeralf soils on more stable surfaces nearby.

Typically these soils have brown fine sandy loam, slightly acid, surface soils, low to very low in organic matter that grade into yellowish brown loam subsoils that are underlain by weathered gabbro-diorite at about 100 cm.

Following is a profile description of a representative pedon located in a delineation of Typic Xerocrepts, 30 to 45 percent slopes, in the southeast part of the southern watershed at an elevation of about 725 m; supports cover of annual grasses: (Colors are for dry soil unless otherwise noted)

A1 -- 0 to 5 cm; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; hard, very friable, nonsticky and slightly plastic; many fine and very fine roots; slightly acid; abrupt wavy boundary.

A2 -- 5 to 15 cm; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; slightly acid; clear smooth boundary.

AB -- 15 to 43 cm; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; slightly acid; abrupt wavy boundary.

Bt -- 43 to 75 cm; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/6) moist; moderate coarse angular blocky structure; very hard, friable, slightly sticky and slightly plastic; few thin clay

films on ped faces; few fine roots; slightly acid; clear smooth boundary.

BC -- 75 to 90 cm; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt irregular boundary.

Cr -- 90 to 120^{+}cm; gray to light gray well weathered gabbo-diorite; rock structure visible.

Range of Characteristics: These soils range in depth from 60 to 100 cm to the underlying weathered parent rock. Dry colors of the surface soil range from yellowish brown to brown; dry subsoil colors range from brown to dark yellowish brown. Surface and subsoil textures are loams to fine sandy loams, generally without coarse fragments. Reaction ranges from slightly acid (pH 6.2) in the surface soil to medium acid (pH 6.0) in the subsoil.

Solum thickness to weathered gabbro-diorite of the Elk Creek Formation ranges from 40 to 100cm.

Soil Map Units - Typic Xerochrepts - Elk Creek Area:

TaC – Typic Xerochrepts, 5 to 15 percent slopes. This unit is of limited extent comprising about one percent of the study area. There are two small delineations in the southern watershed, one at its highest point, and one east of the Elk Creek Trail. The soil of this unit is similar to the representative pedon. The surface relief is undulating to rolling.

Vegetative cover is a semi-dense stand of chamise with a sparse understory of annual grasses; denser grass growth occupies openings in the shrub cover.

TaD – Typic Xerochrepts, 15 to 30 percent slopes. This soil is of limited extent comprising about three percent of the study area. There are two delineations in the northern watershed. The soil of this unit is similar to the representative pedon. The surface slopes of this unit are moderately steep.

Vegetative cover in one of the two delineations is dense chamise with an understory of sparse annual grasses. Cover in the other delineation, near the southeast corner of the northern watershed, is dominated by annual grasses with a few scattered shrubs.

TaE - Typic Xerochrepts, 30 to 45 percent percent slopes. This unit is of moderate extent comprising about four percent of the study area. There is a single delineation in each of the two watersheds. This unit contains the pedon described as representative of Xerochrepts in this area. Surface slopes are steep.

Vegetative cover is dense chamise with sparse annual grass understory (delineation in the northern watershed), or annual grasses with scattered shrubs (delineation in the southern watershed).

Entic Ultic Haploxerolls

In the study area, this subgroup includes only shallow, well drained, dull or drab colored soils formed from basic igneous rock of the Elk Creek Formation. They are located on ridge crests or on slopes near stream channels where mass wasting or incision by local streams has exposed weathered gabbro-diorite. The mean annual soil temperature is about 17°C, and the difference between mean winter and mean summer soil temperature is greater than 5°C. The soils are moist during the late fall, winter, and spring and dry during the summer. Vegetative cover is generally chamise with an understory of very sparse annual grasses; young blue oak grow where these soils occur near stream channels or in protected areas.

Typically these soils have grayish brown, slightly acid, fine sandy loam surface horizons overlying a light gray to gray mix of saprolite and paralithic material at depths of about 25 cm.

Following is a profile description of a representative pedon (83CA-107-8) located about 100 m east of Elk Creek Trail in the southern watershed of the study area. It is on the shoulder of an east facing hill slope in a delineation of Entic Ultic Haploxerolls, 30 to 45 percent slopes under a dense cover of chamise at an elevation of about 730 m: (Colors are for dry soil unless otherwise noted)

A1 -- 0 to 8 cm; grayish brown (2.5YR 5/2) fine sandy loam, very dark grayish brown (2.5YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, nonsticky and very slightly plastic; few very fine roots; many fine tubular pores; 7 percent gravel by volume; slightly acid (pH 6.2); abrupt wavy boundary.

A2 -- 8 to 25 cm; grayish brown (2.5YR 5/2) fine sandy loam, very dark grayish brown (2.5YR 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few very fine roots; many medium and fine tubular pores; 5 percent gravel by volume; slightly acid (pH 6.3); abrupt wavy boundary.

C/Cr -- 25 to 55 cm; gray to light gray irregular mix of saprolite and paralithic material - saprolite dominant above about 40 cm; rock fabric visible in place; crushes to fine sandy loam texture; saprolite is slightly hard, friable, nonsticky and nonplastic; few fine roots in the saprolite; paralithic material is hard to very hard; can be dug by hand with difficulty.

For additional information see the laboratory characterization analyses for this pedon in Appendix II, p. 17 - Section 7.0.

Range of Characteristics: The surface soils range in color from dark brown to grayish brown; they are very dark grayish brown when moist.

Organic matter content of these soils range from about 2 percent near the surface to less than 0.5 percent near the paralithic contact. They are fine sandy loams with or without fine gravels that may comprise up to about 10 percent by volume of the soil.

The solum thickness to the weathered gabbro-diorite (paralithic contact) ranges from 20 to 50 cm.

Soil Map Units - Entic Ultic Haploxerolls-Elk Creek Area:

ToD - Entic Ultic Haploxerolls, 15 to 30 percent slopes. This soil is of limited extent, comprising about 3 percent of the study area. There are two delineations in the southeastern part of the southern watershed. The soils of this unit are like the representative pedon but occupy less steep hillslopes. It has a semi-dense cover of chamise with mixed annual grasses in the openings.

ToE - Entic Ultic Haploxerolls, 30 to 45 percent slopes. This unit is of moderate extent comprising about 7 percent of the study area. There are scattered delineations in both watersheds; the largest is located in the southeast corner of the northern watershed. The soils of this unit occupy steep hilly slopes and are similar to the representative pedon which is located in this map unit. Vegetative cover is semi dense to dense chamise with an understory of mixed, but sparse annual grasses. In scattered open areas, grasses provide a more complete groundcover.

Ultic Haploxeralfs

This subgroup includes deep, well drained soils, with base saturation above 50, but below 75 percent in some part of the subsoil. These soils have well developed argillic horizons, and they are formed from gabbro-dioritic residuum in the Elk Creek Study Area. The mean annual soil temperature is about 17°C, and the difference between mean winter and mean summer soil temperature is more than 5°C. These soils are usually moist during the late fall, winter, and spring months, and dry during the summer months.

Vegetative cover consists of dense stands of chamise or deer brush with an understory of sparse annual grasses. These soils are extensive in the Elk Creek Study Area, and occupy undulating to steep slopes on the landscape.

Typically, these soils have thin, brownish colored, moderately coarse to medium textured surface horizons. The underlying subsoil is thick, yellowish-brown colored, and of moderately fine texture with many visible clay films on ped faces.

Following is a profile description of a local representative pedon located about 62 m W. 25°N of the reference pedon site 83CA-107-7 beside the Elk Creek trail in the southern watershed of this study area; dense chamise cover; elevation about 770 m. (Colors are for dry soil unless otherwise noted)

A1 -- 0 to 5 cm; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; slightly acid (pH 6.5); abrupt wavy boundary.

A2 -- 5 to 15 cm; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; few fine tubular pores; slightly acid (pH 6.5); abrupt wavy boundary.

Bt1 -- 15 to 41 cm; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/3) moist; moderate coarse angular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; continuous thin clay films on ped faces, dark reddish brown (5YR 3/3) moist; medium acid (pH 6.0); clear wavy boundary.

Bt2 -- 41 to 66 cm; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/3) moist; moderate medium angular blocky structure; very hard, firm, sticky and plastic; few fine roots; continuous thin to moderately thick clay films on ped faces, dark brown (7.5YR 3/2) moist; medium acid (pH 6.0); clear wavy boundary.

C -- 66 to 75 cm; brown (10YR 5/3) fine sandy loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and non-plastic; very few fine roots; slightly acid (pH 6.2); abrupt wavy boundary.

Cr -- 75 to 100^{+} cm; weathered gabbro-diorite; rock fabric clearly visible.

Additional information about these soils is available in the description of reference pedon 83CA-107-6 in Appendix I, p. 30-31 and its laboratory characterization data in Appendix II, p. 15 - Section 7.0.

Range of Characteristics: A thin surface layer of chamise leaves and twigs may be present. The surface soil is brown to dark brown, and very dark grayish brown to dark brown when moist. Textures range from sandy loam to loam. Depth to the underlying argillic horizon (subsoil) is from 8 to 20 cm. The subsoil ranges in color from brown or yellowish brown to strong brown, and from brown or dark brown (with a reddish tint and, in places, a bright chroma) to dark yellowish brown when moist. Organic carbon compounds normally drop to 0.5% or less at depths of 20 to 25 cm. Subsoil texture ranges from sandy clay loam to clay loam. Soil reaction is slightly acid to neutral in the surface soil, and slightly to medium acid in the subsoil.

Depth to a paralithic contact ranges from about 50 to 100 cm.

Soil Map Units - Ultic Haploxeralfs-Elk Creek Area:

UaC – Ultic Haploxeralfs, 5 to 15 percent slopes. This map unit exists as one delineation in the southern watershed in its southernmost part. It is limited in extent, occupying about 1 percent of the Elk Creek Study Area. The soils are similar to the representative pedon. The surface relief is undulating to rolling. Vegetative cover is dense chamise with an understory of sparse mixed annual grasses.

UaD – Ultic Haploxeralfs, 15 to 30 percent slopes. There are three delineations of this unit in the southern watershed which together occupy about 5 percent of the Elk Creek Study Area. The soils are similar to the representative pedon. Surface slopes are moderately steep. Vegetative cover is dense chamise with an understory of sparse annual grasses.

UaE – Ultic Haploxeralfs, 30 to 45 percent slopes. There are delineations of this unit in each of the two watersheds. Combined, they cover about 9 percent of the study area. The delineation in the southern watershed covers most of the land surface west and uphill from the Elk Creek Trail. The representative pedon for the Ultic Haploxeralfs in the Study Area is located in this map unit in the southern watershed. Surface relief is steep and hilly. Vegetative cover is commonly chamise with an understory of sparse annual grasses. In some sheltered sites near stream channels, deer brush is the dominant shrub species.

UaF – Ultic Haploxeralfs, 45 to 75 percent slopes. There are two delineations of this unit in the northern watershed. They occupy very steeply sloping sites adjacent to the intermittent stream that drains the watershed. These soils are similar to the representative pedon. Vegetative cover is dense chamise and deer brush with a sparse mixed annual grass understory.

UaoE – Ultic Haploxeralfs-Entic Ultic Haploxerolls complex, 30 to 45 percent slopes. There is a single delineation of this unit at the west end of the northern watershed. It occupies about 3 percent of the study area. The Ultic Haploxeralfs are like the representative pedon. They are the dominant soils in a complex association with shallow Entic Ultic Haploxerolls similar to those separately mapped in this study area (see page). These soils are too intricately intermingled to be separately mapped at the scale used. Vegetative cover is a mix of chamise and deer brush that is sparse (near the ridge top) to dense (down slope and near the stream channel).

Ultic Palexeralfs

This subgroup includes moderately deep to very deep, well drained soils with base saturation above 50 but below 75 percent in all parts of the argillic horizon. They are marked by a well developed argillic horizon near the soil surface. They have formed in gabbro-diorite residuum in the Elk Creek Study Area. The mean annual soil temperature is about 17°C and the difference between mean winter and mean summer soil

temperatures is more than 5°C. These soils are usually moist during the late fall, winter, and spring months, and dry during the summer months. They are distinguished from Ultic Haploxeralf soils by an abrupt textural change between the surface and subsoil, reflecting at least a 20 percent (absolute) increase in clay content within a short distance vertically.

These soils support chamise and buck brush. Water stress during the summer is particularly severe on these soils because root growth is restricted largely to the surface soils by the dense subsoil. The abundance of buck brush in these two watersheds relative to surrounding granitic watersheds may be due to its adaptability to this soil.

Ultic Palexeralfs are the most extensive soils in these watersheds and they include a variety of surface slope classes.

Typically these soils have granular, brown loam surface soils that grade within 3 to 4 cm into angular blocky, strong brown dense, heavy clay loam subsoils with dark reddish brown clay coatings on structural units. They are underlain by well weathered gabbro-diorite at depths in excess of 100 cm.

Following is a profile description of a representative pedon (83CA-107-7) located west of Elk Creek Trail on a steep, east facing hill slope in the south-central part of the southern watershed in a delineation of Ultic Palexeralfs, 30 to 45 percent slopes; dense chaparral cover, mainly chamise; elevation about 756 m. (Colors are for dry soil unless otherwise noted)

A -- 0 to 15 cm; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine tubular pores, occasional krotovinas filled with fine granular material; slightly acid (pH 6.1); clear wavy boundary.

Bt1 -- 15 to 54 cm; strong brown (7.5YR 5/6) heavy clay loam, strong brown (7.5YR 4/6) moist; strong angular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; few very fine, fine and medium tubular pores; continuous thin to moderately thick clay films on ped faces, dark reddish brown (2.5YR 2.5/4) moist; slightly acid (pH 6.2); clear wavy boundary.

Bt2 -- 54 to 90 cm; brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 4/4) moist; strong coarse angular blocky structure; extremely hard, very firm, sticky and plastic; very few very fine roots; very few fine tubular pores; continuous thin to moderately thick clay films on ped faces, dark reddish brown (5YR 3/2) moist; slightly acid (pH 6.3); abrupt wavy boundary.

BCt -- 90 to 125 cm; yellowish brown (10YR 5/6) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse angular blocky structure; very hard, firm, sticky and slightly plastic; very few fine roots; 20 percent gravel by volume; common thin clay films on ped

faces, dark brown (7.5YR 3/2) moist; slightly acid (pH 6.4); abrupt wavy boundary.

C -- 125 to 150^{+} cm; brown (10YR 5/3) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and nonplastic; slightly acid (pH 6.5).

For additional information see the laboratory characterization analyses in Appendix II, p. 16 - Section 7.0.

Range of Characteristics: These soils range in depth from about 55 to 150^{+} cm to weathered parent rock (paralithic contact). The thin surface soils are brown loams or clay loams, with moist colors ranging from very dark grayish brown to dark brown. Granular structure may be present in some, others are massive. Surface soil thickness ranges from about 5 to 22 cm. The subsoil is a strong brown to brown heavy clay loam to clay, with moist colors ranging from strong brown to reddish brown. There may be a thin duff layer of chamise or deer brush leaves in places under the plant canopy. Gabbro-diorite cobbles, possibly forced to the surface by shrinking and swelling of the fine textured subsoils, are common.

Soil Map Units - Ultic Palexeralfs-Elk Creek Area:

UbC – Ultic Palexeralfs, 5 to 15 percent slopes. This unit exists as one fairly large delineation with an undulating to rolling relief that straddles the Elk Trail in the southern watershed. It occupies about 4 percent of the study area. The soils are similar to the representative pedon. Depths to a paralithic contact are frequently less than 150 cm.

UbD – Ultic Palexeralfs, 15 to 30 percent slopes. This is one of the most extensive units in the Elk Creek Study Area with several delineations in both watersheds. It covers about 18 percent of the study area. The soil is similar to the representative pedon. The surface slopes are moderately steep. The depth to a paralithic contact is usually less than 150 cm.

UbE – Ultic Palexeralfs, 30 to 45 percent slopes. This is the most extensive unit in the Elk Creek Study Area with large delineations in both watersheds. It covers about 24 percent of the study area. The soils are like the representative pedon which is located in one of the delineations of this unit. The surface relief is hilly and steep.

UbEe – Ultic Palexeralfs, eroded, 30 to 45 percent slopes. This unit exists as one delineation on a steep slope in the southern watershed near its northeast corner. The unit comprises about 1 percent of the study area. The soils of this unit are like the representative pedon but have been severely eroded. Gully and sheet erosion has exposed much of the reddish colored subsoils and, in places, weathered parent material. Chamise cover is sparse due to the erosion.

UbaE – Ultic Palexeralfs-Ultic Haploxeralfs complex, 30 to 45 percent slopes. There is a single delineation of this unit in each of the watersheds. It comprises about 6 percent of the study area on steep hilly

terrain. The dominant soils of the complex are Ultic Palexeralfs which are similar to the representative pedon except that depths to a paralithic contact are usually less than 150 cm. The Ultic Palexeralfs form a pattern with Ultic Haploxeralf soils that is too intricate for them to be mapped separately at the scale used. The latter soils are similar to their representative pedon described on page

UbaF - Ultic Palexeralfs-Ultic Haploxeralfs complex, 45 to 75 percent slopes. This map unit exists as a single delineation in each of the two watersheds. Surface slopes are very steep. The unit comprises about 10 percent of the study area. The dominant soil of the complex is an Ultic Palexeralf that is similar to its representative pedon, except that depth to a paralithic contact is usually less than 150 cm. These soils exist in a pattern with Ultic Haploxeralf soils that is too intricate for them to be mapped separately at the scale used. The Ultic Haploxeralf soils are similar to their representative pedon described on page .

Due to the steepness of the terrain in this unit, access is difficult in places. Vegetative cover is unusual for these soils in the Elk Creek Study, since they include large areas of annual grasses. The unusual cover is likely due to recent fire rather than to soil properties.

6.22 Log Meadow Study Area

Aquepts

In this study area, Aquepts include the poorly drained soils of the mixed conifer zone that have formed in granitic alluvium or colluvium accumulated along small streams that drain the study watersheds. The mean annual soil temperature ranges from about 8 to 9°C. They have a mesic soil temperature regime.

Typically, these soils are dark colored, reflecting high organic matter contents. This often varies irregularly with depth, further reflecting alluvial stratification or periodic burial of former soil surfaces. The textures of the mineral soil horizons are coarse, moderately coarse or medium. Some horizons consist of organic soil materials. The soils support wet meadow vegetation.

Following is a profile description of a representative pedon located near Wolverton; elevation 2200 m; the pedon is physically like the Aquepts in the Log Creek study area, but differs in having a mean annual soil temperature less than 8°C. (Colors are for moist soil)

Oa -- 7 to 0 cm; very dark brown gritty muck; structureless; held together as a dense sod by many very fine and common medium roots; occasional twigs and small branches of lodgepole pine; strongly acid (pH 5.2); abrupt smooth boundary.

Ag -- 0 to 8 cm; very dark grayish brown (10YR 3/2) coarse sand, common medium distinct dark brown (7.5YR 4/4) mottles; single grain; loose, nonsticky and nonplastic; many very fine and common fine roots;

many fine interstitial pores; strongly acid (pH 5.3); abrupt smooth boundary.

O'a -- 8 to 24 cm; black (10YR 2/1) muck; structureless; friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine interstitial pores; strongly acid (pH 5.4); abrupt smooth boundary.

2A'g -- 24 to 68 cm; black (2.5YR 2/2) sandy loam; massive; friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine interstitial pores; strongly acid (pH 5.5); clear smooth boundary.

2Cg -- 68 to 108 cm; very dark gray (5YR 3/1) coarse sandy loam; massive; friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 15 percent by volume partially weathered granitic pebbles; scattered black zones of decomposed twigs or roots; medium acid (pH 6.0).

Range in Characteristics: This soil is underlain by stratified moderately coarse and coarse alluvium to depths in excess of 150 cm. The occurrence and thickness of horizons of organic soil material varies from place to place. They are absent in some sites.

Soil Map Units - Aquepts-Log Meadow Area:

Aq - Aquepts, 0 to 2 percent slopes. This soil occupies slightly more than 1 percent of the study area, occurring in several small delineation in the Log Creek watershed. Surface slopes are nearly level. It is similar in profile to the representative pedon for Aquepts, but has a mesic soil temperature regime. It is saturated throughout for most of the year; however, in late autumn the water table may drop below the surface horizons. The soil supports a wet meadow vegetation.

In some delineations, Cumulic Haplumbrept soils are included near unit boundaries where the water table is lower and surface slopes somewhat steeper.

Cumulic Haplumbrepts

This subgroup of soils in the study area includes deep to very deep, moderately well drained soils that are moist from oxygenated seepage water all year in most years. They formed in granitic alluvium or colluvium accumulated in swales or near drainage channels. The mean annual soil temperature is about 9 degrees C.

These soils support dense stands of bracken fern, elephants ear, and other forbs and herbs.

Typically, surface horizons are thick (in excess of 50 cm), dark colored, and coarse to moderately coarse textured. The underlying horizons are medium and moderately coarse in texture, yellowish colored and slightly

mottled in places. The water table is at about 80 cm during most of the summer. These soils are similar to Pachic Haplumbrepts (see page), but differ in having an irregular decrease in organic matter content with depth.

Soil Map Unit - Cumulic Haplumbrepts-Log Meadow Area:

CaB - Cumulic Haplumbrepts, 5 to 15 percent slopes. This unit occurs as a narrow body along the sloping principal drainage in the Tharp's Creek watershed. It covers less than 1 percent of the study area. Colluvium transported from a slope to the west has formed a thin, sandy cap in some places. There is a slight increase in clay content with depth that is probably due to stratification. The soil is saturated below 80 cm, but there is little or no mottling at that depth and chromas of the yellowish soil colors are bright.

Minor inclusions of Aquepts are located in small pockets close to the drainage channel where the water table is higher and the waters slower moving.

Lithic Xerumbrepts

This subgroup of soils in the study area includes shallow to very shallow, well to excessively drained, dark colored, acid soils formed in locally derived colluvium accumulated on rock surfaces and ledges, and in joints of granitic rock outcrops. They range in elevation from about 2100 to 2390 m, mainly on southerly facing slopes. These soils are cool to cold and moist in the winter, and dry and warm in the summer. Mean annual soil temperature at the lithic contact ranges from about 8 to 10°C.

The soils of this subgroup support open to semi-open stands of Jeffrey pine and white fir with a green leaf manzanita and snowbush understory.

Typically, these soils are very dark grayish brown, loamy coarse sands or coarse sandy loams, strongly acid, and high in organic matter content. They are underlain at depths less than 50 cm by slightly weathered granitic rock.

The following description is of a representative pedon (82CA-107-5) located 635 m south, 10 degrees east of the west end of the Wolverton parking area at an elevation of 2250 m on a very steep (50 percent) west facing slope under a sparse cover of manzanita and Jeffrey pine. This soil differs from the Log Creek soils in having a mean annual soil temperature less than 8°C. (Colors are for dry soil unless otherwise noted)

0 -- 1 to 0 cm; brown to dark brown litter of Jeffrey pine needles, catkins and twigs.

A1 -- 0 to 6 cm; dark grayish brown (10YR 4/2) fine gravelly loamy coarse sand, very dark brown (10YR 2/2) moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; common fine

roots; many very fine interstitial pores; strongly acid (pH 5.1); abrupt smooth boundary.

A2 -- 6 to 12 cm; dark grayish brown (10YR 4/2) loamy coarse sand, very dark brown (10YR 2/2) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; many very fine interstitial pores; strongly acid (pH 5.2); very abrupt wavy boundary.

R -- 12 to 100+ cm; light gray, slightly weathered granitic rock.

Range of characteristics: Depth to bedrock ranges from about 10 to 50 cm. Colors range from brown to dark grayish brown when dry; dark brown to very dark grayish brown when moist. Organic matter contents generally range from about 3 to 11 percent. Textures range from loamy coarse sands to coarse sandy loams; coarse fragments, if present, are fine to medium gravel. Soil reaction is medium to strongly acid. An O horizon may be present or absent.

Soil Map Units - Lithic Xerumbrepts-Log Meadow Area:

LaC - Lithic Xerumbrepts, very shallow, 5 to 15 percent slopes. This map unit is limited to one delineation along the Wolverton Cutoff in the Log Creek watershed. It occupies about 0.5 percent of the study area. The soils are similar to the representative pedon, but are on gentler surface slopes and have a mesic soil temperature regime. Depths to the lithic contact ranges from about 5 to 25 cm. These very shallow soils support a semi-open cover of low site Jeffrey pine and green leaf manzanita.

Included in this unit are similar soils that are somewhat deeper to the lithic contact. They support white fir. These soils comprise less than 15 percent of the unit.

LaD-R - Lithic Xerumbrepts, very shallow-Rock outcrop complex, 15 to 30 percent slopes. This map unit exists as one delineation along the west edge of the Tharp's Creek watershed. It occupies about 0.5 percent of the study area. The soils are similar to the representative pedon but have a mesic soil temperature regime. Surface slopes are moderately steep. The depth to lithic contact ranges from about 5 to 25 cm. Comprising about 50 percent of the map unit, these soils occur in close association with granitic rock outcrops in a pattern too intricate to map separately at the scale used. The well-jointed outcrops occupy about 40 percent of the surface area.

The vegetation is an open stand of old growth Jeffrey pine.

This unit includes very similar soils that are somewhat deeper to the lithic contact. These comprise less than about 10 percent of the unit.

LaE-R - Lithic Xerumbrepts, very shallow-Rock outcrop complex, 30 to 45 percent slopes. This map unit covers less than 2 percent of the Log Meadow watersheds. Delineations are located in the northernmost tip of the Log Creek drainage on steep, south-facing slopes at about 2400 m elevation. The

soils are similar to the representative pedon but have a mesic soil temperature regime. Depths to the lithic contact are less than 25 cm. These soils occur in a complex pattern with granitic rock outcrops too intricate to map separately at the scale used. The jointed outcrops occupy from 20 to 50 percent of the various delineations of this unit.

About 10 percent of this map unit consists of inclusions of very similar, somewhat deeper Lithic Xerumbrept soils that support growths of young white fir.

LaF-R - Lithic Xerumbrepts, very shallow-Rock outcrop complex, 45 to 75 percent slopes. This map unit covers about 1 percent of the Log Meadow watersheds. The largest delineation is along the southeast border of the Log Creek drainage on a northwest-facing slope. The soils are similar to the representative pedon and are on very steep slopes. They have a mesic soil tempearture regime. The duff layer includes white fir needles as well as giant sequoia leaves from trees in adjacent units. These soils are too intricately associated with granitic rock outcrops to map them separately. The jointed rock outcrops occupy from 20 to 50 percent of the various delineations of this unit.

This unit includes some small areas of Pachic Xerumbrept soils formed in residuum from the underlying weathered granitic rock. These minor inclusions are located beneath larger trees growing within the unit.

LabC - Lithic Xerumbrepts, very shallow and shallow, 5 to 15 percent slopes. This map unit covers about 1 percent of the Log Meadow watersheds. It occurs as a single delineation located on a gently sloping ridgecrest along the southeast border of the Tharp's Creek drainage. This unit is a mosaic of soils similar to the representative pedon in an intricate pattern with other Lithic Xerumbrept soils that range in depth from about 25 to 50 cm. They have a mesic soil temperature regime. Large granitic boulders are scattered over the surface, but they constitute less than 10 percent of the unit's area.

These soils support a semi-open cover of both Jeffrey pine and white fir.

LabE - Lithic Xerumbrepts, very shallow and shallow, 30 to 45 percent slopes. This unit covers between 1 and 2 percent of the Log Meadow watersheds. There is a single delineation of this unit north of the Wolverton Cutoff in the Log Creek drainage. It is composed of soils similar to the representative pedon and complexly intermingled with other Lithic Xerumbrepts ranging in depth from about 25 to 50 cm. They have a mesic soil temperature regime. The slopes are steep.

Soils of this unit support a semi-open to semi-dense cover of Jeffrey pine, deer brush, and green leaf manzanita. Somewhat more vigorous stands are associated with the deeper Lithic Xerumbrepts.

LabE-R - Lithic Xerumbrepts, very shallow and shallow-Rock outcrop complex, 30 to 45 percent slopes. This map unit covers about 2.5 percent of the Log Meadow watersheds. There are five delineations of this unit in the

Log Creek drainage at elevations ranging from about 2100 to 2300 m. The soils are a complex of Lithic Xerumbrept depth phases, as described for map unit LabE, with granitic outcrops too intricately intermingled to be mapped separately. The jointed outcrops occupy from 20 to 40 percent of the map unit delineations.

The vegetation is similar to that for map unit LabE.

LabF – Lithic Xerumbrepts, very shallow and shallow, 45 to 75 percent slopes. This unit covers between 1 and 2 percent of the Log Meadow watersheds. There are two delineations in the southern half of the Log Creek drainage at an elevation of about 2250 m. The soils are a complex of Lithic Xerumbrept depth phases, as described for map unit LabE. The slopes of this unit are very steep. Runoff from one delineation along the northern drainage boundary has helped to form the regular pattern of parallel, channeled (fluted) microrelief in adjacent unit PbDf.

The vegetation is similar to that for map unit LabE.

LabF-R – Lithic Xerumbrepts, very shallow and shallow-Rock outcrop complex, 45 to 75 percent slopes. This map unit covers slightly less than 2 percent of the Log Meadow watersheds. There are delineations in both drainages at elevations ranging from about 2180 m to 2260 m. The soils are a complex of depth phases of similar soils as described for map unit LabE, and an intermingled, pattern of jointed granitic rock outcrops that comprise about 20 to 40 percent of the unit delineations too intricate to map separately. Slopes are very steep. Runoff from one delineation along the northern boundary of the Log Creek drainage has helped to form the parallel, channeled (fluted) microrelief in adjacent unit PbFf.

The soils support an open to semi-open cover of Jeffrey pine and green leaf manzanita.

LbC-R – Lithic Xerumbrepts, shallow-Rock outcrop complex, 5 to 15 percent slopes. This unit covers less than 0.5 percent of the Log Meadow watersheds. It is limited to one small delineation along the Trail of the Sequoias where the trail cuts across the northern tip of the Tharp's Creek drainage. The soils are like the representative pedon for Lithic Xerumbrepts except that the lithic contact is deeper, ranging from about 25 to 50 cm, and that the soils have a mesic soil temperature regime. Jointed granitic outcrops comprising about 30 percent of the unit area, are too complexly intermingled with the soils to be mapped separately. Slopes range from undulating to moderately steep. Runoff from this unit is not as rapid as from most units of Lithic Xerumbrept soils in the study area.

The soils support an open stand of old growth Jeffrey pine and white fir.

LbD – Lithic Xerumbrepts, shallow, 15 to 30 percent slopes. This unit covers less than 1 percent of the Log Meadow watersheds. There are small delineations in each of the study drainages at elevations ranging from about 2100 m to 2350 m. The soils are like the representative pedon except that depths to the lithic contact range from about 25 to 50 cm and the soils have

mesic soil temperature regimes. The slopes are steep. A semi-open cover of Jeffrey pine and green leaf manzanita is common on these sites. Their leaves and needles often form thick duff horizons.

LbD-R - Lithic Xerumbrepts, shallow-Rock outcrop complex, 15 to 30 percent slopes. This unit covers less than 1 percent of the Log Meadow watersheds. There is a single delineation in each of the study drainages at elevations of about 2200 m and 2300 m. The soils are like the representative pedon except that depths to the lithic contact range from about 25 to 50 cm and have a mesic soil temperature regime. Jointed granitic outcrops, comprising 20 to 40 percent of the unit's delineations, are too complexly intermingled with the soils to be mapped separately. Slopes are steep.

A semi-open cover of mature Jeffrey pine and green leaf manzanita are common on these soils. Their needles and leaves form thick duff horizons on the soil surfaces.

LbE - Lithic Xerumbrepts, shallow, 30 to 45 percent slopes. This unit covers between 1 and 2 percent of the Log Meadow watersheds. There are two delineations in the Log Creek drainage, the largest of which is just south of the Wolverton Cutoff at about 2260 m elevation. The soils are like the representative pedon for Lithic Xerumbrepts except that the depths to lithic contacts range from about 25 to 50 cm and the soils have a mesic soil temperature regime. Surface slopes are steep.

The vegetation is similar to that for map unit LabE.

LbE-R - Lithic Xerumbrepts, shallow-Rock outcrop complex, 30 to 45 percent slopes. This unit covers slightly less than 2 percent of the Log Meadow watersheds. There are 3 delineations of this unit on steep slopes in the Log Creek drainage at elevations ranging from about 2270 m to 2370 m. The soils are like the representative pedon except that the depths to lithic contacts range from about 25 to 50 cm and the soils have a mesic soil temperature regime. Jointed granitic rock outcrops comprising 20 to 40 percent of the map unit are too complexly intermingled with the soils and cannot be mapped separately at the scale used.

The vegetation is similar to that for map unit LabE.

LbF-R - Lithic Xerumbrepts, shallow-Rock outcrop complex, 45 to 75 percent slopes. This unit covers about 1 percent of the Log Meadow watersheds. There are two delineations in the Log Creek drainage at elevations of about 2070 m and 2245 m. The lower delineation is just south of the outlet weir constructed by Park personnel. The soils are similar to the representative pedon, except for depths to lithic contacts ranging from 25 to 50 cm, and the soils have a mesic soil temperature regime. Jointed granitic outcrops comprising 20 to 40 percent of the map unit delineations are too complexly intermingled with the soils to be mapped separately. Surface slopes are very steep.

The vegetation is similar to that for map unit LabE.

Pachic Xerumbrepts

This subgroup of soils in the study area includes moderately deep and deep, dark colored, well to somewhat excessively drained acid soils formed in granitic rock residuum. They range in elevation from about 2075 m to 2385 m. Mean annual soil temperatures range from about 8 degrees C to 10 degrees C, and the difference between mean summer and mean winter soil temperatures is more than 5 degrees C. The soil profiles are moist from late fall to early summer. From early summer to fall the profiles are usually dry except for the surface horizons which may be periodically moistened by thunder showers.

These soils support a semi-dense cover of white fir intermixed with some sugar pine and Jeffrey pine. Toward the upper part of the drainages, the soil climate becomes somewhat cooler and red fir becomes part of the forest canopy. Giant sequoia are common on these soils in hollows or along stream ways where they receive waters draining from surrounding slopes.

Typically, these soils are dark grayish brown to brown, coarse sandy loams to loamy coarse sands, slightly acid, and moderately high in organic matter. They are underlain by weathered granitic rock residuum at depths ranging from 50 cm to more than 150 cm.

Following is a profile description of a representative pedon (82CA-107-4) located about 350 m northeast of the Crescent Meadow Road-Huckleberry Trail Junction at an elevation of about 2048 m on a southwest facing slope of 25 percent. Vegetation is a semi-dense, old growth cover of white fir with a widely scattered understory of chinquapin: (Colors are for dry soil unless otherwise noted)

O1 -- 10 to 2 cm; very dark brown litter of white fir needles.

O2 -- 2 to 0 cm; very dark brown, well decomposed white fir needles.

A1 -- 0 to 8 cm; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; few fine and very fine tubular pores; slightly acid (pH 6.4); abrupt smooth boundary.

A2 -- 8 to 38 cm; yellowish brown (10YR 5/4) loamy coarse sand, dark brown (7.5YR 3/3) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; few very fine and fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.

A3 -- 38 to 57 cm; yellowish brown (10YR 5/4) loamy coarse sand, dark brown (7.5YR 3/3) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; few medium, common very fine and coarse roots; few very fine and fine tubular pores; slightly acid (pH 6.1); clear wavy boundary.

AC -- 57 to 100 cm; light yellowish brown (10YR 6/4) loamy coarse sand, dark brown (7.5YR 3/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine, medium and coarse roots; few fine tubular pores; strongly acid (pH 5.4) abrupt irregular boundary.

Cr -- 100 to 120+ cm; light gray, well weathered granitic rock; occasional circular areas or convoluted bands of yellowish-red staining of the weathered rock fabric.

Range of Characteristics: These soils range in depth from 50 cm to more than 150 cm to weathered granitic bedrock. Dry colors of the surface soil horizons are brown, yellowish brown, or dark grayish brown; moist colors are dark brown, very dark brown, or very dark grayish brown. Organic matter content in the surface soils ranges from about 1 to 12 percent. Textures range from loamy coarse sand to coarse sandy loams. Fine gravel constitutes 15 to 35 percent of the volume in some horizons. Reaction ranges from slightly acid to medium acid. Transitional horizons below the surface soil horizons and above the weathered rock contact are lighter in color, have less than 1 percent organic carbon, are medium to strongly acid, but are similar in texture.

Soil Map Units - Pachic Xerumbrepts-Log Meadow Area:

PaC - Pachic Xerumbrepts, moderately deep, 5 to 15 percent slopes. This unit is very limited in the Log Meadow study area. There is one delineation of 0.1 hectares near the North tip of the Tharp's Creek Watershed at an elevation of about 2240 m. The soils are similar to the representative pedon for Pachic Xerumbrepts. Depths to a paralithic contact are less than 1 m. The surface relief is undulating to rolling.

The soils support an open stand of mature Jeffrey pine and white fir. There is much bare ground and little or no understory growth of shrubs.

PaC-R - Pachic Xerumbrepts, moderately deep-Rock outcrop complex, 5 to 15 percent slopes. This unit covers less than 1 percent of the Log Meadow study watersheds on undulating to rolling slopes. There are three small delineations in the Log Creek Drainage at elevations ranging from about 2260 m to 2375 m. The soils of this unit are like the representative pedon for Pachic Xerumbrepts. Depths to a paralithic contact are less than 1 m. Jointed granitic outcrops cover 15 to 40 percent of the surface area of the delineations. The components of this unit are so intricately undermingled that it was not practical to map then separately at the scale used.

The soils support a semi-dense plant cover of predominantly green leaf manzanita. This mono-type in plant cover is likely to have a substantial influence on the quantity and composition of organic matter in the duff layer and surface soils.

PaD - Pachic Xerumbrepts, moderately deep, 15 to 30 percent slopes. This unit covers nearly 1.5 percent of the Log Meadow study area. There is one

large delineation near the center of the Log Creek Drainage (elevation 2260 m) and one small delineation near the center of the Tharp's Creek Drainage (elevation 2210 m). The soils are like the representative pedon for Pachic Xerumbrepts. Depths to a paralithic contact are less than 1 m. The surface slopes of this unit are moderately steep.

These soils support a semi-dense cover of white fir, Jeffrey pine, and some sugar pine.

PaE – Pachic Xerumbrepts, moderately deep, 30 to 45 percent slope. This unit is one of the more extensive in the study area, covering slightly more than 15 percent of the total area. There are several large delineations in the Log Creek Drainage, and one large delineation in the Tharp's Creek Drainage that covers roughly 40 percent of its area. The soils of this unit are similar to the representative pedon for Pachic Xerumbrepts. Their surface slopes are steep. At 23 investigation sites, depths to a paralithic contact ranged from 50 cm to 95 cm with a median depth of 60 cm. The surface litter is typically 1 cm of undecomposed white fir needles grading abruptly into a mineral soil horizon. In places, however, the litter and duff layers may be as much as 8 cm thick with measurable humified and saprofied horizons, or they may be absent.

Vegetative cover is dense white fir with scattered sugar pine, and Jeffrey pine. Some giant sequoia occupy relatively more moist sites. Less than about 15 percent of the unit consists of inclusions of Pachic Xerumbrept soils that are greater than 100 cm in depth to weathered parent rock (paralithic contact).

PaE-R – Pachic Xerumbrepts, moderately deep-Rock outcrop complex, 30 to 45 percent slopes. This unit covers 4 percent of the study area and occupies steep slopes. There is a fairly large delineation in the Log Creek watershed 100 m upstream (east) from the outlet weir constructed by Park personnel. There is also a larger delineation in the northernmost quarter of the Tharp's Creek watershed. The soils of this unit are like the representative pedon for Pachic Xerumbrepts. Depths to a paralithic contact are less than 1 m. Jointed granitic outcrops cover 15 to 40 percent of the map unit in a complexly intermingled pattern with the soils. Litter layers usually consist of about 1 cm of undecomposed white fir needles that grade abruptly into the mineral A horizon of the soils.

This unit has a dense cover of white fir except where rock outcrops occur.

There are minor inclusions of Pachic Xerumbrept soils that are deeper than 100 cm to weathered bedrock.

PaF – Pachic Xerumbrepts, moderately deep, 45 to 75 percent slopes. This unit covers between 2 and 3 percent of the study area on significantly steeper slopes than map unit PaE which it otherwise resembles. There are two delineations in the southwest third of the Log Creek watershed. The soils of this unit are like the representative pedon for Pachic Xerumbrepts. Soil depths to a paralithic contact range from 50 to 100 cm.

This unit has a dense cover of white fir with scattered sugar pine or Jeffrey pine. It has less than 15 percent inclusions of Pachic Xerumbrept soils that are deeper than 1 m to weathered parent rock.

PaF-R - Pachic Xerumbrepts, moderately deep-Rock outcrop complex, 45 to 75 percent slopes. This unit covers about 1 percent of the study area on very steep slopes. There are two delineations in the Log Creek drainage at mid elevation. The soils of this unit are like the representative pedon for Pachic Xerumbrepts. Soil depths to a paralithic contact range between 50 and 100 cm. Jointed granitic outcrops occupy about 25 percent of the unit's area in an intermingled pattern with the soils too intricate to map separately. This unit includes minor areas of shallow Lithic Xerumbrepts as described for map unit LbF-R.

The vegetation is similar to that for map unit PaF.

PaLD-R - Pachic Xerumbrepts, moderately deep-Lithic Xerumbrepts, shallow-Rock outcrop complex, 15 to 30 percent slopes. This unit occupies about 0.6 percent of the study area. It occurs in one delineation along the western boundary of the Tharp's Creek drainage at mid-elevation. About 60 percent of this unit consists of Pachic Xerumbrepts that are similar to the representative pedon described above with soil depths less than 1 m. About 25 percent of the unit consists of shallow Lithic Xerumbrepts, and about 15 percent consists of jointed granitic outcrops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. The slopes are moderately steep.

The proportion of shallower soils and areas occupied by rock outcrop cause the conifer cover of Jeffrey pine and white fir to be more open.

PbC - Pachic Xerumbrepts, deep, 5 to 15 percent slopes. This is one of the more extensive map units, covering nearly 12 percent of the study area on undulating to rolling slopes. There are large delineations in both the Log Creek and the Tharp's Creek watersheds. The soils are similar to the representative pedon for Pachic Xerumbrepts, except that soil depths are greater than 1 m. For 21 investigation sites, depth to a granitic paralithic contact was as little as 101 cm. However, the majority of sites investigated had depths in excess of 150 cm which is the maximum depth that could be examined with our field equipment. A typical duff layer consists of 1 to 2 cm of undecomposed white fir needles overlying about 1 cm of humified needles that rest abruptly on the mineral soil. Occasionally, however, the duff layer may be as much as 7 cm thick with proportionately thicker litter and humified layers. Typical vegetative cover is dense white fir intermixed with giant sequoia, with scattered patches of lupine or bracken fern on the forest floor.

Delineations of this unit may include minor areas of moderately deep Pachic Xerumbrepts or Typic Haploxerults. The latter soils are located in more moist sites, usually along drainage ways.

PbD – Pachic Xerumbrepts, deep, 15 to 30 percent slopes. This is the most extensive map unit in the study area, covering about 20 percent of the total area on moderately steep slopes. There are several large delineations in the Log Creek watershed, and one delineation in the Tharp's Creek watershed. The soils are similar to the representative pedon for Pachic Xerumbrepts, except that soil depths are greater than 1 m. Of 44 investigation sites, 30 were deeper than 150 cm to a paralithic contact. The remainder ranged from 101 to 140 cm to the contact. A typical duff layer consists of 1 cm of undecomposed white fir needles above 1 cm of humified needles that rest abruptly on the mineral soil. Occasionally, the duff layer may be as much as 12 cm thick. The semi-dense vegetation cover is white fir intermixed with giant sequoia. There are also scattered Jeffrey pine and sugar pine, with lupine or bracken fern understory on the forest floor.

Other soils included in delineations of this map unit are Pachic Xerumbrepts that are less than 100 cm to a paralithic contact. These comprise from 10 to 15 percent of the delineations of this unit.

PbDf – Pachic Xerumbrepts, deep, 15 to 30 percent slopes, fluted. This map unit covers less than 4 percent of the study area, and is limited to one delineation on moderately steep slopes in the Log Creek watershed near the outlet weir. The soils of this unit are similar to the soils of map unit PbD, however, they are marked by parallel, healed channelways about 1 m deep with gentle side slopes, that run up and down hill in a repeated pattern across the unit. The channelways were probably formed by runoff from steeper slopes to the east of the map unit, perhaps during a particularly severe storm following a fire. Vegetative cover is an unusually dense stand of white fir of approximately the same height and stem diameter.

PbE – Pachic Xerumbrepts, deep, 30 to 45 percent slopes. This unit is one of the more extensive in the study area, covering somewhat more than 11 percent of the total area on steep slopes. There are several large delineations in the Log Creek watershed, one of which includes a large portion of the most intensively studied vegetation plot of the Acid Precipitation Project. There are no delineations of this unit in the Tharp's Creek watershed. The soils of this unit are like the representative pedon for Pachic Xerumbrepts except that the soil depths are greater than 1 m. Of 29 investigation sites, 24 exceeded 150 cm in depth to a paralithic contact of weathered granodiorite. The remainder ranged in depth from 101 to 110 cm to the contact. The duff layer is typically 1 cm of undecomposed white fir needles that rests abruptly on the mineral soil surface. Occasionally, however, the duff layer may be as much as 13 cm thick, with distinct litter and humified layers of organic matter. Vegetation cover is dense white fir interspersed with giant sequoia and scattered sugar or Jeffrey pine. Some delineations of this unit include pockets of moderately deep Pachic Xerumbrepts.

PbF – Pachic Xerumbrepts, deep, 45 to 75 percent slopes. This map unit is very limited in extent, covering less than 1 percent of the study area on very steep slopes. There is one delineation along the northern border of the Log Creek watershed at its western end. The soils of this unit are like

the representative pedon for Pachic Xerumbrepts except that the soil depths are greater than 1 m. Vegetation cover is dense white fir and scattered Jeffrey pine or sugar pine. Due to the steepness of the terrain, soils of this unit are likely to be excessively drained. There may be inclusions of moderately deep Pachic Xerumbrepts in the single delineation of this unit.

PbFf – Pachic Xerumbrepts, deep, 45 to 75 percent slopes fluted. This unit is limited in extent, covering less than 1.5 percent of the study area on very steep slopes. There is one delineation in the Log Creek watershed near its western end. The soils of this unit are like the representative pedon for Pachic Xerumbrepts except that the soil depths are greater than 1 m. Another difference is that the slopes have been serially incised in the past by runoff from a rock outcrop area to the northeast of the map unit. These erosion scars, subsequently healed, have left a "fluted" microrelief pattern of repeated, parallel gentle swales that run up and down slope for the length of the unit. Vegetative cover is dense white fir. Due to the steepness of the terrain, runoff is likely to be excessive. There may be inclusions of moderately deep Pachic Xerumbrepts in the single delineation of this unit.

Other Soil Map Units - Miscellaneous Areas and Complexes - Log Meadow Area:

R – Rock outcrop. This map unit is very limited in the Log Meadow Study area, covering less than one percent. There is a single small delineation in each of the watersheds. This unit consists of at least 90 percent exposed, jointed granitic rock of the Giant Forest Pluton. On the average, deep vertical joints in the rock are spaced closer than 30 m. There are a few small included areas of very shallow Lithic Xerumbrept soils.

No significant vegetation grows in this map unit except various lichens on the exposed rock surfaces.

Fairly extensive areas of this unit are mapped in complex with various soils.

R-LaD – Rock outcrop-Lithic Xerumbrepts, very shallow complex, 15 to 30 percent slopes. This unit is of limited extent in the Log Meadow Study Area, covering about 1 percent of the total area on moderately steep slopes. There are two delineations in the Tharp's Creek watershed. Jointed granitic outcrops of the Giant Forest Pluton cover more than 60 percent of the unit. The soils are similar to the representative pedon for Lithic Xerumbrepts described previously and cover less than 40 percent of the unit. Soil depths are less than 25 cm. The soils have a mesic soil temperature regime. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. This map unit contains less than 10 percent inclusions of Lithic Xerumbrepts with soil depths ranging from 25 to 50 cm.

Vegetation is an open cover of green leaf manzanita and stunted Jeffrey pine.

R-LaE - Rock Outcrop-Lithic Xerumbrept, very shallow complex, 30 to 45 percent slopes. This unit is of limited extent on steep slopes covering less than 2 percent of the study area. There are two delineations in the Log Creek watershed. The larger is adjacent to the Wolverton Cutoff, the smaller in the northern part of the watershed. Jointed granitic rock outcrops of the Giant Forest Pluton make up more than 60 percent of the unit. The soils are similar to the representative Lithic Xerumbrept pedon described previously. The soils have a mesic soil temperature regime. They comprise less than 40 percent of the unit. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The soils support is an open cover of green leaf manzanita and Jeffrey pine. This unit contains a few inclusions of somewhat deeper Lithic Xerumbrept soils beneath more vigorous growths of pine and manzanita.

R-LaF - Rock outcrop-Lithic Xerumbrepts, very shallow complex, 45 to 75 percent slopes. This unit is of very limited extent on very steep slopes covering less than 1 percent of the study area. There is one delineation of this map unit in each of the two watersheds. Fractured granitic outcrops of the giant Forest Pluton make up more than 60 percent of each delineation. The soils, comprising less than 40 percent of the unit, are similar to the representative Lithic Xerumbrept pedon. The soils have a mesic soil temperature regime. The rock and soil components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. Delineations of this unit may contain minor inclusions of Lithic Xerumbrepts with soil depths ranging from about 25 to 50 cm.

The soils support an open to semi-open cover of green leaf manzanita and Jeffrey pine.

R-LbF - Rock outcrop-Lithic Xerumbrepts, shallow complex, 45 to 75 percent slopes. This unit is of very limited extent on very steep slopes covering less than 1 percent of the study area. There is one delineation in the northern part of the Log Creek watershed. Jointed granitic outcrops of the Giant Forest Pluton make up more than 60 percent of the delineation. Less than 40 percent of the unit consists of Lithic Xerumbrept soils similar to the representative pedon except that soil depths range from about 25 to 50 cm and they have a mesic soil temperature regime. They are too intricately associated with the rock outcrops to map separately at the scale used. There are minor inclusions of Lithic Xerumbrepts with soil depths less than 25 cm.

The soils support an open cover of green leaf manzanita and Jeffrey pine.

Xeric Haplohumults

This subgroup of soils in the study area includes deep to very deep, well drained, acid soils formed in granitic residuum and colluvium that have significant subsoil development. The mean annual soil temperature is about 8 degrees C and the difference between mean summer soil temperature and mean winter soil temperatures is more than 5 degrees C. The profile is moist from late fall to early summer. From early summer to early fall, the soil drys to a depth of 60 cm or more.

These soils are generally found on moderate slopes in the mixed conifer zone along stream channels or near meadows where subsurface drainage waters tend to accumulate. They support a dense cover of white fir and are almost always associated with stands of giant sequoia. (Many of the named trees and groves in the Giant Forest area are rooted in Xeric Haplohumults).

Typically, surface horizons of these soils are dark grayish brown to brown coarse sandy loams, slightly acid, moderate to high in organic matter, and low in exchangeable bases. They are underlain by strong brown to reddish yellow, coarse sandy loam subsoil horizons that are medium to strongly acid, low to very low in organic matter, and low to very low in exchangeable bases. The subsoil horizons, showing a slight but significant increase in clay content marked by clay films on mineral grains as well as the low base saturation, separates these soils taxonomically from the more abundant Pachic Xerumbrept soils of the mixed conifer zone.

Following is a profile description of a representative pedon located 80 meters N, 36 degrees E of the "Auto Log" sign on the south edge of the Auto Log parking lot (82CA-107-2); elevation is about 1990 meters; vegetation is a semi-dense cover of old growth white fir, sugar pine, Jeffrey pine and giant sequoia: (Colors are for dry soil unless otherwise noted)

O1 -- 5 to 1 cm; dark brown conifer needles and twigs.

O2 -- 1 to 0 cm; very dark brown decomposed conifer needles and twigs.

A1 -- 0 to 5 cm; dark grayish brown (10YR 4/2) coarse sandy loam, very dark brown (7.5YR 2/2) moist; weak medium crumb structure; soft and slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; slightly acid (pH 6.1); very abrupt wavy boundary.

A2 -- 5 to 16 cm; brown (10YR 4/3) coarse sandy loam, dark brown (7.5YR 3/2) moist; weak fine crumb structure; soft and slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common fine tubular pores, many very fine irregular pores; slightly acid (pH 6.1); abrupt wavy boundary.

A3 -- 16 to 35 cm; dark brown (7.5YR 4/4) coarse sandy loam, dark reddish brown (5YR 3/4) moist; weak fine crumb structure; slightly hard, very friable, slightly sticky and nonplastic; common fine, medium and coarse roots; common very fine and few fine tubular pores, many very fine irregular pores; slightly acid (pH 6.1); clear wavy boundary.

AB -- 35 to 57 cm; brown (7.5YR 5/4) coarse sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine and medium, and few coarse roots; common fine tubular pores, many very fine irregular pores; medium acid (pH 5.6); clear wavy boundary.

BA -- 57 to 77 cm; brown (7.5YR 5/4) coarse sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine, few medium and coarse roots; few fine tubular pores, many very fine irregular pores; colloidal stains on mineral grains; strongly acid (pH 5.5); abrupt wavy boundary.

Bt1 -- 77 to 106 cm; strong brown (7.5YR 5/6) coarse sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, sticky and slightly plastic; few medium and coarse roots; few very fine tubular pores, common very fine irregular pores; colloidal stains on mineral grains, clay films as bridging and irregular pore fill; strongly acid (pH 5.2); clear wavy boundary.

Bt2 -- 106 to 150 cm; reddish yellow (7.5YR 7/6) coarse sandy loam, brown (7.5YR 5/4) moist; massive; hard, firm, sticky and slightly plastic; few fine, medium and coarse roots; few very fine tubular pores, common very fine irregular pores; colloidal stains on mineral grains, clay films as bridging and irregular pore fill; very strongly acid (pH 5.0); clear irregular boundary.

(Sampled by auger below 150 cm - many irregular, well weathered granitic rock fragments interfere with sampling 150 to 184 cm).

C1 -- 184 to 234 cm; light yellowish brown (10YR 7/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very strongly acid (pH 4.9); gradual boundary.

C2 -- 234 to 280 cm; very pale brown (10YR 7/4) coarse sandy loam, dark yellowish brown 10YR 4/4) moist; massive; very strongly acid (pH 5.0).

Range of Characteristics: No significant variations of horizon properties noted in the above pedon description were observed in the Log Meadow area.

Soil Map Unit - Xeric Haplohumults-Log Meadow Area:

TeD – Xeric Haplohumults, 15 to 30 percent slopes. This unit is of limited extent on moderately steep slopes. It comprises somewhat less than 2 percent of the area. There is a single delineation in the Log Creek

watershed along the Wolverton Cutoff Trail. The soil is similar to the representative pedon for Xeric Haplohumults. The map unit may contain minor inclusions of deep Pachic Xerumbrepts near its perimeter.

Vegetation is a dense cover of white fir and giant sequoia, with an understory of bracken fern and lupine.

6.23 Emerald Lake Study Area

Cryaquepts

This great group includes the soils of alpine and subalpine meadows formed in granitic alluvium-colluvium accumulated in rock basins. They are poorly drained. The mean annual soil temperatures are above freezing, but the mean summer soil temperatures are very cool to cold, usually less than 10°C.

Typically, these soils are dark colored with coarse to medium textures, strongly acid and high in organic matter content to depths of 50 cm or more, or to shallower lithic contacts in the rock basins.

Following is the profile description of a representative pedon located about 30 m north of Parson's Pond in a wet meadow; elevation 2956 m (colors are for moist soil).

O -- 3 to 0 cm; black peaty muck, very strongly acid, very abrupt wavy boundary.

A -- 0 to 5 cm; black loam, massive; very friable, slightly sticky, slightly plastic; many fine and very fine roots; very strongly acid; abrupt wavy boundary.

ACg -- 5 to 30 cm; very dark grayish brown very gravelly loamy coarse sand, few dark brown mottles; single grain; loose, nonsticky, nonplastic; few fine roots; strongly acid; clear smooth boundary.

C -- 30 to 150 cm; dark grayish brown very gravelly coarse sand; single grain; loose, nonsticky, non plastic; strongly acid.

Range of Characteristics: The O horizon is not continuous. The textures of the mineral horizons vary from sands to loams reflecting original stratification of the parent materials. The reaction ranges from strongly to extremely acid. The depth to underlying hard rock ranges from less than 50 cm to several meters.

Soil Map Unit - Cryaquepts-Emerald Lake Area:

CqB - Cryaquepts, 0 to 5 percent slopes. This soil includes the representative pedon for Cryaquepts. It is very limited in extent and occurs in a single body adjacent to Parson's Pond. Organic matter content in the A horizon ranges from about 4 to 8 percent. The soil is saturated throughout. The depth to the water table ranges from about 20 cm to above

the soil surface near the pond. The surface slopes range from nearly level to very gently sloping - less than 5 percent.

There is less than about 15 percent inclusion of other soils and miscellaneous areas in this unit. These inclusions are similar soils low in organic matter content that are associated with the several small water ways entering the pond's basin. There are also occasional rock outcrops and similar soils near the edges of the basin that are shallower to the underlying rock.

Entic Cryumbrepts

This subgroup includes very deep to moderately shallow, well to excessively drained, grayish brown to brown soils formed predominantly in granitic colluvium accumulated on ledges, ridge slopes, and in joint systems of large rock outcrops. Some of these soils have formed in local granitic rock residuum or in patches of ground moraine. In this area they range in elevation from about 2788 to 2990 m. Some are wet in the summer from seepage waters, but are not poorly drained. The mean annual soil temperatures are above freezing but the mean summer soil temperatures are very cool.

The soils support very open stands of red fir, but mainly clusters of short perennial grasses, and some alpine shrubs and forbs.

Typically, these soils have thick, dark colored, strongly acid, coarse to moderately coarse textured surface layers overlying lighter colored, medium to strongly acid, moderately coarse textured substrata. The soils rest on underlying, slightly weathered granitic rock at depths ranging from 70 to more than 150 cm.

Following is a profile description of a representative pedon (83CA-107-14) located about 220 m east-northeast of the outlet to Emerald Lake at an elevation of about 2860 m in a delineation of Entic Cryumbrepts, deep, 45 to 75 percent slopes: (Colors are for dry soil unless otherwise noted)

A1 -- 0 to 6 cm; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark gray (10YR 3/1) moist; very weak fine granular structure; loose, very friable, nonsticky and nonplastic; many very fine and few medium roots; 30 percent gravel and stones; strongly acid (pH 5.2); abrupt smooth boundary.

A2 -- 6 to 28 cm; brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine, few medium roots; common very fine and fine tubular pores; 20 percent gravel and stones; strongly acid (pH 5.1); clear wavy boundary.

A3 -- 28 to 55 cm; brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; very weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots;

common very fine and fine tubular pores; 25 percent gravel; strongly acid (pH 5.3); abrupt wavy boundary.

AC -- 55 to 70 cm; light brownish gray (10YR 6/2) very gravelly coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable; nonsticky and nonplastic; few fine roots; few very fine tubular pores; 35 percent gravel and cobbles; strongly acid (pH 5.4); very abrupt irregular boundary.

C -- 70 to 150 cm; interlocking granitic cobbles and stones; very pale brown coarse sandy loam soil material in the interstices.

Range of Characteristics: Organic carbon contents are in excess of 3 percent to depths of 50 to 80 cm. The surface soil horizons range in color from grayish brown to brownish gray. When moist, they range from very dark grayish brown to dark gray. The textures range from loamy coarse sand to loam; coarse fragments (pebbles, cobbles and stones) in the surface soils range from less than 15 to about 40 percent by volume. The reactions range from strongly to extremely acid.

The subsurface horizons range in color from brown to grayish brown, grading to light brownish gray, light gray or pale brown at depths in excess of 50 cm. When moist, colors range from very dark grayish brown to dark brown. Bright mottles occur in wet phases, but the matrix colors have chromas of 3 or more. Textures range from coarse sandy loam to loamy coarse sand; rock fragments (pebbles, cobbles and stones) range from about 20 to 70 percent by volume. The soil reactions range from strongly to very strongly acid.

The soil depths to hard or well weathered granitic rock range from more than 50 cm to several meters.

Soil Map Units - Entic Cryumbrepts-Emerald Lake Area:

EaD - Entic Cryumbrepts, moderately deep, wet, 15 to 30 percent slopes. This soil is similar in profile to the representative pedon, but it is wet throughout or in the subsurface during the summer months due to local seepage. Some mottling has formed in places below the surface soil but the chromas of the mottled horizons or of the mottles are 3 or greater. The soil is very limited in extent and occupies a wide, moderately steep rock bench east of Emerald Lake at an elevation of about 2890 m. It has developed a denser sod cover than is typical for Cryumbrepts in this study area. Soil depth ranges from 50 to more than 150 cm to a lithic contact.

Less than 15 percent of this unit consists of minor areas of sandy, light colored recent alluvium; low rounded exposures of granitic rock; and areas of Cryumbrepts that rest on rock contacts at depths less than 50 cm. Some, but not all of the latter are affected by seepage waters.

EbF - Entic Cryumbrepts, deep, 45 to 75 percent slopes. This map unit contains the representative pedon for Entic Cryumbrepts. It is a deep soil

of very limited extent on very steep slopes formed in colluvium accumulated in a master joint tract on the east side of Emerald Lake. Angular stones and cobbles are scattered across the soil surface in varying amounts ranging from about 1.5 to 3 m apart. It is well to somewhat excessively drained, becoming droughty late in the summer.

The plant cover consists mainly of scattered short perennial grasses and forbs. It occupies less than half of the soil surface. There is much bare ground and an occasional red fir.

Included in this unit are small areas of similar soils with surface slopes less than 45 percent, and occasional large boulders and rock outcrops.

EcF – Entic Cryumbrepts, deep, cobbly, 45 to 75 percent slopes. This unit is limited in extent and occupies the very steep slopes of a colluvial cone west of Emerald Lake. The soils have formed in very cobbly and stony colluvium accumulated to depths of more than 1.5 m from a higher lying avalanche chute formed in a large joint system that cuts across the watershed. The soils are similar in profile to the representative pedon for Entic Cryumbrepts, but are very cobbly throughout and have many stones and boulders strewn over their surfaces. These soils are somewhat to excessively drained and quite droughty in the late summer. The soils support a scattering of alpine plants and grasses.

Included in this unit are small areas of recent stony or gravelly colluvium and a few granitic rock outcrops.

Soil Map Units - Miscellaneous Areas-Emerald Lake Area:

F-K – Felsenmeer-Stony colluvial land. This map unit consists mainly of frost-riven, spalled rockland of unglaciated ridges associated with lesser areas of steep, recent accumulations of sandy, gravelly and stony materials, many meters thick, emplaced by creep, wash, and local avalanche action. The unit is very limited in area and is located in the easternmost part of the Emerald Lake drainage above timberline at elevations of about 3290 to 3365 m.

The felsenmeer (sea of rock) areas are exceedingly rough, consisting of a chaotic jumble of large angular blocks of granitic rock, ranging in size from about 1 to 5 m across. The blocks reflect severe frost wedging of well jointed rock, particularly during glacial times. The surfaces of some blocks are fresh, others are deeply pitted, weathered, and covered with lichens. The openings between blocks, often up to a meter in width, are irregular and tortuous to uncertain depths; small earthy pockets of soil material can be found in some shallow openings.

This shattered rockland offers much more weathering surface and is likely the source of the sands and fine gravel in the associated colluvial land. Both the felsenmeer and stony colluvial land act to slow and divert runoff from rainfall or melt water.

G - Glacial rubble land. This map unit consists of neo-glacial ground moraine and large erratics laid down on a moderately steep bench sloping to the northwest on the north side and below the cliffs and talus slopes of Alta Peak. It is a thick veneer of very poorly sorted sands, gravels, cobbles, stones and boulders of limited extent on a jointed rock surface. Irregular, low morainal ridges of this material have helped to divert local runoff into Emerald Lake that otherwise would have entered Pear Lake.

K - Stony colluvial land. This map unit consists of steep to very steep slopes of sandy, gravelly and stony material recently accumulated in places by creep, wash and local avalanche action on the slopes and cliffs below Alta Peak along the south edge of the Emerald Lake watershed. It is of limited extent and occurs in several delineations. Because of its recent origin and unstable surface, little or no soil development has taken place.

The colluvial material is several meters thick and rests on stony, bouldery talus or glacial rubble. The fine earth fraction of the colluvium stores moisture and slows the rate of melt-water runoff into Emerald Lake.

Lithic Cryumbrepts

Lithic Cryumbrepts in this area include shallow and very shallow, dark colored, well to somewhat excessively drained soils formed in granitic rock colluvium and local alluvium accumulated on rock surfaces, ledges or steps, and in very complex systems of jointing and fracturing of large areas of granitic rock outcrop. They range in elevation from about 2788 to 3200 m. Mean annual soil temperatures are above freezing, but the mean summer soil temperatures are very cool to cold.

The soils support a variety of subalpine and alpine plants and shrubs, including short-hair grass, cryptograma, hens and chickens, buckwheat, and willow. The cover density and kinds of plants range from open to semidense, depending upon local sources of moisture. The denser cover is commonly willow in more moist sites.

Typically, these soils are grayish brown to brown, gravelly to stony, coarse or moderately coarse textured, strongly acid and moderately high in organic matter. They are underlain at depths less than 50 cm by slightly weathered granitic rock.

Following is a profile description of a representative pedon (82CA-107-13) located about 150 m northeast of the mouth of Emerald Lake at an elevation of about 2840 m in a delineation of Rock outcrop - Lithic Cryumbrepts, very shallow complex, 45 to 75 percent slopes: (Colors are for dry soil unless otherwise noted)

A1 -- 0 to 5 cm; grayish brown (10YR 5/2) very gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; very weak fine granular structure; loose, loose to very friable, nonsticky and nonplastic; many very fine and common fine roots; 40 percent fine gravel, 10 percent cobbles; thin, fine gravel erosion pavement on surface of horizon; strongly acid (pH 5.2); abrupt wavy boundary.

A2 -- 5 to 23 cm; yellowish brown (10YR 5/4) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; few or no roots, few fine roots flattened on rock contact below; common fine and very fine tubular pores; 20 percent fine gravel, 10 percent cobbles; strongly acid (pH 5.2); very abrupt smooth boundary.

2R -- 23 to 50+ cm; slightly weathered granitic rock.

Range of Characteristics: These soils range in depth from about 10 to 50 cm to the underlying rock. They range in color from grayish brown to brown or dark brown; dark gray, very dark grayish brown or dark brown when moist. Organic matter contents are in excess of 3 percent. Textures range from loamy coarse sand to coarse sandy loam; coarse fragment texture modifiers range from gravelly to very gravelly, cobbly or stony. The soil reaction ranges from strongly to extremely acid.

For additional information, see Appendix I, pp 44-45; Appendix II, p 22 - Section 7.0.

Soil Map Units - Lithic Cryumbrepts-Emerald Lake Area:

LcF - Lithic Cryumbrepts, very shallow, 45 to 75 percent slopes. This map unit is of very limited extent. The soils are similar in profile to that of the representative pedon. The depth of soil to an underlying lithic contact is less than 25 cm. They are on very steep slopes and have a scattering of stones and boulders on their surfaces. They support a sparse cover of scattered perennial grasses and alpine plants.

Included in this map unit are minor areas of similar soils that are deeper to the lithic contact, and other sandy, shallow soils that lack an umbric epipedon.

LcF-R - Lithic Cryumbrepts, very shallow-Jointed rock outcrop complex, 45 to 75 percent slopes. This map unit is of limited extent. Delineations are located on some of the glaciated rock faces of the watershed south and southeast of Emerald Lake at elevations ranging from about 2835 to 3050 m. The soils are similar in profile to that of the representative pedon. The depth of soil to an underlying lithic contact is less than 25 cm. They exist in close association with large granitic rock outcrops and glaciated faces broken by many vertical fractures and rock joints that are closer than 30 m. The soils occupy ledges, very steep slopes, and irregular grooves and depressions in the rock formed from previous glaciations. The unit is 45 percent Lithic Cryumbrepts, very shallow, and 40 percent Jointed rock outcrop. They are too intricately intermingled to be mapped separately at the scale used.

The soils support an open to semi-open cover of low alpine plants, perennial grasses, and willow in somewhat more moist sites.

Included in this unit are about 15 percent similar, but deeper soils; similar soils that are wet periodically during the summer from seepage waters; very small areas of Cryaquepts; and small areas of shallow Cryorthents.

LdF - Lithic Cryumbrepts, very shallow, stony, 45 to 75 percent slopes. This map unit is moderate in extent. The larger of its two delineations is located below the extensive areas of rock outcrop and talus south of Emerald Lake at elevations ranging from about 2820 m to 2900 m. The smaller delineation lies above Parsons Pond at an elevation of about 3000 m. The soils are similar in profile to the representative pedon for Lithic Cryumbrepts, but are more gravelly and are littered with many stones and boulders. Soil depths to lithic contacts are less that 25 cm.

Melt water from lingering snow banks higher on the watershed provide moisture to these soils during part of the summer period. In response, these very shallow soils support a dense cover of willow.

Minor areas of similar, but deeper soils are included in this unit.

LdF-R - Lithic Cryumbrepts, very shallow, stony-Jointed rock outcrop complex, 45 to 75 percent slopes. This map unit is limited in extent. Delineations are located along the very steep, irregular drainage ways that lead melt water from the snow fields below Alta Peak to the basin of Emerald Lake. They range in elevation from about 2865 to 3050 m. The soils are similar in profile to that of the representative pedon, but are more gravelly, and are littered with many stones fallen from higher lying bodies of talus and rock cliffs.

The soils exist on very steep slopes in a complex pattern around many large granitic rock outcrops broken by vertical joints or fractures closer than 30 m. Many of the rock areas are, in reality, very large talus blocks. The soils occupy ledges, and irregular grooves and depressions in the underlying rock worn by previous glaciations. The unit consists of about 45 percent Lithic Cryumbrepts, very shallow, stony, and 40 percent Jointed rock outcrop. They are too intricately intermingled to be mapped separately at the scale used.

The soils of this unit support a dense cover of willow thickets that obscure some of the rock outcrops.

Included in this unit are about 15 percent of similar, but deeper soils; and very tiny areas of shallow, well drained organic soils resting on rock and associated with willows or ferns.

LeC-R - Lithic Cryumbrepts, shallow-Jointed rock outcrop complex, 5 to 15 percent slopes. This unit is of limited extent and is located in a single delineation adjacent to Emerald Lake at elevations ranging from about 2788 to 2830 m. It consists of a complex of about 55 percent Lithic Cryumbrepts, shallow on sloping ledges and 35 percent irregular prominent granitic rock outcrops that have vertical joints or fractures closer than 30 m. These

components are too intricately intermingled to be mapped separately at the scale used.

The soils have profiles similar but slightly deeper than that described for the representative pedon. The depth of soil to the lithic contact in this unit ranges from about 25 to 50 cm.

The soils support a semi-dense cover of shrubs - mainly willow, grasses and subalpine plants.

Included in this unit are about 10 percent of similar soils that are wet from local seepage, and other similar soils that are deeper than 50 cm to slightly weathered or well weathered granitic rock contacts.

LeD - Lithic Cryumbrepts, shallow, 15 to 30 percent slopes. This map unit is very limited in extent. It is located in a single delineation on a moderately steep bench southeast of Emerald Lake at an elevation of about 3000 m. The soils have profiles similar to that described for the characterizing pedon, but are somewhat deeper. The depth of soil to the lithic contact ranges from about 25 to 50 cm. A scattering of a few stones and large boulders litter the surface of this unit along with a few rock outcrops comprising less than 15 percent of the unit.

The soil supports a semi-open cover of short perennial grasses and alpine plants. A few small red firs and larger western white pines grow in included sites of deeper soils or associated with large, deep, earth-filled fractures in the few low profile rock outcrops.

LfqC - Lithic Cryumbrepts, shallow, wet-Histic Lithic Cryaquepts complex, 5 to 15 percent slopes. This map unit is very limited in extent. It is close to the south shore of Emerald Lake at an elevation of about 2810 m on a sloping to moderately steep rock bench. It is a complex of Lithic Cryumbrepts that are periodically wet from seepage waters, but not poorly drained, and shallow, poorly drained, low hummocky soils that are mantled with a spongy, fiberous sod and support wet meadow vegetation. The proportion of these dominant soils in this unit is about 60 to 35 percent, respectively. They are too intricately intermingled to map separately at the scale used.

The Lithic Cryumbrepts are similar in profile to that described for their representative pedon. They range in depth from about 25 to 50 cm.

Following is a profile description of the associated poorly drained soil. It is classed with Histic Lithic Cryaquepts: (colors are for moist soil)

O -- 3 to 0 cm; dark brown dense, fiberous sod; many fine and medium roots from grasses and water loving plants; patches of moss; abrupt smooth boundary.

Oa -- 0 to 10 cm; black (N 2/) organic loam; massive; friable, nonsticky, very slightly plastic; many very fine and fine and common medium roots; extremely acid (pH 4.4); very abrupt wavy boundary.

C -- 10 to 11 cm; brown (10YR 4/3) very fine sandy loam, few faint mottles; massive; friable, nonsticky and nonplastic; very strongly acid (pH 4.5); very abrupt wavy boundary.

O'a -- 11 to 25 cm; black (10YR 2/1) organic loam; massive; friable, nonsticky, nonplastic; many very fine and fine roots, very strongly acid (pH 4.7); abrupt wavy boundary.

A -- 25 to 38 cm; black (10YR 2/1) loam; massive; friable, slightly sticky, slightly plastic; few fine roots; few medium tubular pores-conducting water; strongly acid (pH 5.1); very abrupt irregular boundary.

2R -- 38 to 50 cm; closely interlocking angular cobbles and stones resting on glaciated bedrock.

Range in Characteristics: The thickness of the surface organic soil material (histic epipedon) ranges from about 20 to 40 cm. The reaction of the Oa horizons ranges from strongly to extremely acid; the reaction of the A horizon ranges from strongly to very strongly acid. Rust colored mottles are present in the A horizon in places. Depth to the lithic contact ranges from about 25 to 50 cm. The thin C horizon occurs in a lens-like pattern horizontally beyond the limits of the pedon. For additional information, see Appendix I, pp 48-49; Appendix II, p 24-Section 7.0.

Included in this unit are about 5 percent rock outcrops and scattered talus boulders.

Soil Map Units - Miscellaneous Areas and Lithic Cryumbrepts - Emerald Lake Area:

Rj - Rock outcrop, jointed. This map unit consist of areas of 90 percent or more exposed granitic rock - mainly granodiorite - that is frequently broken by deep, vertical jointing closer than 30 m, and by some sheet jointing. The unit is extensive and comprises a significant portion of the watershed, occurring in separate delineations as well as in complex association with many of the soils in the area.

Much, but not all of these rock surfaces have been smoothed and rounded by glaciation in Pleistocene times and, to a lesser extent, in the neo-glacial period of Holocene times. Those rock surfaces above the firn line are more weathered and frost riven, such as the cliffs below Alta Peak and the arete-like ridge crest between Emerald and Pear Lakes. Lichens are prevalent on these latter surfaces.

The close vertical jointing of these rock areas afford some deep percolation of runoff waters. Included are less than 10 percent Lithic Cryumbrepts, Lithic Cryorthents and detached, large boulders.

R-LcE - Jointed rock outcrop-Lithic Cryumbrepts, very shallow complex, 30 to 45 percent slopes. This unit is a complex combination of Jointed rock outcrop and Lithic Cryumbrepts that are less than 25 cm deep and have steep surface slopes. The components, comprising about 70 percent and 20 percent of the unit respectively, are too intricately intermingled to be mapped separately at the scale used. The map unit is limited in extent, occurring at an elevation of about 3100 m in a single delineation that slopes toward Emerald Lake from Stohlgren Saddle. The latter is a gentle segment, of an otherwise distinct drainage divide, that subtly separates local runoff waters flowing into Emerald and Pear Lakes.

The rock outcrop is cross jointed with vertical fractures closer than 30 m that produce a complex local runoff pattern and determine the patterns of accumulation of colluvial soil material. The Lithic Cryumbrepts, very shallow, formed in this material have profiles similar to the representative pedon for these soils.

Seepage water from higher lying areas of Talus and Glacial rubble land favors a fairly dense growth of perennial grasses and alpine plants in the shallow soils. The unit is above the local timberline.

About 10 percent of this unit consists of similar but deeper soils and a scattering of very small areas of Cryaquepts and Histic Lithic Cryaquepts that support alpine meadow vegetation.

R-LcF - Jointed rock outcrop-Lithic Cryumbrepts, very shallow, complex, 45 to 75 percent slopes. This map unit is a complex combination of jointed rock outcrop and Lithic Cryumbrepts less than 25 cm deep on very steep slopes. The proportion of Jointed rock outcrop to Lithic Cryumbrepts is about 70 to 20 percent, respectively. The components are too intricately intermingled to be mapped separately at the scale used. It is an extensive unit existing in several delineations, south and east of Emerald Lake, that range in elevation from 2788 to about 3100 m.

The rock outcrop is complexly jointed with vertical fractures closer than 30 m, and has been smoothed and rounded by past glacial action. The Lithic Cryumbrepts have profiles similar to the representative pedon which is located in this unit.

The very shallow soils support clusters of perennial grasses, subalpine and alpine plants and shrubs, including willow in more moist sites. Occasional red fir or western white pine exist in included sites of deeper soils.

About 10 percent of the unit consists of similar, but deeper soils (in excess of 50 cm to underlying weathered or unweathered rock, and large talus boulders, particularly in the vicinity of Parsons Pond.

R-LeF - Jointed rock outcrop-Lithic Cryumbrepts, shallow, complex, 45 to 75 percent slopes. This map unit is a complex combination of Jointed rock outcrop and Lithic Cryumbrepts, shallow, on very steep slopes. The proportion of Jointed rock outcrop to Lithic Cryumbrepts, shallow, is about

50 to 30 percent, respectively. The components are too intricately intermingled to be mapped separately at the scale used. The map unit is limited in extent. It exists as a single delineation east of Emerald Lake, near the crest of the ridge separating Emerald and Pear Lake drainages, at elevations ranging from about 2900 to 3050 m.

The rock outcrop is complexly jointed with vertical fractures closer than about 30 m. The surfaces are only slightly weathered and have been smoothed and rounded by past glacial action. The Lithic Cryumbrepts are similar to their representative pedon but are 25 to 50 cm to a lithic contact.

The shallow soils support clusters of chinquapin shrubs, and other subalpine plants as well as a scattering of western white pine.

About 20 percent of this unit consists of small included areas of similar, shallower soils and Lithic Cryorthents.

Soil Map Units - Other Miscellaneous Areas-Emerald Lake Area:

Ru – Unjointed rock outcrop. This unit is minor in extent and consists of smooth outcrops of granitic rock that have few or no deep, vertical joints. If present, they are more than 30 m apart. Sheet jointing parallel to the surface is common. The rock surfaces are only very slightly weathered and retain evidence of some glacial polish.

Most runoff waters sheet-flow off of these areas to be concentrated in adjacent land types or soil bodies.

T – Talus. This unit is moderately extensive and consists of several delineations. These are mainly located at the base of the rock cliffs below Alta Peak along the south edge of the watershed. These bodies are skirt-like accumulation zones of angular block fall from these cliffs caused by frost wedging or exfoliation of the jointed granitic rock. The blocks are mainly boulder, stone or cobble-size. The surface of this unit is very rough, irregular and barren. The slopes are steep to very steep with an uncertain stability in the angle of repose of the interlocking rock fragments.

These rock fragments have accumulated to depths of many meters above, below and along the upper limit of sapping by Pleistocene glacial ice. Bodies of this unit provide winter snow accumulation sites that afford slower subsurface drainage of the summer melt-waters in comparison to comparably located jointed or unjointed rock outcrop surfaces.

T-LeF – Talus-Lithic Cryumbrepts, shallow, complex, 45 to 75 percent slopes. This map unit is a complex combination of bouldery talus and Lithic Cryumbrepts, shallow, on very steep slopes. The proportion of Talus and Lithic Cryumbrepts, shallow, is about 65 to 25 percent, respectively. These components are too intricately intermingled to be mapped separately at the scale used. The unit is very limited in extent, occurring in a single delineation at an elevation of about 2970 m adjacent to and west of Parsons Pond.

The Talus consists of an accumulation of large boulders, stones and cobbles from the cliffs and areas of pure talus above this unit. The Lithic Cryumbrepts, shallow, have formed in thin accumulations of locally derived sandy material in crevices and on the surfaces of some of the boulders. The profiles of these soils are similar to that of the representative pedon for Lithic Cryumbrepts, but range in depth from about 25 to 50 cm.

The soil component of this unit supports a semi-dense cover of shrubs, mainly willow, perennial grasses and other alpine plants.

About 10 percent of the unit consists of unjointed granitic rock outcrop.

Typic Cryorthods

This subgroup represents soils not commonly found in California. Where observed, they are at high elevations, above about 2900 m, under conifers and subject to periodic summer precipitation. In this area, the subgroup includes well to somewhat excessively drained, distinctly horizonated soils formed in sandy colluvium on ridge slopes. They range in elevation from about 2900 to 3000 m. The mean annual soil temperature is above freezing, but the mean summer soil temperature is very cool.

Typically, these soils have a thin litter of plant parts overlying a thin, dark colored surface soil resting on an equally thin, pale colored subsurface soil that overlies a subsoil, darker colored in its upper part and grading to brighter colors with depth. Pale colored, sandy parent material underlies the subsoil. It in turn, rests abruptly on slightly weathered granitic rock. The solum is coarse to moderately coarse in texture and acid in reaction. The classification of these soils is provisional pending further study of the nature of the E and B horizons.

Following is a profile description of a representative pedon located about 400 m east-northeast of the outlet to Emerald Lake, at an elevation of about 2930 m under a semi-open stand of western white pine; located in a delineation of Typic Cryorthods-Lithic Cryorthents-Jointed rock outcrop complex, 45 to 75 percent slopes: (Colors are for dry soil unless otherwise noted)

0 -- 1 to 0 cm; brown, loose litter of conifer needles.

A -- 0 to 5 cm; pale brown (10YR 6/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, loose; nonsticky, nonplastic; few very fine roots; extremely acid (pH 4.0); very abrupt wavy boundary.

E -- 5 to 6.5 cm; white (10YR 8/2) coarse sandy loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine roots; few very fine tubular pores; very strongly acid (pH 4.5); very abrupt wavy boundary.

Bh -- 6.5 to 18 cm; brown (10YR 5/3) very gravelly loamy coarse sand, dark brown (10YR 3/3) moist; massive; soft, very friable to loose; nonsticky, nonplastic; common fine and very fine roots; very strongly acid (pH 4.5); clear smooth boundary.

Bs -- 18 to 64 cm; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/5) moist; massive; soft, very friable to loose; nonsticky, nonplastic; common fine, few medium roots; very strongly acid (pH 5.0); clear smooth boundary.

C -- 64 to 69 cm; very pale brown (10YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable to loose, nonsticky, nonplastic; few fine roots; strongly acid (pH 5.5); very abrupt smooth boundary.

2R -- 69 to 75+ cm; light gray, slightly weathered granitic rock.

Range of Characteristics: The depth to underlying rock ranges from about 50 to 100 cm. The solum thickness ranges from about 40 to 70 cm. The textures are sandy to moderately coarse and are usually modified as gravelly or very gravelly. However, the pebble size is fine, ranging from 2 to about 10 mm in diameter.

The O horizon is thin and discontinuous across the soil's surface. The A horizon may or may not be present. The E horizon ranges in thickness from about 1 to 8 cm. The Bh horizon may or may not be identified. Field recognition of this horizon is based on the darker appearance of the upper part of the subsoil in relation to a brighter colored lower part. Recognition of the subsoil as a taxonomic spodic horizon is based on the horizon sequence as shown in the above description and upon the presence of distinct dark, silt-size pellets in the horizon as seen under magnification. The organic carbon content in the upper 10 cm or more of the subsoil ranges from about 2.5 to 4 percent.

Lithic Cryorthents

This subgroup includes shallow, pale colored, somewhat excessively to excessively drained, minimally horizonated soils formed in both colluvium and residuum from granitic rock. In this area, they range in elevation from about 2900 to 3100 m. The mean annual soil temperature is above freezing, but the mean summer soil temperatures are very cool.

The soils support a sparse cover of perennial grasses and alpine plants.

Typically, these shallow soils are very acid and low in organic matter. They have thin, sandy to moderately coarse textured, brown surface soils overlying similarly textured, lighter, somewhat brighter colored subsoils that rest abruptly on slightly weathered granitic rock at depths less than 50 cm.

Following is a profile description of a representative pedon located about 450 m east of the mouth of Emerald Lake at an elevation of about 2950 m; located in a delineation of Typic Cryorthods-Lithic Cryorthents-

Jointed rock outcrop complex, 45 to 75 percent slopes: (colors are for dry soil unless otherwise noted)

A -- 0 to 5 cm; brown (10YR 5/3) very gravelly loamy coarse sand, dark brown (10YR 3/3) moist; single grain; loose, very friable to loose, nonsticky, nonplastic; very few fine roots; 35 percent gravel by volume; extremely acid (pH 4.3); abrupt wavy boundary.

Bw1 -- 5 to 30 cm; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 3/4) moist; massive; soft, very friable, nonsticky, nonplastic; few fine roots; 35 percent gravel by volume; very strongly acid (pH 4.5); clear smooth boundary.

Bw2 -- 30 to 43 cm; light yellowish brown (10YR 6/4) very gravelly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky, nonplastic; 40 percent gravel by volume; very strongly acid (pH 5.0); very abrupt wavy boundary.

2R -- 43 to 50+ cm; light gray, slightly weathered granitic rock.

Range of Characteristics: The soil textures throughout the profile range from loamy coarse sands to light coarse sandy loams. They are usually very gravelly; the pebbles range in diameter from 2 to about 10 mm in most of the soil, but may be as large as 76 mm in some places. The surface soils range in thickness from about 3 to 25 cm, and in color from brown to grayish brown. The horizons below the surface soil may be either C horizons or morphologic color B horizons (Bw). The latter have sandy textures and brighter chroma, moist or dry, in comparison to the underlying, slightly weathered granitic rock or an underlying C horizon above the rock. The chromas of the C horizon and underlying rock are similar with colors ranging from light gray to pale brown. The soils are very strongly to extremely acid.

Soil Map Unit - Cryorthods/Cryorthents-Emerald Lake Area:

TdoF-R - Typic Cryorthods-Lithic Cryorthents-Jointed rock outcrop complex, 45 to 75 percent slopes. This unit is limited in extent. It occurs in a single delineation northeast of Emerald Lake at elevations from about 2900 to 3000 m. The unit is a complex combination of Typic Cryorthods (35 percent) and Lithic Cryorthents (35 percent) intricately associated with many Jointed rock outcrops (15 percent). The components of the map unit are too intricately intermingled to be mapped separately at the scale used. The soils are similar in profile to the descriptions for their respective representative pedons. The outcrops are of granitic rock and are broken by vertical joints or fractures closer than 30 m.

The soils support an open stand of western white pine and a semi-open understory of chinquapin with some red heather and other alpine plants.

Included in this unit are about 15 percent of other soils that are similar to the Lithic Cryorthents but are deeper to unweathered or weathered rock. They may have less than 30 percent gravel throughout, or have

taxonomic cambic B horizons rather than morphologic color B horizons. Some are Lithic Cryumbrepts. There are also large, scattered boulders throughout the unit that have moved downslope or were left as erratics by former glacial ice.

Typic Cryofluvents

This subgroup includes deep, well drained, stratified soils subject to seasonal flooding and deposition of sediment. In this area, they have formed in the better drained part of the top-set beds of a small delta forming on the east side of Emerald Lake. The mean annual soil temperature is above freezing, but the mean summer soil temperature is very cool.

The soils support a dense cover of willow and a few grasses and forbs.

Typically, these soils are very acid. They have a thin surface litter of shrub leaves over a thin dark colored fine sandy loam surface soil immediately underlain by light colored fine gravelly sand. Below this is a series of stratified dark and light colored layers similar to the above horizons.

Following is a profile description of a representative pedon located about 10 m from the edge of Emerald Lake in a small deltaic fan deposit on the east side of the Lake: (colors are for dry soil unless otherwise noted)

O -- 3 to 0 cm; dark brown, slightly decomposed willow leaves and twigs; very abrupt smooth boundary.

A -- 0 to 3 cm; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky, slightly plastic; many very fine roots; very strongly acid (pH 5.0); very abrupt wavy boundary.

2C -- 3 to 6 cm; pale brown (10YR 6/3) fine gravelly sand, brown (10YR 5/3) moist; single grain; loose, very friable to loose; nonsticky, nonplastic; few fine roots; very strongly acid (pH 4.5); very abrupt wavy boundary.

3Ab to 8C -- 6 to 68 cm; sequence of 6 alternating horizons very similar to the A and 2C horizons above, ranging in thickness from 3 to 20 cm - the Ab horizons being thinnest; medium as well as fine roots present; very abrupt wavy boundary.

9Ab -- 68 to 75 cm; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky, slightly plastic; few fine and medium roots; very strongly acid (pH 5.0); very abrupt wavy boundary.

10C -- 75 to 150 cm; light brownish gray (10YR 6/2) fine gravelly sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky, nonplastic; strongly acid (pH 5.5).

Range of Characteristics: The thickness of the buried A horizons ranges from about 2 to 10 cm. The number and thicknesses of the buried A horizons increases from the apex of the deltaic fan deposit toward the edge of the lake.

Soil Map Unit - Cryofluvents - Emerald Lake Area

TfB - Typic Cryofluvents, 0 to 5 percent slopes. This unit is very limited in extent, consisting of a single delineation that contains the representative pedon for Typic Cryofluvents in this area. It encompasses the small delta on the east side of Emerald Lake. It slopes gently westward toward the lake.

The plant cover is mainly willow.

Included in this unit are very small areas of a sandy to gravelly stream channel and a thin strand of saturated beach sand at the lake's edge. A very narrow zone of wet Cryofluvents lies adjacent to the strand of beach sands.

Typic Cryorthents

This subgroup includes shallow to deep, minimally horizonated soils formed mainly in residuum from granitic rock. Some have formed in colluvial or morainal material. The soils are well to excessively drained, acid in reaction, have coarse to moderately coarse textures, and have formed on ridge crests, mountain slopes, and morainal areas near and above timberline in the High Sierra. Mean annual soil temperatures are slightly above freezing, and the mean summer soil temperatures are cold.

The soils support a few repressed conifers, scattered shrubs and alpine plants. Much of the soil surface is barren and has developed a fine gravelly erosion pavement.

Typically, these soils have a thin, slightly darkened surface soil overlying either a morphologic subsoil of brighter chroma or a fairly thick layer of light colored, low chroma parent material that, in turn, rests on deeply weathered parent rock. Gravel and some cobbles or stones are common in the profile.

Following is a profile description of a representative pedon (83-107-16) located on the ridge crest between Emerald and Pear Lakes at an elevation of about 3080 m; located in a delineation of Typic Cryorthents, moderately deep-Jointed rock outcrop complex, 15 to 30 percent slopes: (colors are for dry soil unless otherwise indicated)

> A -- 0 to 5 cm; pale brown (10YR 6/3) gravelly loamy coarse sand, dark brown (10YR 4/3) moist; single grain; loose, loose, nonsticky, nonplastic; few very fine roots; 30 percent gravel (2-10 mm) by volume; strongly acid (pH 5.1); abrupt wavy boundary.

Bw -- 5 to 43 cm; very pale brown (10YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/6) moist; very weak fine granular structure; soft, very friable, nonsticky, nonplastic; common very fine, fine and medium roots; many fine and very fine interstitial pores; 45 percent gravel (2-10 mm) by volume;) strongly acid (pH 5.4); clear wavy boundary.

C -- 43 to 61 cm; light gray (10YR 7/2) very gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable to loose, nonsticky, nonplastic; few fine and medium roots; many fine and very fine interstitial pores; 40 percent gravel (2-10 mm) by volume; strongly acid (pH 5.4); abrupt wavy boundary.

Cr -- 61 to 75+ cm; light gray, well weathered granitic rock; can be excavated by hand with difficulty.

Range of Characteristics: These soils range in depth from about 25 to 100 cm to well weathered parent rock or unweathered underlying rock; those formed in morainal material have depths in excess of 150 cm.

The thickness of the surface soils range from about 10 to 30 cm. Surface soil colors range from light brownish gray to grayish brown. The organic matter content averages less than 1.5 percent in the upper 25 cm. Subsurface colors range from light gray to light yellowish brown. The brighter chroma color is associated with sandy textures in morphologic B horizons. Fine gravel, gravel, cobbles and stones are common in the various sola and range from about 10 to 75 percent by volume.

The soil reaction is extremely acid to strongly acid - pH 4.0 to 5.5.

For additional information, see Appendix I, pp 50-51; Appendix II, p 25-Section 7.0.

Soil Map Units - Cryorthents-Emerald Lake Area:

ToC - Typic Cryorthents, shallow, 5 to 15 percent slopes. This unit is very limited in extent. It is located on the crest of the western drainage divide for the Emerald Lake watershed just north of the prominent gap west of Emerald Lake at an elevation of 3120 m. The soils have formed in residuum from granitic rock on gentle, moderately steep slopes and have profiles similar to that of the representative pedon for Typic Cryorthents. They differ in being shallower, ranging from about 25 to 50 cm to an underlying well weathered parent rock (paralithic contact). A few angular cobbles and stones litter the surface.

The soils support sparse alpine plants. Most of the unit is barren and has a thin erosion pavement of fine gravel.

A few stunted foxtail pine grow in the unit in included deeper soils associated with crevices in the rock. A few rock outcrops are also included. These inclusions comprise about 5 percent of the unit.

TpD-R - Typic Cryorthents, moderately deep-Jointed rock outcrop complex, 15 to 30 percent slopes. This map unit is very limited in extent and occurs in a single delineation on the crest of the ridge between Pear and Emerald Lakes at an elevation of about 3080 m. The representative pedon for Typic Cryorthents is located in this delineation. Soil depths range from about 50 to 75 cm to the underlying weathered parent rock.

The Typic Cryorthents, moderately deep, are on moderately steep slopes in a complex association with many large granitic rock outcrops broken by vertical joints or fractures averaging less than 30 m apart. The proportion of Typic Cryorthents to Jointed rock outcrop in this unit is about 70 to 30 percent, respectively. These components of the unit are too intricately intermingled to be mapped separately at the scale used.

The soils support a sparse cover of alpine plants and a few western white pines in a very open stand. Most of the soil is barren and has a thin erosion pavement of fine gravel.

TrF - Typic Cryorthents, moderately deep, cobbly, 45 to 75 percent slopes. This map unit is limited in extent. It occurs in two delineations - one beneath the west shoulder of Alta Peak at an elevation of about 3250 m, the other on very steep slopes southwest of Emerald Lake at an elevation of about 3050 m. Both delineations are areas of accumulation of cobbly, sandy colluvium in which the soils have formed. The soils have profiles similar to that of the representative pedon for Typic Cryorthents, but differ in having hard, slightly weathered rock underlying the soil at depths ranging from about 50 to 100 cm. In addition, many angular cobbles are scattered over the surface and comprise from 20 to 50 percent of the soil volume.

The soils support a sparse cover of alpine plants. Occasional western white pine grow in the lower delineation. Most of the soil surface is barren and has a thin erosion pavement of fine gravel.

Included in this unit are Lithic Cryorthents with depths to the underlying rock ranging from about 10 to 50 cm. Also included are many large, angular boulders and a few rock outcrops. The inclusions comprise about 15 percent of the unit.

TrF-R - Typic Cryorthents, moderately deep, cobbly-Jointed rock outcrop complex, 45 to 75 percent slopes. This map unit is very limited in extent. It occurs in two small delineations on very steep slopes of the ridge west of Emerald Lake at an elevation of about 3050 m. Both delineations are areas of cobbly, sandy colluvium in which the soils have formed. The soils have profiles similar to that of the representative pedon for Typic Cryorthents, but differ in having hard, slightly weathered rock underlying the soil at depths ranging from about 50 to 100 cm.

Many cobbles are scattered over the surfaces and comprise from 20 to 50 percent of the soil volume. The soils exist in a complex pattern with many large rock outcrops broken by vertical joints or fractures averaging less than 30 m apart. The proportion of Typic Cryorthents, moderately deep,

cobbly, to Jointed rock outcrop is about 50 to 45 percent, respectively. The components of this unit are too intricately intermingled to be mapped separately at the scale used.

The soils support only a sparse cover of alpine plants. Most of the soil surface is barren and has a thin erosion pavement of fine gravel.

About 5 percent of this unit consist of Lithic Cryorthents.

TsD - Typic Cryorthents, deep, cobbly, 15 to 30 percent slopes. This map unit is very limited in extent. It occurs in a single delineation on Stohlgren Saddle at an elevation of about 3260 m. The soils have formed in a low hilly area of neoglacial ablation and terminal moraines. The materials consist of poorly sorted sands and rock fragments that overlie a glaciated rock surface. The rock fragments are mainly angular, interlocking gravel and cobbles with a scattering of stones and very large boulders. The outer moraine effectively diverts most of the local runoff water northwesterly into Emerald Lake.

The soils have profiles similar to that of the representative pedon of Typic Cryorthents, but are extremely gravelly and cobbly throughout. The depth to the underlying glaciated rock is in excess of 150 cm.

The soils support only very sparse, low growing alpine plants. Lichens cover parts of the larger rock fragments.

Included in this unit are small areas of soils with moderately coarse textured subsoils, skeletal in character, with bright chroma colors.

7.0 Appendixes to the Report

7.1 Appendix I - Reference Pedons for Pedologic Studies in Sequoia National Park, Central Part, California

7.2 Appendix II - Physical and Chemical Soil Analyses for Horizon Samples from References Pedons (Appendix I).

7.3 Appendix III - Glossary of Terms

7.4 Appendix IV - Map Errata

APPENDIX I

Reference Pedons for Pedologic Studies in Sequoia National Park, Central Part, California

Pedon 1-82 -- Site Information

Classification: coarse-loamy, mixed, mesic Xeric Haplohumults

Location: Approx. 30 m NE of turnout 0.65 km N of junction Generals Highway and Crystal Cave Road on Crystal Cave Road. Near center Sec. 1, T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-161)

Physiographic Position: Upland - ridge backslope; 1,658 m (5,440 ft.) elevation.

Topography: West facing slope (30 percent) of Marble Fork canyon.

Climate:[1] Precipitation (MAP) - 101 cm (40 in.); air temperature (MAT) - 10°C (50°F).

Vegetation: Dense, old growth mixed conifer cover; white fir (Abies concolor), sugar pine (Pinus lambertiana), Incense cedar (Calocedrus decurrens).

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson, W. R. Allardice, Sept. 13, 1982.

Remarks: Depth to weathered parent rock (paralithic contact) in excess of 3 m; thickness of paralithic material in excess of 2 m. Well drained soil. Upper part of horizon 1-8* (237-268 cm) not sampled because of many coarse roots.

Sample Site No.: 82CA-107-1

[1]Source of information, all sites:

Precipitation - R.F. Cushing. 1971. Mean Annual Precipitation, State of California. map, isohyetel

Temperature - F.F. Harradine. 1954. Factors Influencing the Organic Carbon and Nitrogen Levels in California Soils. Ph.D. Thesis, Univ. of Calif., Berkeley, Calif. (Regression equation for MAT vs. elevation, Lat. 35°-36°59'N on west slope of Sierra Nevada: $y = -0.0035x + 68.9$)

Pedon 1-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	O1	5-2 cm -- Dark brown conifer needles, twigs, and bark fragments.
	O2	2-0 cm -- Very dark brown decomposed needles, twigs and bark fragments.
(1-1)	A1	0-6 cm -- Dark brown (7.5YR 4/2) coarse sandy loam, very dark brown (7.5YR 2/2) moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; neutral (pH 6.7); very abrupt wavy boundary.
(1-2)	A2	6-24 cm -- Dark brown (7.5YR 4/4) coarse sandy loam, dark brown (7.5YR 3/3) moist; weak medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; few fine, common very fine roots; few fine and medium tubular pores, many very fine irregular pores; neutral (pH 6.7); clear wavy boundary.
(1-3)	AB	24-53 cm -- Brown (7.5YR 5/4) coarse sandy loam, reddish brown (5YR 4/4) moist: weak medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; many fine, common medium, few coarse roots; common tubular pores; slightly acid (pH 6.5); clear wavy boundary.
(1-4)	BA	53-83 cm -- Strong brown (7.5YR 5/6) coarse sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard to hard; friable, slightly sticky and slightly plastic; common very fine, fine and medium roots, few coarse roots; common fine tubular pores, many very fine irregular pores; slightly acid (pH 6.4); abrupt wavy boundary.
(1-5)	Bt1	83-120 cm -- Strong brown (7.5YR 5/6) coarse sandy loam, reddish brown (5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine tubular pores, common very fine irregular pores; clay films as bridges and irregular pore fill; slightly acid (pH 6.2); clear wavy boundary

Pedon 1-82 continued.....

(1-6)	Bt2	120-162 cm -- Reddish brown (5YR 5/4) and strong brown (7.5YR 5/6) coarse sandy loam, reddish brown (5YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few fine roots; very few fine tubular pores, common very fine irregular pores; clay films as bridging and irregular pore fill; medium acid (pH 5.8); gradual wavy boundary.
(1-7)	BC1	162-237 cm -- Light brown (7.5YR 6/4) coarse sandy loam, strong brown (7.5YR 5/6) moist; massive (sampled by soil auger); medium acid (pH 5.7); diffuse boundary.
(1-8)*	BC2	237-300 cm -- Light yellowish brown (10YR 6/4) coarse sandy loam, reddish yellow (7.5YR 6/6) moist; massive (sampled by soil auger).

Pedon 2-82 -- Site Information

Classification: coarse-loamy, mixed, mesic Xeric Haplohumults

Location: Approx. 80 m N 36° E of Auto Log sign, south edge of Auto Log parking lot; in NW¼, Sec. 7, T. 16 S., R. 30 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-174)

Physiographic Position: Upland - ridge backslope; 1990 m (6,530 ft.) elevation.

Topography: South facing slope (20 percent) in rolling to hilly terrain of Giant Forest area.

Climate: Precipitation (MAP) - 114 cm (45 in.); air temperature (MAT) - 8°C (46°F).

Vegetation: Semi-dense, old growth mixed conifer cover; white fir (Abies concolor), sugar pine (Pinus lambertiana), Jeffrey pine (Pinus jeffreyi), sequoia (Sequoiadendron giganteum).

Parent Material: Residuum from granodiorite.

Sampled by: G. L. Huntington, M. Akeson, W. R. Allardice - Sept. 14, 1982.

Remarks: Depth to weathered parent rock (paralithic contact) in excess of 300 cm; thickness of paralithic material in excess of 2 m. Well drained soil.

Sample Site No.: 82CA-107-2

Pedon 2-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	01	5-1 cm -- Dark brown conifer needles and twigs.
	02	1-0 cm -- Very dark brown decomposed conifer needles and twigs.
(2-1)	A1	0-5 cm -- Dark grayish brown (10YR 4/2) coarse sandy loam, very dark brown (7.5YR 2/2) moist; weak medium crumb structure; soft and slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; slightly acid (pH 6.1); very abrupt wavy boundary.
(2-2)	A2	5-16 cm -- Brown (10YR 4/3) coarse sandy loam, dark brown (7.5YR 3/2) moist; weak fine crumb structure; soft and slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common fine tubular pores, many very fine irregular pores; slightly acid (pH 6.1); abrupt wavy boundary.
(2-3)	A3	16-35 cm -- Dark brown (7.5YR 4/4) coarse sandy loam, dark reddish brown (5YR 3/4) moist; weak fine crumb structure; slightly hard, very friable, slightly sticky and nonplastic; common fine, medium and coarse roots; common very fine and few fine tubular pores, many very fine irregular pores; slightly acid (pH 6.1); clear wavy boundary.
(2-4)	AB	35-57 cm -- Brown (7.5YR 5/4) coarse sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine and medium, and few coarse roots; common fine tubular pores, many very fine irregular pores; medium acid (pH 5.6); clear wavy boundary.
(2-5)	BA	57-77 cm -- Brown (7.5YR 5/4) coarse sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine, few medium and coarse roots; few fine tubular pores, many very fine irregular pores; colloidal stains on mineral grains; strongly acid (pH 5.5); abrupt wavy boundary.

(2-6) Bt1 77-106 cm -- Strong brown (7.5YR 5/6) coarse sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, firm, sticky and slightly plastic; few medium and coarse roots; few very fine tubular pores, common very fine irregular pores; colloidal stains on mineral grains, clay films as bridging and irregular pore fill; strongly acid (pH 5.2); clear wavy boundary.

(2-7) Bt2 106-150 cm -- Reddish yellow (7.5YR 7/6) coarse sandy loam, brown (7.5YR 5/4) moist; massive; hard, firm, sticky and slightly plastic; few fine, medium and coarse roots; few very fine tubular pores, common very fine irregular pores; colloidal stains on mineral grains, clay films as bridging and irregular pore fill; very strongly acid (pH 5.0); clear irregular boundary.

(Sampled by auger below 150 cm - many irregular, well weathered granitic rock fragments interfere with sampling 150 to 184 cm)

(2-8) C1 184-234 cm -- Light yellowish brown (10YR 7/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very strongly acid (pH 4.9); gradual boundary.

(2.9)* C2 234-280 cm -- Very pale brown (10YR 7/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; very strongly acid (pH 5.0).

Pedon 3-82 -- Site Information

Classification: sandy, mixed, mesic, shallow Entic Xerumbrepts.

Location: Aprox. 258 m (845 ft.) S 15° E from Huckleberry Meadow trial sign on Crescent Meadow Road in NW¼, Sec. 8 (projected), T. 16 S., R. 30 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 3-25)

Physiographic Position: Upland; 2,025 m (6,645 ft.) elevation.

Topography: South facing, stepped rocky slope (12 percent) on Crescent Creek drainage.

Climate: Precipitation (MAP) - 114 cm (45 in.); air temperature (MAT) - 8°C (46°F).

Vegetation: Shrub and low-site conifer cover in semi-open rockland; greenleaf manzanita (Archtostaphylos patula), Jeffrey pine (Pinus jeffreyi), sugar pine (Pinus lambertiana), and incense cedar (Calocedrus decurrens).

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson, and W. R. Allardice - Sept. 14, 1982.

Remarks: Depth to weathered rock (paralithic contact) less than 50 cm; thickness of paralithic material is less than about 1 m. Somewhat excessively drained soil.

Sample Site No.: 82CA-107-3

Pedon 3-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	01	4-0 cm -- Dark brown conifer and shrub litter.
(3-1)	A1	0-10 cm -- Dark grayish brown (10YR 4/2) loamy coarse sand, black (10YR 2/1) moist; weak fine crumb structure; loose, very friable, nonsticky and nonplastic; few very fine roots; 10 percent fine gravel, 5 percent angular cobbles by volume; strongly acid (pH 5.4); abrupt smooth boundary.
(3-2)	A2	10-23 cm -- Dark grayish brown (10YR 4/2) loamy coarse sand, black (10YR 2/1) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and very fine roots, few medium roots; 5 percent angular cobbles by volume; medium acid (pH 5.6); abrupt smooth boundary.
(3-3)*	A3	23-42 cm -- Brown (10YR 5/3) loamy coarse sand, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, fine and medium roots; 5 percent angular cobbles by volume; strongly acid (pH 5.5); very abrupt wavy boundary.
	Cr	42-60 cm -- Light gray, weathered granitic rock; grades to unweathered rock.

Pedon 4-82 -- Site Information

Classification: Sandy, mixed, mesic Pachic Xerumbrepts.

Location: 91 m (300 ft.) E of junction Crescent Meadow Road and Huckleberry Meadow Trail along Crescent Mdw. Road, thence approx. 259 m (850 ft.) NE; about 365 m (1,200 ft.) E of SW cor., Sec. 5, T. 16 S., R. 30 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 3-25)

Physiographic Position: Upland - hill backslope; 2,048 m (6,720 ft.) elevation.

Topography: Southwest facing slope (25 percent) of hilly terrain in Giant Forest area.

Climate: Precipitation (MAP) - 114 cm (45 in.); air temperature (MAT) - 7°C (45°F).

Vegetation: Semi-dense old growth conifer cover of white fir (Abies concolor); widely scattered understory of chinquapin (Castanopsis sempervirens).

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and W. R. Allardice - Sept. 15, 1982.

Remarks: Thickness of paralithic (weathered rock) material below contact is in excess of 1 m. Well drained soil.

Sample Site No.: 82CA-107-4

Pedon 4-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	01	10-2 cm -- Very dark brown mat of white fir needles.
	02	2-0 cm -- Very dark brown well decomposed white fir needles.
(4-1)	A1	0-8 cm -- Brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; few fine and very fine tubular pores; slightly acid (pH 6.4); abrupt smooth boundary.
(4-2)	A2	8-38 cm -- Yellowish brown (10YR 5/4) loamy coarse sand, dark brown (7.5YR 3/3) moist: weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; few very fine and fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.
(4-3)	A3	38-57 cm -- Yellowish brown (10YR 5/4) loamy coarse sand, dark brown (7.5YR 3/3) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; few medium, common very fine and coarse roots; few very fine and fine tubular pores; slightly acid (pH 6.1); clear wavy boundary.
(4-4)*	AC	57-100 cm -- Light yellowish brown (10YR 6/4) loamy coarse sand, dark brown (7.5YR 3/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine, medium and coarse roots; few fine tubular pores; strongly acid (pH 5.4); abrupt irregular boundary.
	Cr.	100-120^{+} cm -- Light gray, well weathered granitic rock, occasional circular areas or convoluted bands of yellowish-red staining.

Pedon 5-82 -- Site Information

Classification: Sandy, mixed, frigid Lithic Xerumbrepts.

Location: About 635 m (2,080 ft.) airline S 10°E of park ranger living quarters, west end of Wolverton parking ellipse; in NW¼, SW¼ Sec. 28, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 3-106)

Physiographic Position: Upland - ridge backslope; 2,300 m (7,545 ft.) elevaton.

Topography: Very steep west facing slope (50 percent) of a ridge ascending to Panther Peak.

Climate: Precipitation (MAP) - 119 cm (47 in.); air temperature (MAT) - 5.5°C (42°F).

Vegetation: Semi-dense cover of shrubs - pinemat manzanita (Arctostaphylos nevadensis) and greenleaf manzanita (A. patula); occasional Jeffrey pine (Pinus jeffreyi).

Parent Material: Local colluvium weathered from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and W. R. Allardice - Sept. 15, 1982.

Remarks: Excessively drained soil.

Sample Site No.: 82CA-107-5

Pedon 5-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	0	1-0 cm -- Brown to dark brown Jeffrey pine needles, catkins and twigs.
(5-1)	A1	0-6 cm -- Dark grayish brown (10YR 4/2) fine gravelly loamy coarse sand, very dark brown (10YR 2/2) moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; common fine roots; many very fine interstitial pores; strongly acid (pH 5.1); abrupt smooth boundary.
(5-2)*	A2	6-12 cm -- Dark grayish brown (10YR 4/2) loamy coarse sand, very dark brown (10YR 2/2) moist; weak fine crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; many very fine interstitial pores; strongly acid (pH 5.2); very abrupt wavy boundary.
	R	12-100^{+} cm -- Light gray, slightly weathered granitic rock.

Pedon 6-82 -- Site Information

Classification: coarse-loamy, mixed, frigid Histic Humaquepts.

Location: On west side of Long Meadow. About 450 m (1,475 ft.) S 8° W of park ranger living quarters, west end of Wolverton parking ellipse; in NE¼, SE¼ Sec. 29, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 3-106)

Physiographic Position: Small local valley, slowly drained; 2,200 m (7,218 ft.) elevation.

Topography: Nearly level (2 percent) northerly sloping surface; shallow, slightly meandering drainageway nearby.

Climate: Precipitation (MAP) - 119 cm (47 in.); air temperature (MAT) - 6.5°C (44°F).

Vegetation: Wet meadow grasses and sedges; dense cover. Young lodgepole pines (Pinus contorta murrayana) nearby.

Parent Material: Alluvium from granitic rock - mainly granodiorite.

Sampled By: G. L. Huntington, M. Akeson and W. R. Allardice - Sept. 16, 1982.

Remarks: Soil saturated at time of sampling; water table within 60 cm of surface. Soil has histic epipedon of mineral soil material. Poorly drained soil.

Sample Site No.: 82CA-107-6

Pedon 6-82 -- Profile Description

(Horizon Sample No.)		(Colors are for moist soil)
(6-1)	Oa	7-0 cm -- Very dark brown gritty muck; structureless; held together as a dense sod by many very fine and common medium roots; occasional twigs and small branches of lodgepole pine; strongly acid (pH 5.2); abrupt smooth boundary.
(6-2)	Ag	0-8 cm -- Very dark grayish brown (10YR 3/2) coarse sand, common medium distinct dark brown (7.5YR 4/4) mottles; single grain; loose, nonsticky and nonplastic; many very fine and common fine roots; many fine interstitial pores; strongly acid (pH 5.3); abrupt smooth boundary.
(6-3)	O'a	8-24 cm -- Black (10YR 2/1) muck; structureless; friable, slightly sticky and slightly plastic; many very fine and common fine roots; strongly acid (pH 5.4); abrupt smooth boundary.
(6-4)	2A'g	24-68 cm -- Black (2.5Y 2/2) sandy loam; massive; friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine interstitial pores; strongly acid (pH 5.5); clear smooth boundary.
(6-5*)	2Cg	68-108 cm -- Very dark gray (5Y 3/1) coarse sandy loam; massive; friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; 15 percent by volume partially weathered granitic pebbles; scattered black zones of decomposed twigs or roots; medium acid (pH 6.0).

Pedon 7-82 -- Site Information

Classification: sandy, mixed, frigid Pachic Xerumbrepts.

Location: About 457 m (1,500 ft.) S 28°E of park ranger living quarters at west end of Wolverton parking ellipse; about 122 m (400 ft.) E of W¼ cor. Sec. 28, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 3-106)

Physiographic Position: Upland - lower part of ridge backslope; 2,250 m (7,380 ft.) elevation.

Topography: West facing, very steep slope (60 percent) of ridge ascending to Panther Peak.

Climate: Precipitation (MAP) - 119 cm (47 in.); air temperature (MAT) - 6°C (43°F).

Vegetation: Semi-dense stand of red fir (Abies magnifica) and white fir (Abies concolor) with sparse shrub understory of chinquapin (Castanopsis sempervirens).

Parent Material: Deeply weathered residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and W. R. Allardice - Sept. 16, 1982.

Remarks: Soil slightly moist throughout when sampled. Well drained soil.

Sample Site No.: 82CA-107-7

Pedon 7-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	0	5-0 cm -- Very dark brown red fir needle litter, partly decomposed; surface scatter of twigs.
(7-1)	A1	0-8 cm -- Dark grayish brown (10YR 4/2) fine gravelly coarse sandy loam, very dark brown (7.5YR 2/2) moist; moderate fine and medium crumb structure; soft, very friable, nonsticky and nonplastic; common very fine roots; few very fine and fine tubular pores; slightly acid (pH 6.1); abrupt wavy boundary.
(7-2)	A2	8-15 cm -- Grayish brown (10YR 5/2) fine gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; few very fine and fine tubular pores; slightly acid (pH 6.3); abrupt wavy boundary.
(7-3)	A3	15-55 cm -- Brown (10YR 5/3) fine gravelly loamy coarse sand, dark brown (7.5YR 3/3) moist; weak fine and medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and coarse, few fine and medium roots; common very fine and fine tubular pores; slightly acid (pH 6.5); gradual smooth boundary.
(7-4)	AC	55-90 cm -- Pale brown (10YR 6/3) fine gravelly loamy coarse sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and coarse, few fine and medium roots; few fine, medium and coarse tubular pores; slightly acid (pH 6.4); clear wavy boundary.
(7-5)	C1	90-110 cm -- Light yellowish brown (2.5Y 6/3) fine gravelly loamy coarse sand, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; neutral (pH 6.6); abrupt irregular boundary.

(7-6)* C2 110-150 cm -- Light gray (2.5Y 7/2) fine gravelly loamy coarse sand, grayish brown (2.5Y 5/2) moist; massive with a slight suggestion of granitic rock fabric; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; medium acid (pH 5.8).

Pedon 8-82 -- Site Information

Classification: sandy, mixed, mesic Pachic Xerumbrepts.

Location: About 518 m (1,700 ft.) SW of General Sherman Tree and 61 m (200 ft.) E of Sherman Creek; about 61 m (200 ft.) WNW of E¼ cor. Sec. 31, T. 15 S., R. 30 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-171)

Physiographic Position: Colluvial bench; 1,970 m (6,460 ft.) elevation.

Topography: Moderately steep (11 percent) smooth colluvial bench, beveled by Sherman Creek, on west facing incised canyon slope of Marble Fork of the Kaweah River.

Climate: Precipitation (MAP) - 114 cm (45 in.); air temperature (MAT) - 8°C (46°F).

Vegetation: Semi-dense old growth conifer cover of white fir (Abies concolor) and Sequoia (Sequoiadendron giganteum); sparse ground cover cover of ferns (Pteridium sp.) and lupine (Lupinus sp.)

Parent Material: Sandy colluvium from granodiorite rock.

Sampled By: G. L. Huntington, M. Akeson and W. R. Allardice - Sept. 17, 1982.

Remarks: Representative of soils on gentle colluvial slopes in Giant Forest area. Well drained soil.

Sample Site No.: 82CA-107-8

Pedon 8-82 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	0	3-0 cm -- Very dark brown litter of conifer needles and twigs.
(8-1)	A1	0-5 cm -- Very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (7.5YR 2/2) moist; moderate fine crumb structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; slightly acid (pH 6.2); abrupt wavy boundary.
(8-2)	A2	5-30 cm -- Dark brown (7.5YR 4/3) fine gravelly coarse sandy loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard to hard, friable, nonsticky and nonplastic; common fine, medium and coarse roots; few medium and common fine tubular pores; slightly acid (pH 6.1); clear smooth boundary.
(8-3)	A3	30-71 cm -- Brown (7.5YR 5/4) fine gravelly coarse sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few coarse, common fine and medium roots; few fine and medium tubular pores; medium acid (pH 6.0); clear wavy boundary.
(8-4)	AC	71=112 cm -- Pale brown (10YR 6/3) loamy coarse sand, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine tubular pores; medium acid (pH 6.0); gradual wavy boundary.
(8-5)*	C	112-142 cm -- Light brownish gray (2.5Y 6/2) loamy coarse sand, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few coarse roots; many very fine interstitial pores; medium acid (pH 5.7).

Pedon 1-83 -- Site Information

Classification: loamy, mixed, nonacid, thermic, shallow Typic Xerorthents.

Location: Approx. 152 m (500 ft.) NE of Shepherd Saddle along Ash Peaks Ridge fire trail, thence 15 m (49 ft.) E; in SW¼, SW¼ of T. 16 S., R. 29 E., MDB&M - unsectionized. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-107)

Physiographic Position: Upland - ridge shoulder; 963 m (2,160 ft.) elevation.

Topography: South facing slope (45 percent) of Ash Peaks Ridge.

Climate: Precipitation (MAP) - 63.5 cm (25 in); air temperature (MAT) - 14.5°C (58°F).

Vegetation: Dense chaparral cover; chamise (Adenostoma fasciculatum), white-leaf manzanita (Arctostaphylos viscida).

Parent Material: Residuum from Cactus Point granite.

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 13, 1983.

Remarks: Excessively drained soil.

Sample Site No.: 83CA-107-1

Pedon 1-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(1-1)	A1	0-12 cm -- Brown (10YR 5/3) coarse sandy loam, dark yellowish brown (10YR 3/4) moist; moderate very fine and fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine roots; common fine tubular pores; slightly acid (pH 6.3); abrupt wavy boundary.
(1-2)	A2	12-30 cm -- Brown (10YR 5/3) coarse sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine, few coarse roots; few fine tubular pores; slightly acid (pH 6.4); abrupt wavy boundary.
(1-3)*	C	30-42 cm -- Light yellowish brown (2.5Y 6/4) coarse sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few fine and coarse roots; very few very fine and fine tubular pores; slightly acid (pH 6.4); abrupt irregular boundary.
	Cr	42-60 cm -- Light yellowish brown well weathered granite; rock fabric clearly visible; very hard, firm; few weathered joint planes accomodate few fine roots.

Pedon 2-83 -- Site Information

Classification: fine-loamy, mixed, thermic Ultic Haploxeralfs.

Location: Approx. 1,920 m (6,300 ft.) W by WNW of Sequoia National Park Headquarters (Ash Mountain) in the SE¼ of the SW¼ of T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-115)

Physiographic Position: Upland - hillslope; 610 m (2,000 ft.) elevation.

Topography: Southeast facing slope (41 percent) in hilly terrain.

Climate: Precipitation (MAP) - 51 cm (20 in.); air temperature (MAT) - 16.5°C (62°F).

Vegetation: Semi-open cover of blue oak (Quercus douglasii); dense ground cover of annual grasses and forbs.

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 13, 1983.

Remarks: Well drained soil.

Sample Site No.: 83CA-107-2

Pedon 2-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(2-1)	A	0-12 cm -- Light brown (7.5YR 6/4) coarse sandy loam, dark brown (7.5YR 3/3) moist: massive - upper 3 cm has weak medium granular structure; hard, friable, slightly sticky and nonplastic; few very fine roots; few fine tubular pores; slightly acid (pH 6.2); clear wavy boundary.
(2-2)	AB	12-28 cm -- Light reddish brown (5YR 6/4) coarse sandy loam, reddish brown (5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few fine tubular pores; medium acid (pH 5.8); clear wavy boundary.
(2-3)	BA	28-47 cm -- Reddish yellow (5YR 6/5) coarse sandy loam, yellowish red (5YR 4/6) moist; very weak medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; very few very fine roots; common fine tubular pores; few colloid bridges between mineral grains; medium acid (pH 5.8); clear wavy boundary.
(2-4)	Bt1	47-107 cm -- Yellowish red (5YR 5/6) sandy clay loam, reddish brown (2.5YR 4/4) moist; weak medium angular blocky structure; very hard, friable to firm, sticky, slightly plastic; very few fine roots; very few fine tubular pores; common thin reddish brown (2.5YR 4/4) clay films in pores and as bridges between mineral grains; medium acid (pH 5.7); clear wavy boundary.
(2-5)*	Bt2	107-150 cm -- Reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/8) moist; massive; very hard, friable to firm, sticky, slighty plastic; colloid as bridges between mineral grains; strongly acid (pH 5.4); clear wavy boundary.
	cr ≡	150-160+ cm -- Reddish stained well weathered granodiorite.

Pedon 3-83 -- Site Information

Classification: coarse-loamy, mixed, thermic Ultic Haploxerolls. (Marginal to Typic Haploxerolls)

Location: Approx. 400 m (1,310 ft.) W of entrance to Potwisha Campground in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-131)

Physiographic Position: Upland - ridge slope; 707 m (2,320 ft.) elevation.

Topography: Southeast facing slope (50 percent) of interfluve separating Marble Fork of Kaweah River and Elk Creek.

Climate: Precipitation (MAP) - 76 cm (30 in.); air temperature (MAT) - 16°C (61°F).

Vegetation: Semi-dense cover of chaparral - mainly chamise (Adenostoma fasciculatum).

Parent Material: Residuum from metamorphic sedimentary rock (marble)

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 14, 1983.

Remarks: Somewhat excessively drained soil.

Sample Site No.: 83CA-107-3

Pedon 3-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(3-1)	A1	0-10 cm -- Brown (10YR 5/3) fine sandy loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; few coarse, common very fine roots; few coarse tubular pores; 10 percent gravel; neutral (pH 7.2); abrupt wavy boundary.
(3-2)	A2	10-26 cm -- Yellowish brown (10YR 5/6) fine sandy loam, dark brown (7.5YR 3/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few coarse tubular pores; mildly alkaline (pH 7.4); abrupt wavy boundary.
(3-3)*	Bw	26-54 cm -- Dark yellowish brown (10YR 4/6) gravelly fine sandy loam, dark yellowish brown (7.5YR 3/4) moist; very weak medium to coarse angular blocky structure; slightly hard, friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; few fine tubular pores; 25 percent gravel by volume; mildly alkaline (pH 7.6); abrupt iregular boundary.
	R	54-75^{+} cm -- White (5Y 8/1) metamorphic sedimentary rock (marble).

Pedon 4-83 -- Site Information

Classification: fine-loamy, mixed, thermic Mollic Haploxeralfs. (Marginal to fine particle size class family)

Location: About 75 m (246 ft.) SW of Tunnel Rock on the Generals Highway in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-133).

Physiographic Position: Upland - hillslope; 610 m (2,000 ft.) elevation.

Topography: East facing slope (32 percent) of middle Fork (Kaweah River) Canyon.

Climate: Precipitation (MAP) - 68 cm (27 in.); air temperature (MAT) - 16.5°C (62°F)

Vegetation: Semi-open cover of Douglas blue oak (Quercus douglasii) with dense ground cover of annual grasses and forbs.

Parent Material: Residuum from metamorphosed basic igneous rock.

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 14, 1983

Remarks: Well drained soil.

Sample Site No.: 83CA-107-4

Pedon 4-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(4-1)	A	0-30 cm -- Grayish brown (10YR 5/2) - brown (10YR 5/3) when crushed - fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive - upper 8 cm has a weak subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine and medium tubular pores, few krotovinas; slightly acid (pH 6.4); gradual smooth boundary.
(4-2)	AB	30-50 cm -- Brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; very hard, friable, sticky and plastic; very few fine roots; few very fine tubular pores; slightly acid (pH 6.3); abrupt wavy boundary.
(4-3)	Bt1	50-95 cm -- Dark yellowish brown (10YR 4/4) clay loam, brown (10YR 5/3) moist; strong coarse angular blocky structure; very hard very firm, sticky and plastic; few medium and coarse roots; continuous thin to moderately thick dark brown (7.5YR 3/2) clay films on ped faces, brown (7.5YR 4/2) when moist; slightly acid (pH 6.2); abrupt smooth boundary.
(4-4)	Bt2	95-135 cm -- Yellowish brown (10YR 5/4) clay loam, dark brown (10YR 4/3) moist; moderate coarse angular blocky structure; very hard, very firm, sticky and plastic; few medium roots; continuous thin dark brown (7.5YR 3/2) clay films on ped faces, brown (7.5YR 4/2) when moist; slightly acid (pH 6.4); clear smooth boundary.
(4-5)	BC	135-160 cm -- Brown (10YR 5/3) loam, brown (10YR 4/3) moist; massive; very hard, friable, slightly sticky and slightly plastic; neutral (pH 6.6).

Pedon 5-83 -- Site Information

Classification: Coarse-loamy, mixed, thermic Ultic Haploxeralfs. (Marginal to Typic Xerochrepts)

Location: Approx. 850 m (2,790 ft.) NE of Ash Mountain Headqurters, Sequoia National Park; about 30 m (98 ft.) north of Generals Highway, in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS (Map photo SEKI 4-133)

Physiographic Position: Upland - hillslope; 560 m (1,840 ft.) elvevation.

Topography: Southeast facing slope (25 percent) of a beveled strath bench on the canyon slopes of the Middle Fork (Kaweah River).

Climate: Precipitation (MAP) - 68 cm (27 in.); air temperature (MAT) - 17°C (62.5°F)

Vegetation: Semi-open cover of Douglas blue oak (Quercus douglasii) and interior live oak (Quercus wislizenii) with a dense understory cover of annual grasses and forbs.

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 14, 1983.

Remarks: Site in area of Ash Mountain basement rock complex - a mix of granodiorite, diorite and possible inclusions of meta-basic rock. A well drained soil.

Sample Site No.: 83CA-107-5

Pedon 5-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(5-1)	A	0-25 cm -- Brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive - upper 3 cm has moderate fine granular structure; mainly hard - some parts slightly hard, friable, nonsticky and nonplastic; few very fine roots; few fine and very fine tubular pores, occasional krotovinas; slightly acid (pH 6.2); clear wavy boundary.
(5-2)	Bt1	25-65 cm -- Brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and nonplastic; very few very fine and few medium roots; few fine tubular pores; few thin dark brown (10YR 4/3) bands of clay accumulation; medium acid (pH 6.0); clear wavy boundary.
(5-3)	Bt2	65-100 cm -- Brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; very few very fine roots; few fine and very fine tubular pores; continuous thin clay films as pore coatings and some colloid as bridges between sand grains; medium acid (pH 6.0); abrupt wavy boundary.
(5-4)	Cr	100-125^{+} cm -- Light gray weathered granodiorite; excavates with some difficulty.

Pedon 6-83 -- Site Information

Classification: fine-loamy, mixed, thermic Ultic Haploxeralfs

Location: On west side of Elk Creek trail, approx. 640 m (2,100 ft.) WSW of Marble Fork Bridge (Generals Highway), in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-131)

Physiographic Position: Upland - hillslope; 707 m (2,320 ft.) elevation.

Topography: East facing slope (35 percent) associated with a beveled strath bench on the lower canyon slopes on the north side of the Middle Fork (Kaweah River).

Climate: Precipitation (MAP) - 76 cm (30 in.); air temperature (MAT) - 16°C (61°F)

Vegetation: Dense chaparral - dominantly chamise (Adenostoma fasciculatum); some hollyleaf coffeeberry (Ramnus crocea ilicifolia).

Parent Material: Residuum from meta-basic igneous rock (gabbro-dioritic).

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 15, 1983

Remarks: Well drained soil.

Sample Site No.: 83CA-107-6

Pedon 6-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(6-1)	A	0-8 cm --Brown (10YR 5/3) fine sandy loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; hard, friable, nonsticky and nonplastic; common very fine roots; few fine and medium tubular pores, occasional krotovinas; neutral (pH 6.6); abrupt wavy boundary.
(6-2)	BAt	8-28 cm -- Brown (10YR 5/3) loam, dark yellowish brown (7.5YR 3/4) moist; weak medium angular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine, common very fine roots; few fine and medium tubular pores; few thin clay films on ped faces; slightly acid (pH 6.4); abrupt wavy boundary.
(6-3)	Bt1	28-75 cm -- Dark yellowish brown (10YR 4/6) clay loam, dark brown (7.5YR 4/4) moist; strong coarse angular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; very few fine tubular pores; continuous thin clay films on ped faces, dark reddish brown (5YR 3/3) moist; medium acid (pH 6.0); clear wavy boundary.
(6-4)	Bt2	75-100 cm -- Brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium angular blocky structure; extremely hard, firm, sticky and slightly plastic; few very fine roots; continuous thin to moderately thick clay films on ped faces, dark brown (7.5YR 3/2) moist; medium acid (pH 6.0); clear wavy boundary.
(6-5)	BC	100-120 cm -- Yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; massive; very hard, friable, sticky and slightly plastic; very few very fine roots; slightly acid (pH 6.1); abrupt wavy boundary.
(6-6)*	C	120-150+ cm -- Brown (10YR 5/3) fine sandy loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and nonplastic; very few very fine roots; slightly acid (pH 6.2).

Pedon 7-83 -- Site Information

Classification: fine, mixed, thermic Ultic Palexeralfs.

Location: On west side of Elk Creek Trail, approx. 823 m (2,700 ft.) W of Marble Fork bridge (Generals Highway), in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-131).

Physiographic Position: Upland - hillslope; 756 m (2,480 ft.) elevation.

Topography: East facing slope (37 percent) of a beveled strath bench on the canyon slopes of Elk Creek, tributary to the Marble Fork (Kaweah River).

Climate: Precipitation (MAP) - 76 cm (30 in.); air temperature (MAT) - 15.5°C (60°F).

Vegetation: Dense chararral cover - dominantly chamise (Adenostoma fasciculatum); some hollyleaf coffeeberry (Rhamnus crocea illicifolia), sparse annual and perennial grasses.

Parent Material: Residuum from meta-basic igneous rock (gabbro-dioritic).

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 15, 1983.

Remarks: Well drained soil.

Sample Site No.: 83CA-107-7

Pedon 7-83 -- Profile Description

(Horizon Sample No.:)		(Colors are for dry soil unless otherwise noted)
(7-1)	A	0-15 cm -- Brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine tubular pores, occasional krotovinas filled with fine granular material; slightly acid (pH 6.1); clear wavy boundary.
(7-2)	Bt1	15-54 cm -- Strong brown (7.5YR 5/6) clay loam, strong brown (7.5YR 4/6) moist; strong angular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; few very fine, fine and medium tubular pores; continuous thin to moderately thick clay films on ped faces, dark reddish brown (2.5YR 2.5/4) moist; slightly acid (pH 6.2); clear wavy boundary.
(7-3)	Bt2	54-90 cm -- Brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; strong coarse angular blocky structure; extremely hard, very firm, sticky and plastic; very few very fine roots; very few fine tubular pores; continuous thin to moderately thick clay films on ped faces, dark reddish brown (5YR 3/2) moist; slightly acid (pH 6.3); abrupt wavy boundary.
(7-4)	BCt	90-125 cm -- Yellowish brown (10YR 5/6) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse angular blocky structure; very hard, firm, sticky and slightly plastic; very few fine roots; 20 percent gravel by volume; common thin clay films on ped faces, dark brown (7.5YR 3/2) moist; slightly acid (pH 6.4); abrupt wavy boundary.
(7-5)*	C	125-150^{+} cm -- Brown (10YR 5/3) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and nonplastic; slightly acid (pH 6.5).

Pedon 8-83 -- Site Information

Classification: loamy, mixed, nonacid, thermic, shallow Entic Ultic Haploxerolls

Location: About 100 m (328 ft.) east of Elk Creek Trail, approx. 670 m (2,198 ft.) W by WNW of the Marble Fork Bridge (Generals Highway), in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-131)

Physiographic Position: Upland shoulder; 731 m (2,400 ft.) elevation.

Topography: East facing slope (16 percent) near gentle ridge crest of a dissected beveled strath bench on canyon slopes of Elk Creek, tributary to the Marble Fork (Kaweah River).

Climate: Precipitation (MAP) - 76 cm (30 in); air temperature (MAT) - 15.5°C (60°F)

Vegetation: Dense cover of chaparral - entirely chamise (Adenostoma fasciculatum); some scattered annual grasses as understory.

Parent Material: Residuum from meta-basic igneous rock (dioritic).

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 15, 1983.

Remarks: Well drained soil

Sample Site No.: 83CA-107-8

Pedon 8-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(8-1)	A1	0-8 cm -- Grayish brown (2.5YR 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, nonsticky and very slightly plastic; few very fine roots; many fine tubular pores; 7 percent gravel by volume; slightly acid (pH 6.2); abrupt wavy boundary.
(8-2)	A2	8-25 cm -- Grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few very fine roots; many medium and fine tubular pores; 5 percent gravel by volume; slightly acid (pH 6.3); abrupt wavy boundary.
(8-3)*	C/Cr	25-55 cm -- Gray to light gray irregular mix of saprolite and paralithic material - saprolite dominant above about 40 cm; rock fabric visible in place; crushes to fine sandy loam texture; saprolite is slightly hard, friable, nonsticky and nonplastic; paralithic material is hard to very hard; few fine roots in the saprolite.

Pedon 9-83 -- Site Information

Classification: Coarse-loamy, mixed, thermic Ultic Haploxerolls.

Location: Eastside of Moro Rock Trail, approx. 825 m (2,707 ft.) air-line NE of Buckeye Flat, in unsectionized part of T. 16 S., R. 30 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-176)

Physiographic Position: Upland - hillslope; 1,050 m (3,445 ft.) elevation.

Topography: Southeast facing slope (38 percent) on Moro Rock interfluve portion of Middle Fork canyon (Kaweah River).

Climate: Precipitation (MAP) - 89 cm (35 in.); air temperature (MAT) - 14°C (57°F)

Vegetation: Dense chaparral cover; entirely chamise (Adenostoma fasciculatum). About 15 percent bare ground.

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and D. Bcssio - June 16, 1983.

Remarks: Site burned in past; slightly eroded. A well drained soil.

Sample Site No.: 83CA-107-9

Pedon 9-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	0	1-0 cm -- Brown litter of chamise leaves and twigs; loose.
(9-1)	A	0-22 cm -- Brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; very few very fine roots; few very fine, many fine tubular pores; slightly acid (pH 6.4); gradual wavy boundary.
(9-2)*	Bw	22-53 cm -- Yellowish brown (10YR 5/6) coarse sandy loam, dark brown (10YR 4/3) moist; weak medium angular blocky structure; hard, very friable, very slightly sticky and nonplastic; few fine and medium roots; few fine and medium tubular pores; colloidal coatings on sand grains; medium acid (pH 6.0); abrupt wavy boundary.
	Cr	53-75^{+} cm -- Light gray weathered granodiorite, rock fabric clearly visible in place; excavates with difficulty.

Pedon 10-83 -- Site Information

Classification: fine-loamy, mixed, thermic Ultic Haploxeralfs

Location: Approx. 305 m (1,000 ft.) NE of Middle Fork Trail crossing of Moro Creek in unsectionized part of T. 16 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 3-33)

Physiographic Position: Upland - hillslope; 1,100 m (3,600 ft.) elevation.

Topography: Southeast facing slope (27 percent) on broad, downsweeping interfluve on eastside of Moro Creek; part of south facing slopes of Middle Fork Canyon (Kaweah River).

Climate: Precipitation (MAP) - 89 cm (35 in.); air temperature (MAT) - 13.5°C (56°C).

Vegetation: Dense chaparral cover of chamise (Adenosotoma fasciculatum), buck brush (Ceanothus cuneatus) and whiteleaf manzanita (Arctostaphylos viscida).

Parent Material: Residuum from granodiorite.

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 16, 1983.

Remarks: A well drained soil.

Sample Site No.: 83CA-107-10

Pedon 10-83 -- Profiles Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(10-1)	A	0-3 cm -- Brown (7.5YR 5.5/4) coarse sandy loam, dark brown (7.5YR 3/5) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few very fine roots; slightly acid (pH 6.2); abrupt wavy boundary.
(10-2)	Bt1	3-18 cm -- Strong brown (7.5YR 5/6) sandy clay loam, dark red (2.5YR 3/6) moist; strong very coarse angular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine and few medium roots; few fine tubular pores; continuous thin dark reddish brown and dark red clay films on ped faces; slightly acid (pH 6.2); abrupt wavy boundary.
(10-3)*	Bt2	18-60 cm -- Yellowish red (5YR 5/8) sandy clay loam, red to yellowish red (2.5-5YR 4/6) moist; strong coarse angular blocky structure; very hard, friable, sticky and slightly plastic; very few very fine and few medium roots; few fine tubular pores; continuous moderately thick dark reddish brown and dark red clay films on ped faces; medium acid (pH 5.9); abrupt irregular boundary.
	C	60-150 cm -- Granitic gray coarse sandy loam saprolite; rock fabric clearly visible in place; massive; hard, very friable, very slightly sticky from kaolinized feldspar grains, nonplastic, common very fine roots.

Pedon 11-83 -- Site Information

Classification: Coarse-loamy, mixed, mesic Ultic Haploxerolls.

Location: Approx. 45 m (148 ft.) NW of Amphitheater Point on contour trail in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-159)

Physiographic Position: Upland - upper hillslope; 1,340 m (4,400 ft) elevation.

Topography: Extremely steep southwest facing slope (80 percent) on upper part of plunging spur from Deer Ridge comprising part of south-facing canyon slopes of the Middle Fork (Kaweah River).

Climate: Precipitation (MAP) - 89 cm (35 in); air temperature (MAT) - 11.5°C (53°F)

Vegetation: Semi-dense woodland-shrub-grass cover. Locally mainly flannel bush (Fremontia californica), poison oak (Rhus diversiloba), mountain mahogany (Cercocarpus betuloides), grasses and forbs.

Parent Material: Colluvium from weathered mica schist.

Sampled By: G. L. Huntington, M. Akeson and D. Bossio - June 17, 1983.

Remarks: Excessively drained soil.

Sample Site No.: 83-CA-107-11

Pedon 11-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
	O	2.5-0 cm -- Dark brown partly decomposed shrub leaves and grass/forb parts.
(11-1)	A	0-27 cm -- Dark brown (10YR 3/3) angular gravelly loam, very dark gray (10YR 3/1) moist: moderate fine to medium granular structure; slightly hard, very friable, nonsticky and very slightly plastic; few fine, medium and coarse roots; few fine and very fine tubular pores; 30 percent gravel and cobbles by volume; slightly acid (pH 6.3); abrupt wavy boundary.
(11-2)	AB	27-47 -- Brown (10YR 4/3) angular gravelly loam, dark brown (10YR 3/3) moist; weak medium angular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few fine and very fine roots; common fine tubular pores; 30 percent gravel and cobbles by volume; slightly acid (pH 6.3); abrupt wavy boundary.
(11-3)*	Bw	47-100 cm -- Yellowish brown (10YR 5/4) angular gravelly loam, yellowish brown (10YR 5/6) moist; weak coarse angular blocky structure; hard, friable. slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; common fine and few medium tubular pores; 30 percent gravel and cobbles by volume, finer pebbles are well weathered; slightly acid (pH 6.4); clear wavy boundary.
	C	100-150^{+} cm -- Brown (10YR 5/3) angular gravelly loam, yellowish brown (10YR 5/4) moist; massive; colluvium rests on weathered mica schist below 150 cm.

Pedon 12-83 -- Site Information

Classification: fine-loamy, mixed, thermic Ultic Haploxeralfs.

Location: Approx. 800 m (2,625 ft.) N by NNW of Hospital Rock (60 m E of second hairpin turn of Generals Highway on grade up to Giant Forest) in unsectionized T. 16 S., R. 29 E., MDB&M. Giant Forest Quadrangle, USGS. (Map photo SEKI 4-176)

Physiographic Position: Upland - hillslope; 975 m (3,200 ft.) elevation.

Topography: Southwest facing slope (36 percent) on Moro Rock interfluve portion of the Middle Fork canyon (Kaweah River).

Climate: Precipitation (MAP) - 84 cm (33 in.); air temperature (MAT) - 14.5°C (58°F)

Vegetation: Semi-open cover of Douglas blue oak (Quercus douglasii) and buckeye (Aesculus californica) with a carpet of annual grasses and forbs.

Parent Material: Residuum from mica schist.

Sampled By: G. L. Huntington, M. Akeson and D. B ssio - June 17, 1983.

Remarks: A well drained soil.

Sample Site No.: 83CA-107-12

Pedon 12-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(12-1)	A	0-15 cm -- Yellowish brown (10YR 5/4) loam, very dark brown (10YR 2/3) moist; moderate fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few fine and very fine tubular pores; 10 percent angular gravel by volume; neutral (pH 6.6); abrupt wavy boundary.
(12-2)	BA	15-27 cm -- Yellowish brown (10YR 5/6) loam, dark brown (10YR 4/3) moist; weak medium angular blocky structure; hard, very friable, slightly sticky and slightly plastic; few fine roots; few fine and very fine tubular pores; 15 percent angular gravel by volume; neutral (pH 6.6); abrupt wavy boundary.
(12-3)	Bt1	27-60 cm -- Strong brown (7.5YR 4/5) loam, dark brown (7.5YR 3/3) moist; moderate medium angular blocky structure; hard, friable, sticky and plastic; few fine roots; common fine and very fine tubular pores; few thin clay films on ped faces, many thin clay films line pore walls; 15 percent angular gravel by volume; slightly acid (pH 6.5); clear wavy boundary.
(12-4)*	Bt2	60-100 cm -- Brown (7.5YR 4/4) loam, dark brown (7.5YR 3/3) moist; moderate medium angular blocky structure; hard, friable, sticky and slightly plastic; very few fine roots; few fine tubular pores; common thin clay films on ped faces, many thin clay films line pore walls; 15 percent weathered angular gravel by volume; slightly acid (pH 6.4); abrupt iregular boundary.
	Cr	100-150^{+} cm -- Dark brown weathered mica schist.

Pedon 13-83 -- Site Information

Classification: loamy, mixed Lithic Cryumbrepts.

Location: Approx. 150 m (492 ft.) NE of outlet to Emerald Lake in the NE¼, NW¼ Sec. 25, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 5-45)

Physiographic Position: Upland - colluvial site; 2,840 m (9,317 ft.) elevation.

Topography: Gentle south facing slope (3 percent) of thin colluvial fill in a narrow (2-3 m), stepped fracture channel in well jointed granitic rock.

Climate: Precipitation (MAP) - 101 cm (40 in.); air temperature (MAT) - 2°C (36°F)

Vegetation: Scattered small alpine plants - buckwheat (Eriogonum sp.), pussy paws (Calyptridium umbellatum).

Parent Material: Locally derived colluvium from granodiorite.

Sampled By: G. L. Huntington, W. R. Allardice and D. Bossio - Sept. 17, 1983.

Remarks: A well drained soil.

Sample Site No.: 83CA-107-13

Pedon 13-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(13-1)	A1	0-5 cm -- Grayish brown (10YR 5/2) fine gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; very weak fine crumb structure; loose, loose to very friable, nonsticky and nonplastic; many very fine and common fine roots; 30 percent fine gravel by volume, few scattered cobbles on surface, thin fine gravel erosion pavement on soil surface; strongly acid (pH 5.2); abrupt wavy boundary.
(13-2)*	A2	5-23 cm -- Yellowish brown (10YR 5/4) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine crumb structure; soft, very friable, nonsticky and nonplastic; few or no roots, few fine roots flattened on underlying rock contact; common fine and very fine tubular pores; 20 percent gravel and 10 percent cobbles by volume; strongly acid (pH 5.2); very abrupt wavy boundary.
	2R	23-50^{+} cm -- Slightly weathered gray granitic rock; unjointed within the pedon.

Pedon 14-83 -- Site Information

Classification: loamy-skeletal, mixed Entic Cryumbrepts.

Location: Approx. 220 m (722 ft.) ENE of outlet to Emerald Lake in the NE¼, NW¼ Sec. 25, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 5-45)

Physiographic Position: Upland - colluvial site; 2,860 m (9,385 ft.) elevation.

Topography: Very steep (50 percent) west southwest facing slope of deep gravelly to stony material in a wide major joint zone in the local country rock.

Climate: Precipitation (MAP) - 101 cm (40 in.); air temperature (MAT) - 2°C (36°F).

Vegetation: Scattered short perennial grass clusters and alpine forbs; occasional young red fir in protected sites.

Parent Material: Locally derived colluvium and ground moraine from granodiorite.

Sampled By: G. L. Huntington, D. Bossio and D. Fenn - Sept. 17, 1983

Remarks: A somewhat excessively drained soil.

Sample Site No.: 83CA-107-14

Pedon 14-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(14-1)	A1	0-6 cm -- Grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark gray (10YR 3/1) moist; very weak fine crumb structure; loose, very friable, nonsticky and nonplastic; many very fine and few medium roots; 30 percent gravel and stones by volume; strongly acid (pH 5.2); abrupt smooth boundary.
(14-2)	A2	6-28 cm -- Brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine crumb structure; soft, very friable, nonsticky and nonplastic; many very fine and fine, few medium roots; common very fine and fine tubular pores; 20 percent gravel and stones by volume; strongly acid (pH 5.1); clear wavy boundary.
(14-3)	A3	28-55 cm -- Brown (10YR 5/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; very weak fine crumb structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; 25 percent gravel by volume; strongly acid (pH 5.3); abrupt wavy boundary.
(14-4)*	AC	55-70 cm -- Light brownish gray (10YR 6/2) very gravelly coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; few very fine tubular pores; 40 percent gravel and cobbles by volume; strongly acid (pH 5.4); very abrupt irregular boundary.
	C	70-150 cm -- Very pale brown extremely cobbly coarse sandy loam, massive; soft, very friable, nonsticky and nonplastic; 60 percent angular cobbles and stones.

Pedon 15-83 -- Site Information

Classification: loamy, mixed Histic Lithic Cryaquepts.

Location: In Emerald Lake cirque on west side of streamlet connecting Parsons' Pond and Emerald Lake; on first rock bench above Emerald Lake and about 222 m (730 ft.) SSE of outlet to Emerald Lake in the NW¼ Sec. 25, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 5-45)

Physiographic Position: Upland basin; 2,840 m (9,317 ft.) elevation.

Topography: North facing "hanging meadow" on 10 percent slope; low hummocks 0.5 to 1 m in diameter, 20 to 50 cm high.

Climate: Precipitation (MAP) - 101 cm (40 in.); air temperature (MAT) - 2°C (36°F)

Vegetation: Wet meadow; hydrophilic grasses and herbs; dwarf alpine willow (Salix sp.) grows on some low hummocks.

Parent Material: Alluvium-colluvium from mainly granodiorite rock.

Sampled By: G. L. Huntington and W. R. Allardice - Sept. 17, 1983.

Remarks: Poorly drained soil; water table at 22 cm at time of sampling; very slow downslope seepage; source of water - adjacent streamlet and melt water from large linering snow bank.

Sample Site No.: 83CA-107-15

Pedon 15-83 -- Profile Description

(Horizon Sample No.)		(Colors are for moist soil)
	O	3-0 cm -- Dark brown dense fiberous sod; many fine and medium roots from water loving grasses and plants; patches of moss; abrupt smooth boundary.
(15-1)	Oa	0-10 cm -- Black (N 2/) muck; massive; friable; nonsticky and very slightly plastic; many very fine and fine, and common medium roots; extremely acid (pH 4.4); very abrupt wavy boundary.
(not sampled)	C	10-11 cm -- Brown (10YR 4/3) very fine sandy loam, few faint mottles; massive; friable, nonsticky and nonplastic; very strongly acid (pH 4.5); very abrupt wavy boundary.
(15-2)	O'a	11-25 cm -- Black (10YR 2/1) muck; massive; friable, nonsticky and nonplastic; many very fine and fine roots; very strongly acid (pH 4.7); abrupt wavy boundary.
(15-3)*	A	25-38 cm -- Black (10YR 2/1) loam; massive; friable, slightly sticky and slightly plastic; few fine roots; few medium tubular pores - conducting moving water; strongly acid (pH 5.1); very abrupt irregular boundary.
	2R	38-50 cm -- very closely interlocking angular cobbles and stones resting on glaciated bedrock.

Pedon 16-83 -- Site Information

Classification: sandy-skeletal, mixed Typic Cryorthents.

Location: On ridge between Emerald and Pear Lakes, about 630 m (2,067 ft.) airline E by ESE of the outlet to Emerald Lake, in the NE¼ Sec. 25, T. 15 S., R. 30 E., MDB&M. Triple Divide Peak Quadrangle, USGS. (Map photo SEKI 5-45)

Physiographic Position: Upland - narrow ridge summit (nunatak - never glaciated); 3,078 m (10,100 ft.) elevation.

Topography: West facing slope (10 percent) of the narrow ridge crest; smooth surface.

Climate: Precipitation (MAP) - 101 cm (40 in.); air temperature (MAT) - 1°C (34°F).

Vegetation: Open, irregularly scattered cover of chinquapin (Castanopsis sempervirens) and stunted western white pine (Pinus monticola) with a few widely scattered alpine plants.

Parent Material: Residuum from granodiorite.

Sampled By: M. Akeson and D. Bossio - Sept. 17, 1983

Remarks: A somewhat excessively drained soil. Angular pebbles range in size from 2 to 10 mm.

Sample Site No,: 83CA-107-16

Pedon 16-83 -- Profile Description

(Horizon Sample No.)		(Colors are for dry soil unless otherwise noted)
(16-1)	A	0-5 cm -- Pale brown (10YR 6/3) gravelly loamy coarse sand, dark brown (10YR 4/3) moist: single grain; loose, loose, nonsticky and nonplastic; few very fine roots; many fine and very fine interstitial pores; strongly acid (pH 5.1); abrupt wavy boundary.
(16-2)	Bw	5-43 cm -- Very pale brown (10YR 7/4) very gravelly loamy coarse sand, yellowish brown (10YR 5/6) moist; very weak fine crumb structure; soft, very friable, nonsticky and nonplastic; common very fine, fine and medium roots; many fine and very fine interstitial pores; strongly acid (pH 5.4); clear wavy boundary.
(16-3)*	C	46-61 cm -- Light gray (10YR 7/2) very gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable to loose, nonsticky and nonplastic; few fine and medium roots; many fine and very fine interstitial pores; strongly acid (pH 5.4); abrupt wavy boundary.
	Cr	61-75^{+} cm -- Light gray, well weathered granodiorite; rock fabric clearly visible in place; can be excavated by hand with difficulty.

7.2

APPENDIX II

Physical and Chemical Soil Analyses

for Horizon Samples from

Reference Pedons (Appendix I)

for

Pedologic Studies in Sequoia National Park, Central Part,

California

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: coarse-loamy, mixed, mesic Xeric Haplohumults

Sample No.: 82CA-107-1-(1-8*)

Lab No.: _____ County: Tulare

Location: Near center Sec. 1, T. 16 S., R. 29 E., MDB&M; east side of Crystal Cave Rd.

Date Sampled: 9-13-82

Date Reported: _____

Analyst: W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL <5mm [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
1-1	0	6	7	16.6	12.4	6.6	11.5	7.5	54.6	33.1	12.3	–	CSL	–	6.8	45.6	28.0	17.6	–
1-2	6	24	13	18.4	14.7	7.6	13.2	8.7	62.6	28.3	9.1	–	CSL	–	4.6	25.0	12.0	13.0	–
1-3	24	53	11	17.1	13.6	8.1	13.2	8.2	60.2	30.1	9.7	–	CSL	–	4.3	25.0	11.0	14.0	–
1-4	53	83	12	16.5	15.0	8.2	13.9	7.6	61.2	24.4	14.4	–	CSL	–	4.1	21.8	11.0	10.8	–
1-5	83	120	7	13.8	14.7	8.7	16.7	8.5	62.4	22.9	14.7	–	CSL	–	2.7	19.8	10.0	9.8	–
1-6	120	162	0	12.5	14.6	9.6	19.3	8.2	64.2	20.5	15.3	–	CSL	–	2.7	17.2	9.0	8.2	–
1-7	162	237	0	15.2	16.0	9.5	18.9	8.8	68.4	18.9	12.7	–	CSL	–	2.6	18.1	9.0	9.1	–
1-8*	268	300	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
1-1	6.7	–	–	–	28.44	2.88	0.33	1.38	54.3	60.8	11.22	0.48	23.4	11.44	4.44			–
1-2	6.7	–	–	–	7.65	1.03	0.14	0.80	22.8	42.2	2.61	0.11	23.7	7.04	3.36			–
1-3	6.5	–	–	–	3.84	0.85	0.19	0.91	23.0	25.2	1.57	0.06	26.2	4.12	3.88			–
1-4	6.4	–	–	–	2.16	0.45	0.18	1.03	12.1	31.6	1.03	0.03	34.3	3.80	3.16			–
1-5	6.2	–	–	–	2.26	0.51	0.13	1.04	11.2	35.2	0.49	0.02	24.5	1.52	2.80			–
1-6	5.8	–	–	–	2.41	1.08	0.29	1.19	14.8	33.6	0.21	0.01	21.0	2.92	3.84			–
1-7	5.7	–	–	–	2.53	0.68	0.21	0.71	13.8	30.0	0.26	0.01	26.0	3.28	3.80			–
1-8*	–	–	–	–	–	–	–	–	–	–	–	–	–					–

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

REMARKS: Sampled by auger below 162 cm. Break in sampling (237-268 cm) due to many coarse roots.

Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: coarse-loamy, mixed, mesic Xeric Haplohumults
Sample No.: 82CA-107-2-(1-9*)
Lab No.: ____ County: Tulare
Location: 80m N36°E Auto Log sign, Auto Log parking lot, in NW¼ Sec. 7, T. 16 S., R. 30 E., MDB&M
Date Sampled: 9-14-82
Date Reported: ____
Analyst: W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
2-1	0	5	14	15.9	14.0	8.0	13.5	9.3	60.7	26.8	12.5	–	CSL	–	3.8	33.8	13.4	20.4	–
2-2	5	16	19	17.4	16.5	8.3	15.1	9.6	66.9	25.4	7.7	–	CSL	–	2.9	24.8	10.6	14.2	–
2-3	16	35	13	15.9	16.0	9.0	15.3	8.9	65.1	25.2	9.7	–	CSL	–	2.5	21.8	10.4	11.4	–
2-4	35	57	14	18.2	16.9	8.7	13.2	8.0	65.0	25.4	9.6	–	CSL	–	2.0	20.5	9.5	11.0	–
2-5	57	77	14	13.3	14.0	8.3	15.2	9.4	60.2	29.7	10.1	–	CSL	–	2.1	20.9	9.9	11.0	–
2-6	77	106	4	11.4	14.9	8.5	15.2	9.6	59.6	27.8	12.6	–	CSL	–	1.7	20.5	9.0	11.5	–
2-7	106	150	1	10.5	15.4	8.0	14.4	10.0	58.3	28.4	13.3	–	CSL	–	1.5	22.1	9.5	12.6	–
2-8	184	234	1	16.4	15.7	8.1	14.5	10.0	64.7	25.4	9.9	–	CSL	–	1.2	21.3	7.9	13.4	–
2-9*	234	280	3	13.7	17.8	9.6	(27.3)		68.4	23.3	8.3	–	CSL	–	1.3	18.1	7.7	10.4	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
2-1	6.1	–	–	–	6.24	0.62	0.53	0.79	26.1	31.3	6.58	0.15	43.9	5.76	3.40			–
2-2	6.1	–	–	–	3.11	0.29	0.17	0.50	10.6	38.4	1.71	0.08	21.4	4.76	4.68			–
2-3	6.1	–	–	–	1.94	0.22	0.18	0.43	11.8	23.5	1.47	0.05	29.4	5.20	2.76			–
2-4	5.6	–	–	–	0.95	0.17	0.24	0.41	8.3	21.3	1.01	0.04	25.2	4.20	3.48			–
2-5	5.5	–	–	–	0.42	0.21	0.23	0.34	9.9	12.1	0.96	0.02	48.0	3.20	3.48			–
2-6	5.2	–	–	–	0.11	0.17	0.17	0.22	8.3	8.1	0.29	0.01	29.0	2.68	3.44			–
2-7	5.0	–	–	–	0.04	0.20	0.18	0.18	3.0	20.0	0.18	0.01	18.0	1.92	3.28			–
2-8	4.9	–	–	–	0.00	0.09	0.24	0.17	6.0	8.3	0.13	0.01	13.0	3.08	3.32			–
2-9*	5.0	–	–	–	0.14	0.22	0.26	0.20	3.5	23.4	0.07	0.01	7.0	2.40	3.04			–

1 BY WEIGHT OF FIELD SAMPLE
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4 DENSITY OF AIR DRY CLOD
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7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: Sampled by auger below 150 cm. Break in sampling (150-184 cm) because of many irregular granitic rock fragments.

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: sandy, mixed, mesic, shallow Entic Xerumbrepts

Sample No.: 82CA-107-3-(1-3*)

Lab No.: _____ County: Tulare

Location: 258m S 15° E of intersection Huckleberry Mdw. trail and Crescent Mdw. Road in T. 16S, R. 30 E., MDB&M

Date Sampled: 9-14-82

Date Reported: _____

Analyst: W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL <5mm [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
3-1	0	10	20	21.2	23.9	11.8	18.2	8.3	83.4	12.4	4.2	–	LCS	–	2.0	15.0	4.3	10.7	–
3-2	10	23	23	19.4	22.9	11.7	18.1	8.4	80.5	14.5	5.0	–	LCS	–	2.5	16.7	4.7	12.0	–
3-3*	23	42	22	13.0	24.8	13.0	21.2	9.4	81.4	10.8	7.8	–	LCS	–	2.6	15.2	4.5	10.7	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
3-1	5.4	–	–	–	1.54	0.23	0.28	0.38	13.8	17.6	3.30	0.01	33.0	6.12	7.84			–
3-2	5.6	–	–	–	1.43	0.09	0.26	0.33	12.0	17.6	2.21	0.07	31.6	7.44	6.72			–
3-3*	5.5	–	–	–	0.94	0.08	0.22	0.45	10.7	15.8	2.11	0.07	30.1	3.72	2.84			–

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
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6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: _____

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family Sandy, mixed, mesic Pachic Xerumbrepts

Sample No. 82CA-107-4-(1-4*)

Lab No. _____ County Tulare

Location W of Crescent Mdw. About 365 m E of SE corner Sec 5, T. 16 S., R. 30 E., MDB&M

Date Sampled 9-15-82

Date Reported _____

Analyst W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL <5mm [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
4-1	0	8	15	20.6	19.7	9.5	17.5	8.8	76.1	17.4	6.5	–	CSL	–	2.6	18.7	6.3	12.4	–
4-2	8	38	13	19.5	21.0	11.8	19.4	8.7	80.4	13.5	6.1	–	LCS	–	2.1	14.8	5.9	8.9	–
4-3	38	57	18	20.9	22.5	11.9	16.8	8.0	80.1	12.5	7.4	–	LCS	–	1.1	15.8	5.4	10.4	–
4-4*	57	100	20	17.2	19.4	12.0	19.2	9.2	77.0	15.1	7.9	–	CSL	–	1.3	12.2	4.6	7.6	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
4-1	6.4	–	–	–	4.57	0.26	0.20	0.42	10.7	50.9	1.9	0.08	23.7	4.56	2.40			–
4-2	6.2	–	–	–	1.89	0.21	0.22	0.45	10.7	25.9	1.23	0.06	20.5	3.84	4.24			–
4-3	6.1	–	–	–	0.75	0.12	0.38	0.47	7.9	21.8	0.94	0.03	31.3	3.20	3.56			–
4-4*	5.4	–	–	–	0.39	0.10	0.36	0.41	3.0	42.0	0.47	0.03	15.7	3.52	2.80			–

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
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6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: _____

*Lowest horizon sampled in profile

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: sandy, mixed, frigid Lithic Xerumbrepts

Sample No.: 82CA-107-5-(1-2*)

Lab No.:

County: Tulare

Location: 635m S 10° E of west end of Wolverton parking area in NW¼ SW¼ Sec. 28, T. 15 S., R. 30 E., MDB&M

Date Sampled: 9-15-82

Date Reported:

Analyst: W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
5-1	0	6	37	26.2	20.8	10.3	15.1	8.0	80.4	15.7	3.9	–	FGLCS	–	2.5	27.9	14.4	13.5	–
5-2*	6	12	20	26.0	21.4	10.9	14.1	7.4	79.8	16.0	4.2	–	LCS	–	2.2	23.2	10.4	13.0	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
5-1	5.1	–	–	–	4.13	0.30	0.31	0.42	23.7	21.8	7.85	0.19	41.3	5.32	4.08			–
5-2*	5.2	–	–	–	2.33	0.14	0.17	0.24	17.9	16.1	4.78	0.14	34.1	4.48	3.48			–

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
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7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

REMARKS:

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family coarse-loamy, mixed, frigid Histic Humaquepts
Sample No. 82CA-107-6-(1-5*)
Lab No. _____ County Tulare

Location 450m S 8° W of the west end of Wolverton parking area in the NE¼ SE¼ Sec. 29, T.16S., R.30E., MDB&M

Date Sampled 9-16-82
Date Reported _____
Analyst W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
6-1	7	0	0	10.8	16.2	12.8	17.8	9.0	66.6	29.1	4.3	–	muck	–	13.9	58.1	37.8	20.3	–
6-2		8	14	25.3	34.1	13.0	12.6	4.6	89.6	7.9	2.5	–	CS	–	1.0	18.1	13.4	4.7	–
6-3	8	24	0	5.0	6.4	4.8	11.4	13.4	41.0	54.6	4.4	–	muck	–	35.4	65.4	18.1	47.3	–
6-4	24	68	5	12.0	12.3	6.9	13.1	10.0	54.3	33.3	12.4	–	SL	–	6.3	45.9	35.3	10.6	–
6-5*	68	108	13	22.9	20.1	10.2	14.6	8.0	75.8	16.7	7.5	–	CSL	–	2.6	20.9	7.6	13.3	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as $\%Fe_2O_3$ [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
6-1	5.2	–	–	–	9.77	0.89	0.30	1.04	55.2	21.7	14.40	0.53	27.2	36.64	5.92			–
6-2	5.3	–	–	–	1.25	0.09	0.06	0.12	8.3	18.3	1.93	0.07	27.6	3.32	2.88			–
6-3	5.4	–	–	–	5.32	0.38	0.17	0.15	60.3	10.0	15.48	0.68	22.8	18.64	4.64			–
6-4	5.5	–	–	–	3.21	0.20	0.16	0.12	27.7	13.3	4.70	0.12	39.2	5.00	2.64			–
6-5*	6.0	–	–	–	1.77	0.11	0.09	0.15	10.9	19.4	1.54	0.06	25.7	2.24	2.80			–

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5 MOISTURE ON OVEN DRY BASIS
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9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: _____

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: sandy, mixed, frigid Pachic Xerumbrepts

Sample No.: 82CA-107-7-(1-6*)

Lab No.:

County: Tulare

Location: 457m S 28° E of west end of Wolverton parking area in the W½ of Sec. 28, T. 15 S., R. 30 E., MDB&M

Date Sampled: 9-16-82

Date Reported:

Analyst: W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL <5mm [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
7-1	0	8	27	23.6	17.6	9.8	14.8	8.7	74.5	18.7	6.8	–	FGCSL	–	3.6	16.5	9.7	6.8	–
7-2	8	15	27	26.3	18.3	9.5	13.7	8.5	76.3	15.2	8.5	–	FGCSL	–	2.5	12.2	7.3	4.9	–
7-3	15	55	27	24.9	19.6	11.0	16.5	8.6	80.6	13.9	5.5	–	FGLCS	–	2.2	12.3	5.5	6.8	–
7-4	55	90	33	22.3	20.5	20.7	16.3	8.0	87.8	5.2	7.0	–	FGLCS	–	2.6	12.2	4.9	7.3	–
7-5	90	110	26	23.5	22.9	11.4	16.7	6.9	81.4	12.0	6.6	–	FGLCS	–	2.0	14.6	4.7	9.9	–
7-6*	110	150	26	22.9	22.4	11.4	17.2	6.9	80.8	11.8	7.4	–	FGLCS	–	2.6	–	–	–	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
7-1	6.1	–	–	–	6.97	0.35	0.04	0.44	20.1	38.8	6.66	0.07	95.2	7.08	3.60			–
7-2	6.3	–	–	–	4.30	0.22	0.04	0.40	12.8	38.7	2.88	0.02	144.0	5.28	3.40			–
7-3	6.5	–	–	–	1.88	0.15	0.03	0.36	6.6	36.7	0.87	0.02	43.2	2.48	3.28			–
7-4	6.4	–	–	–	1.59	0.14	0.04	0.41	4.6	47.4	0.54	0.01	54.0	3.00	3.40			–
7-5	6.6	–	–	–	1.32	0.11	0.03	0.68	6.6	32.4	0.26	0.01	26.0	1.72	3.36			–
7-6*	5.8	–	–	–	1.20	0.11	0.03	0.48	5.6	32.5	0.27	–	–	1.52	3.40			–

Analyses by Soil Morphology Laboratory University of California Davis

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7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

REMARKS:

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: sandy, mixed, mesic Pachic Xerumbrepts
Sample No.: 82CA-107-8-(1-5*)
Lab No.:
County: Tulare

Location: 518 m SW of General Sherman Tree; 61m WNW E¼ cor. sec. 31, T. 15 S., R. 30 E., MDB&M

Date Sampled: 9-17-82
Date Reported:
Analyst: W. Allardice

HORIZON Sample No.	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
8-1	0	5	4	6.0	12.0	7.6	15.2	13.7	54.5	33.5	12.0	–	FSL	–	6.8	16.1	–	–	–
8-2	5	30	29	15.6	20.5	11.4	19.0	9.0	75.5	17.9	6.6	–	FGCSL	–	2.4	12.1	5.9	6.2	–
8-3	30	71	26	14.7	20.4	13.1	18.8	8.1	75.1	17.4	7.5	–	FGCSL	–	1.8	9.5	4.8	4.7	–
8-4	71	112	17	8.1	20.2	16.4	26.0	10.6	81.3	13.3	5.4	–	LCS	–	2.0	9.6	3.8	5.8	–
8-5*	112	142	18	12.6	19.9	14.5	23.5	11.1	81.6	13.4	5.0	–	LCS	–	2.0	9.4	3.5	5.9	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	SPECIAL ANALYSES [9] NH_4^+ ppm	NO_3^- ppm			$EC \times 10^3$ mmhos/cm
8-1	6.2	–	–	–	25.33	2.23	0.15	0.84	52.55	54.3	12.35	0.25	49.4	8.80	6.40			–
8-2	6.1	–	–	–	5.05	0.47	0.08	0.51	13.82	44.2	1.44	0.05	28.8	1.96	3.12			–
8-3	6.0	–	–	–	2.78	0.43	0.08	0.61	12.79	30.5	0.71	0.01	71.0	0.96	2.44			–
8-4	6.0	–	–	–	1.69	0.33	0.07	0.52	7.60	34.3	0.26	0.01	26.0	2.52	2.52			–
8-5*	5.7	–	–	–	2.03	0.32	0.09	0.46	2.82	100.0	0.19	0.01	19.0	1.56	2.40			–

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10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS:

*Lowest horizon sampled in profile

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family coarse-loamy, mixed, nonacid, thermic, shallow Typic Xerorthents
Sample No. 83CA-107-1-(1-3*)
Lab No.
County Tulare
Location 152 M NE Shepherd Saddle in SE1/4, SW1/4 of T. 16 S., R. 28 E., MDB&M (unsectionized)
Date Sampled 6-13-83
Date Reported
Analyst W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
1-1	0	12	-	13.8	16.6	9.6	18.3	12.9	71.2	21.7	7.1	5.9	CSL	-	1.4	10.4	4.5	5.9	-
1-2	12	30	-	18.1	19.3	10.4	17.2	11.4	76.4	16.9	6.7	5.3	CSL	1.6	1.4	11.4	4.4	7.0	-
1-3*	30	42	-	15.4	18.6	11.0	18.3	11.5	74.8	19.3	5.9	5.0	CSL	1.6	1.5	10.7	4.6	6.1	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
1-1	6.3	-	-	-	7.4	1.3	0.11	0.25	11.2	80.9	2.01	0.09	22.3	-	-	-	-	-
1-2	6.4	-	-	-	7.9	1.3	0.15	0.10	10.6	89.2	0.79	0.03	26.3	-	-	-	-	-
1-3*	6.4	-	-	-	7.9	1.4	0.16	0.06	10.2	93.3	0.36	0.02	18.0	-	-	-	-	-

Analyses by Soil Morphology Laboratory University of California Davis

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10 CBD METHOD

* est horizon sampled in profile

REMARKS:

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: fine-loamy, mixed, thermic Ultic Haploxeralfs
Sample No.: 83CA-107-2-(1-5*)
Lab No.: _____ County: Tulare
Location: 1,920 m airline W-WNW from Park HQ (Ash Mtn.) in SE¼ of SW¼ of T. 16 S., R. 29 E., MDB&M
Date Sampled: 6-13-83
Date Reported: _____
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
2-1	0	12	–	22.6	13.6	6.3	9.4	7.4	59.3	30.8	9.9	6.5	CSL	1.8	1.0	15.8	4.4	11.4	–
2-2	12	28	–	27.1	12.1	6.0	9.3	6.9	61.4	26.2	12.4	8.8	CSL	1.7	0.9	12.1	5.5	6.6	–
2-3	28	47	–	26.0	11.9	5.8	8.6	6.6	58.9	27.8	13.3	10.5	CSL	1.7	1.0	11.7	5.6	6.1	–
2-4	47	107	–	19.4	11.8	5.7	8.8	6.9	52.6	22.0	25.4	16.9	SCL	1.7	1.3	14.1	6.4	7.7	–
2-5*	107	150	–	26.5	10.3	5.0	7.2	5.9	54.9	20.9	24.2	22.0	SCL	2.0	1.5	16.3	8.8	7.5	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	$EC \times 10^3$ mmhos/cm
2-1	6.2	–	–	–	4.2	3.6	0.10	0.32	9.1	90.3	1.33	0.11	12.1	–	–	–	–	–
2-2	5.8	–	–	–	2.3	1.6	0.10	0.25	7.6	55.9	0.35	0.02	17.5	–	–	–	–	–
2-3	5.8	–	–	–	2.4	1.4	0.10	0.26	8.1	51.4	0.25	0.01	25.0	–	–	–	–	–
2-4	5.7	–	–	–	3.2	1.1	0.12	0.22	11.6	40.0	0.14	0.02	7.0	–	–	–	–	–
2-5*	5.4	–	–	–	3.0	1.6	0.15	0.13	11.2	43.6	0.08	0.01	8.0	–	–	–	–	–

Analyses by Soil Morphology Laboratory University of California Davis

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10 CBD METHOD

*Lowest horizon sampled in profile

REMARKS: _____

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: coarse-loamy, mixed, thermic Ultic Haploxerolls

Sample No.: 83CA-107-3-(1-3*)

Lab No.: _____ County: Tulare

Location: 400 m W of entrance to Potwisha Campground in un-sectionized T. 16 S., R. 29 E., MDB&M

Date Sampled: 6-14-83

Date Reported: _____

Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ - 2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
3-1	0	10	10	6.1	9.8	9.1	20.8	17.9	63.7	26.6	9.7	7.5	FSL	1.3	2.1	17.6	6.2	11.4	–
3-2	10	26	15	4.3	9.8	9.0	22.6	19.3	65.0	25.6	9.4	6.9	FSL	–	2.1	14.3	5.4	8.9	–
3-3*	26	54	25	6.6	12.5	10.6	23.4	16.3	69.4	21.2	9.4	7.8	FSL	1.5	2.6	12.5	5.9	6.6	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) [9] Ca	Mg	Na	K	ECx10³ mmhos/cm
3-1	7.2	–	–	–	10.8	2.6	0.10	0.68	19.4	73.1	2.07	0.12	17.2	–	–	–	–	–
3-2	7.4	–	–	–	9.8	2.3	0.11	0.54	16.8	75.9	0.99	0.04	24.7	–	–	–	–	–
3-3*	7.6	–	–	–	14.9	3.1	0.15	0.18	15.9	100.0	0.76	0.03	25.3	–	–	–	–	–

Analyses by Soil Morphology Laboratory University of California Davis

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*L st horizon sampled in profile

REMARKS: _____

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family fine-loamy, mixed, thermic Mollic Haploxeralfs

Sample No. 83CA-107-4-(1-5*)

Lab No. _____ County Tulare

Location 75m SW of Tunnel Rock on Generals' Highway in unsectionized T.16 S., R. 29 E., MDB&M

Date Sampled 6-14-83

Date Reported _____

Analyst W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
4-1	0	30	-	7.9	9.6	8.4	21.8	18.2	65.9	23.6	10.5	8.4	FSL	1.7	1.0	15.0	5.8	9.2	-
4-2	30	50	-	7.4	8.9	8.1	21.0	15.6	61.0	24.3	14.7	12.5	FSL	1.8	1.2	12.6	6.1	6.5	-
4-3	50	95	-	1.3	3.3	4.1	14.5	15.7	38.9	25.5	35.6	32.2	CL	2.0	3.3	23.9	14.0	9.9	-
4-4	95	135	-	3.4	3.6	4.4	15.6	16.7	43.7	28.3	28.0	24.7	CL	2.1	2.9	20.6	11.2	9.4	-
4-5*	135	160	-	2.9	4.6	5.2	18.2	19.5	50.4	29.6	20.0	18.3	L	2.0	2.6	17.2	10.3	6.9	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) [9] Ca	Mg	Na	K	$EC \times 10^3$ mmhos/cm
4-1	6.4	-	-	-	5.5	1.2	0.10	0.25	12.1	58.3	1.05	0.09	11.7	-	-	-	-	-
4-2	6.3	-	-	-	5.4	1.6	0.11	0.23	10.1	72.7	0.47	0.05	9.4	-	-	-	-	-
4-3	6.2	-	-	-	11.5	3.3	0.27	0.16	20.1	75.8	0.10	0.01	10.0	-	-	-	-	-
4-4	6.4	-	-	-	10.9	3.0	0.29	0.13	17.5	81.8	0.06	0.01	6.0	-	-	-	-	-
4-5*	6.6	-	-	-	10.1	2.8	0.31	0.10	15.9	83.7	0.06	0.01	6.0	-	-	-	-	-

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6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: _____

*Lowest horizon sampled in profile

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family coarse-loamy, mixed, thermic Ultic Haploxeralfs

Sample No. 83CA-107-5-(1-3*)

Lab No. _____ County Tulare

Location 850 m NE of Park HQ (Ash Mtn) in unsectionized T. 16 S., R. 29 E., MDB&M

Date Sampled 6-14-83

Date Reported _____

Analyst W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms	% Moisture at Saturation
5-1	0	25	-	5.1	10.1	12.3	26.0	16.2	69.7	23.0	7.3	5.1	FSL	1.6	0.9	13.8	3.5	10.3	-
5-2	25	65	-	7.9	10.4	11.3	24.0	13.7	67.3	20.9	11.8	8.9	FSL	1.7	1.0	13.1	5.5	7.6	-
5-3*	65	100	-	3.8	10.2	11.9	26.3	15.7	67.9	20.2	11.9	9.4	FSL	1.8	1.0	12.6	5.9	6.7	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	$EC \times 10^3$ mmhos/cm
5-1	6.2	-	-	-	3.9	1.2	0.10	0.30	10.1	54.4	0.82	0.06	13.7	-	-	-	-	-
5-2	6.0	-	-	-	4.1	1.2	0.11	0.26	9.6	59.1	0.32	0.03	10.7	-	-	-	-	-
5-3*	6.0	-	-	-	3.9	1.1	0.13	0.21	8.1	65.9	0.21	0.02	10.5	-	-	-	-	-

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS: _____

* Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: fine-loamy, mixed, thermic Ultic Haploxeralfs

Sample No.: 83CA-107-6-(1-6*)

Lab No.:

County: Tulare

Location: W side Elk Cr. Trail, 640 m WSW Marble Fork Bridge in unsectionized T. 16 S., R 29 E., MDB&M

Date Sampled: 6-15-83

Date Reported:

Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ - 2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
6-1	0	8	-	3.2	5.3	6.0	20.7	18.7	53.9	30.9	15.2	12.3	FSL	1.5	1.8	22.4	9.6	12.8	-
6-2	8	28	-	1.6	4.8	5.5	19.7	18.1	49.7	29.1	21.2	17.0	L	1.8	1.8	18.5	9.9	8.6	-
6-3	28	75	-	1.0	3.6	4.8	17.1	16.2	42.7	23.4	33.9	30.4	CL	2.0	2.7	22.0	12.3	9.7	-
6-4	75	100	-	1.4	4.4	4.8	18.1	18.2	46.9	24.8	28.3	26.0	SCL	2.0	2.7	22.5	11.6	10.9	-
6-5	100	120	-	0.9	5.0	5.8	21.8	20.8	54.3	24.4	21.3	19.3	SCL	2.0	2.4	18.5	10.9	7.6	-
6-6*	120	150	-	4.1	11.5	10.4	26.8	19.2	72.0	16.6	11.4	10.3	FSL	1.9	2.1	12.7	7.5	5.2	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) [9] Ca	Mg	Na	K	$EC \times 10^3$ mmhos/cm
6-1	6.6	-	-	-	11.3	1.9	0.11	0.31	20.9	65.2	2.44	0.13	18.8	-	-	-	-	-
6-2	6.4	-	-	-	9.8	2.3	0.11	0.22	18.8	66.1	0.97	0.08	12.1	-	-	-	-	-
6-3	6.0	-	-	-	12.7	3.4	0.16	0.14	22.1	74.2	0.22	0.03	7.3	-	-	-	-	-
6-4	6.0	-	-	-	12.9	3.6	0.22	0.14	23.1	73.0	0.10	0.02	5.0	-	-	-	-	-
6-5	6.1	-	-	-	11.7	3.5	0.24	0.12	17.9	86.9	0.06	0.01	6.0	-	-	-	-	-
6-6*	6.2	-	-	-	10.3	3.4	0.28	0.12	16.3	86.5	0.05	0.01	5.0	-	-	-	-	-

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS:

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: fine, mixed, thermic Ultic Palexeralfs
Sample No.: 83CA-107-7-(1-5*)
Lab No.:
County: Tulare
Location: W. side of Elk Cr. Trail, 823m W of Marble Fork Bridge in unsectionized T. 16 S., R. 29 E., MDB&M
Date Sampled: 6-15-83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ - 2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
7-1	0	15	-	1.6	3.5	4.5	18.6	19.8	48.0	35.2	16.8	13.3	L	1.7	1.9	19.4	9.9	9.5	-
7-2	15	54	-	0.7	1.8	3.1	13.1	15.1	33.8	29.4	36.8	32.9	CL	2.0	3.5	24.0	14.0	10.0	-
7-3	54	90	-	0.6	2.4	3.5	13.5	15.6	35.6	28.2	36.2	32.2	CL	2.0	3.8	25.0	15.0	10.0	-
7-4	90	125	25.8	6.8	4.6	4.2	13.2	16.4	45.2	30.7	24.1	23.5	L	2.0	3.0	19.7	11.8	7.9	-
7-5*	125	150	16.7	5.9	5.8	5.3	16.2	17.0	50.2	27.4	22.4	20.1	SCL	2.0	2.6	17.2	11.8	5.4	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
7-1	6.1	-	-	-	7.2	2.6	0.11	0.26	16.8	60.5	1.27	0.07	18.1	-	-	-	-	-
7-2	6.2	-	-	-	10.1	4.1	0.20	0.16	22.3	65.3	0.27	0.02	13.5	-	-	-	-	-
7-3	6.3	-	-	-	10.1	4.2	0.24	0.13	22.3	65.8	0.13	0.02	6.5	-	-	-	-	-
7-4	6.4	-	-	-	7.6	3.4	0.25	0.13	16.5	69.0	0.13	0.02	6.5	-	-	-	-	-
7-5*	6.5	-	-	-	7.0	3.1	0.27	0.12	15.4	68.1	0.14	0.02	7.0	-	-	-	-	-

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

*L st horizon sampled in profile

REMARKS:

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: loamy, mixed, nonacid, thermic, shallow Entic Ultic Haploxerolls
Sample No.: 83CA-107-8-(1-3*)
Lab No.:
County: Tulare
Location: 100 m E of Elk Cr. Trail, 670 m W by WNW of Marble Fork Bridge in unsectionized T. 16 S, R. 29E., MDB&M
Date Sampled: 6/15/83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
8-1	0	8	10.7	4.6	6.7	6.6	22.7	22.3	62.9	28.9	8.2	6.4	FSL	1.5	1.3	17.6	5.2	12.4	–
8-2	8	25	6.9	5.0	7.7	7.1	23.2	21.1	64.1	27.8	8.1	6.3	FSL	1.5	1.5	15.0	4.6	10.4	–
8-3*	25	55	–	3.9	10.0	10.0	28.0	19.1	71.0	21.9	7.1	6.3	FSL	1.7	1.8	13.1	5.1	8.0	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
8-1	6.2	–	–	–	6.4	1.4	0.11	0.20	13.7	59.2	1.13	0.08	14.1	–	–	–	–	–
8-2	6.3	–	–	–	6.6	2.0	0.13	0.14	12.2	72.7	0.37	0.03	12.3	–	–	–	–	–
8-3*	6.4	–	–	–	7.9	2.7	0.15	0.10	12.2	88.9	0.06	0.01	6.0	–	–	–	–	–

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

*Lowest horizon sampled in profile

REMARKS:

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: coarse-loamy, mixed, thermic Ultic Haploxerolls
Sample No.: 83CA-107-9-(1-2*)
Lab No.:
County: Tulare
Location: E side Moro R. Trail, 825m NE Buckeye Flat, in unsectionized T. 16 S., R. 30 E., MDB&M
Date Sampled: 6-16-83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ - 2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
9-1	0	22	7.0	17.6	15.6	10.4	19.0	11.0	73.6	16.7	9.7	7.5	CSL	1.5	1.0	14.4	3.9	10.5	-
9-2*	22	53	14.9	25.5	17.5	10.0	16.1	8.6	77.7	11.9	10.4	9.1	CSL	1.5	1.0	8.7	4.8	3.9	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
9-1	6.4	-	-	-	4.9	0.9	0.09	0.28	11.6	53.2	1.86	0.05	37.2	-	-	-	-	-
9-2*	6.0	-	-	-	3.5	1.1	0.10	0.21	8.6	57.1	0.59	0.03	19.7	-	-	-	-	-

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

* Test horizon sampled in profile

REMARKS:

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: fine-loamy, mixed, thermic Ultic Haploxeralfs
Sample No.: 83CA-107-10-(1-4*)
Lab No.:
County: Tulare
Location: 305 m airline NE of crossing of Middle Fork Trail & Moro Cr. in unsectionized T. 16 S., R. 30 E., MDB&M
Date Sampled: 6-16-83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ - 2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
10-1	0	3	-	19.1	13.2	7.5	14.3	9.2	63.3	23.1	13.6	10.7	CSL	1.2	1.9	21.3	10.1	11.2	-
10-2	3	18	-	14.1	10.2	5.5	10.3	6.5	46.6	20.1	33.3	30.2	SCL	1.7	2.4	19.7	11.2	8.5	-
10-3	18	60	-	12.6	11.1	6.0	11.4	7.0	48.1	18.0	33.9	31.1	SCL	1.8	2.0	22.0	12.1	9.9	-
10-4*	60	150	-	15.5	18.3	11.4	17.9	9.4	72.5	11.7	15.8	14.3	CSL	1.7	1.3	11.1	7.7	3.4	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
10-1	6.2	-	-	-	9.6	5.0	0.11	0.50	19.9	76.4	3.95	0.19	20.8	-	-	-	-	-
10-2	6.2	-	-	-	5.9	1.9	0.12	0.39	13.3	62.5	0.87	0.05	17.4	-	-	-	-	-
10-3	5.9	-	-	-	5.8	1.7	0.11	0.26	13.8	57.0	0.35	0.02	17.5	-	-	-	-	-
10-4*	5.8	-	-	-	4.7	1.7	0.18	0.12	8.6	77.9	0.13	0.01	13.0	-	-	-	-	-

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
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7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

REMARKS:

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: coarse-loamy, mixed, mesic Ultic Haploxerolls
Sample No.: 83CA-107-11-(1-3*)
Lab No.:
County: Tulare
Location: 45 m NW Amphitheater Pt. on contour trail in unsectionized T. 16 S., R. 29 E., MDB&M
Date Sampled: 6-17-83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ - 2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
11-1	0	27	9.5	7.1	3.3	2.5	10.5	18.2	41.6	45.5	12.9	9.1	L	1.2	2.7	35.8	13.6	22.2	-
11-2	27	47	13.7	5.4	3.5	2.7	11.7	21.5	44.8	47.6	12.6	10.0	L	1.4	1.4	23.2	8.8	14.4	-
11-3*	47	100	24.1	7.2	4.4	3.6	13.4	20.4	49.0	40.7	10.3	8.4	L	1.6	1.4	21.0	8.2	12.8	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS (me./100 grams soil) [7] Ca	Mg	Na	K	Cation Exchange Capacity (me/100 grams soil) [8]	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS (me./liter) [9] Ca	Mg	Na	K	EC x 10^3 mmhos/cm
11-1	6.3	-	-	-	18.5	1.6	0.10	1.00	35.4	59.9	4.76	0.35	13.6	-	-	-	-	-
11-2	6.3	-	-	-	8.0	1.4	0.12	0.52	16.2	62.0	1.05	0.09	11.7	-	-	-	-	-
11-3*	6.4	-	-	-	6.0	1.7	0.09	0.29	11.7	69.1	0.41	0.03	13.7	-	-	-	-	-

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
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6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

REMARKS:

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: fine-loamy, mixed, thermic Ultic Haploxeralfs
Sample No.: 83CA-107-12-(1-4*)
Lab No.:
County: Tulare
Location: 800 m N by NNW of Hospital Rock, 60 m E of Highway, in unsectionized T.16 S., R. 29 E., MDB&M
Date Sampled: 6-17-84
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1]	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ -2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density g/cc. [4]	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
12-1	0	15	18.0	3.9	3.2	2.4	8.7	19.8	38.0	45.6	16.4	12.1	L	1.4	2.2	25.2	11.1	14.1	–
12-2	15	27	10.2	2.9	3.1	2.6	9.1	20.7	38.4	45.0	16.6	12.4	L	1.5	2.2	20.2	9.6	10.6	–
12-3	27	60	20.9	3.4	3.1	2.4	9.3	20.1	38.3	41.7	20.0	15.8	L	1.8	1.8	17.3	9.6	7.7	–
12-4*	60	100	18.6	2.8	3.0	2.5	8.8	19.4	36.5	39.7	23.8	20.4	L	1.9	2.1	18.3	10.9	7.4	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
12-1	6.6	–	–	–	10.8	1.7	0.10	0.60	23.5	56.2	2.38	0.16	14.9	–	–	–	–	–
12-2	6.6	–	–	–	7.5	1.6	0.11	0.68	19.4	51.0	1.17	0.10	11.7	–	–	–	–	–
12-3	6.5	–	–	–	6.1	1.6	0.09	0.57	13.2	63.3	0.50	0.05	11.0	–	–	–	–	–
12-4*	6.4	–	–	–	6.5	1.9	0.11	0.56	14.8	61.3	0.38	0.04	9.5	–	–	–	–	–

1 BY WEIGHT OF FIELD SAMPLE
2 BY WEIGHT OF SOIL <2MM
3 PIPETTE METHOD
4 DENSITY OF AIR DRY CLOD
5 MOISTURE ON OVEN DRY BASIS
6 SODIUM BICARBONATE EXTRACTABLE
7 IN AMMONIUM ACETATE pH 7.0
8 BARIUM SATURATED
9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

Analyses by Soil Morphology Laboratory University of California Davis

REMARKS:

*Lowest horizon sampled in profile

PHYSICAL AND CHEMICAL SOIL ANALYSES
SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family loamy, mixed Lithic Cryumbrepts
Sample No. 83CA-107-13-(1-2*)
Lab No. _____ County _____

Location 150 m NE outlet to Emerald Lake in NE 1/4, NW 1/4 Sec. 25, T. 15 S., R. 16 E., MDB&M

Date Sampled 9-17-83
Date Reported _____
Analyst W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5 mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms	% Moisture at Saturation
13-1	0	5	32.6	30.2	18.7	8.8	12.0	8.1	77.8	17.6	4.6	3.1	FGLCS	–	1.14	13.1	5.0	8.1	–
13-2*	5	23	27.6	22.5	16.3	8.7	13.0	9.1	69.6	23.2	7.2	5.1	FGCSL	–	1.96	18.7	7.4	11.3	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
13-1	5.2	–	–	–	0.7	0.05	0.08	0.07	7.84	11.5	2.99	0.19	15.7	–	–	–	–	–
13-2*	5.2	–	–	–	0.5	0.04	0.12	0.14	11.26	7.1	3.13	0.22	14.2	–	–	–	–	–

Analyses by Soil Morphology Laboratory University of California Davis

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9 SOLUTION EXTRACTED FROM SATURATED PASTE
10 CBD METHOD

* est horizon sampled in profile

REMARKS: _____

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PART, CENTRAL PART

Soil Family: loamy-skeletal, mixed Entic Cryumbrepts
Sample No.: 83CA-107-14-(1-4*)
Lab No.:
County: Tulare
Location: 220 m ENE of outlet to Emerald Lake in NE¼ NW¼ Sec. 25, T. 15 S., R. 30 E., MDB&M
Date Sampled: 9-17-83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
14-1	0	6	31.7	30.2	19.2	9.6	13.7	9.4	82.1	13.4	4.5	3.3	FGLCS	–	1.2	13.7	7.5	6.2	–
14-2	6	28	25.7	25.4	18.5	8.6	12.5	9.1	74.1	19.6	6.3	4.3	FGCSL	–	1.4	14.3	8.2	6.1	–
14-3	28	55	37.3	21.6	15.9	8.4	13.4	8.4	67.7	21.1	11.2	7.9	FGCSL	–	2.6	19.6	10.2	9.4	–
14-4*	55	70	35.3	22.8	16.9	9.0	13.7	8.6	71.0	18.9	10.1	6.6	FGCSL	–	2.0	17.4	8.3	9.1	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
14-1	5.2	–	–	–	1.2	0.10	0.08	0.17	10.30	15.0	3.44	0.23	15.0	–	–	–	–	–
14-2	5.1	–	–	–	0.8	0.08	0.08	0.10	11.15	9.5	3.12	0.24	12.8	–	–	–	–	–
14-3	5.3	–	–	–	0.6	0.04	0.08	0.07	12.32	6.4	3.47	0.34	10.3	–	–	–	–	–
14-4*	5.4	–	–	–	0.6	0.03	0.07	0.06	9.72	7.8	2.18	0.18	12.3	–	–	–	–	–

Analyses by Soil Morphology Laboratory University of California Davis

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10 CBD METHOD

REMARKS:

*Lowest horizon sampled in profile.

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: loamy, mixed Histic Lithic Cryaquepts
Sample No.: 83CA-107-15-(1-3*)
Lab No.:
County: Tulare
Location: 220m SSE of outlet to Emerald Lake in the NW 1/4 Sec. 25, T. 15 S., R. 30E., MDB&M
Date Sampled: 9-17-83
Date Reported:
Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL [1] <5 mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms.	% Available Moisture 1/3 to 15 Atms.	% Moisture at Saturation
15-1	0	10	0.4	4.5	4.0	2.3	3.5	2.2	16.5	75.0	8.5	7.4	OL	0.43	9.0	97.3	85.3	12.0	-
15-2	11	25	2.1	10.6	6.4	4.0	9.1	9.8	39.9	47.5	12.6	10.2	OL	0.63	4.9	54.9	31.8	23.1	-
15-3*	25	37.5	1.1	4.9	5.3	4.4	14.8	16.9	46.3	40.5	13.2	10.1	L	0.94	3.2	42.2	16.2	26.0	-

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
15-1	4.4	-	-	-	5.3	1.50	0.19	0.95	52.1	15.2	28.7	1.56	18.4	-	-	-	-	-
15-2	4.7	-	-	-	0.6	0.14	0.14	0.23	25.7	4.3	16.4	0.75	21.9	-	-	-	-	-
15-3*	5.1	-	-	-	0.5	0.05	0.11	0.09	15.5	4.8	6.9	0.82	21.6	-	-	-	-	-

Analyses by Soil Morphology Laboratory University of California Davis

1 BY WEIGHT OF FIELD SAMPLE
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REMARKS:

*Lowest horizon sampled in profile

PHYSICAL AND CHEMICAL SOIL ANALYSES

SEQUOIA NATIONAL PARK, CENTRAL PART

Soil Family: sandy-skeletal, mixed Typic Cryorthents

Location: 630 m airline E by ESE of the outlet to Emerald Lake in NE 1/4 Sec. 25, T. 15S., R. 30E MDB&M

Date Sampled: 9-17-83

Date Reported: 3-20-84

Sample No.: 83CA-107-16-(1-3*)

Lab No.:

County: Tulare

Analyst: W. Allardice

HORIZON Sample No	DEPTH (cm) From	DEPTH (cm) To	% GRAVEL <10 mm	PARTICLE SIZE DISTRIBUTION [2] % Sand (mm.) VCS 2.0mm to 1.0mm	CS 1.0mm to 0.5mm	MS 0.5mm to 0.25mm	FS 0.25mm to 0.10mm	VFS 0.10mm to 0.05mm	TOTAL 2.0mm to 0.05mm	% Silt 50μ-2μ	% Clay [3] <2μ	<1μ	TEXTURE Lab.	Bulk Density [4] g/cc.	MOISTURE RETENTION DATA [5] % Moisture Retained Air Dry	1/3 Atm.	15 Atms	% Available Moisture 1/3 to 15 Atms	% Moisture at Saturation
16-1	0	5	39.3	19.1	18.4	12.5	17.8	8.9	76.7	17.5	5.8	3.8	FGLCS	–	1.08	12.1	4.7	7.4	–
16-2	5	43	44.7	26.5	19.5	11.6	16.0	8.2	81.8	12.6	5.6	3.8	FGLCS	–	0.95	8.7	4.3	4.4	–
16-3*	43	61	43.7	27.2	19.0	10.7	15.4	8.6	80.9	13.0	6.1	4.1	FGLCS	–	0.74	10.9	4.1	6.8	–

HORIZON Sample No.	pH Glass electrode (Saturated paste)	% Carbonates	ppm Phosphorus in the soil [6]	Fe as % Fe_2O_3 [10]	EXTRACTABLE CATIONS [7] (me./100 grams soil) Ca	Mg	Na	K	Cation Exchange Capacity [8] (me/100 grams soil)	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	WATER SOLUBLE CATIONS [9] (me./liter) Ca	Mg	Na	K	EC x 10^3 mmhos/cm
16-1	5.1	–	–	–	0.4	0.02	0.11	0.11	7.9	8.1	1.63	0.07	23.3	–	–	–	–	–
16-2	5.4	–	–	–	0.4	0.02	0.09	0.07	6.2	9.4	0.64	0.03	21.3	–	–	–	–	–
16-3*	5.4	–	–	–	0.2	0.02	0.11	0.05	6.4	5.9	0.32	0.02	16.0	–	–	–	–	–

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Analyses by Soil Morphology Laboratory University of California Davis

REMARKS:

*Lowest horizon sampled in profile

7.3

APPENDIX III

Glossary of Terms for Pedologic Studies in Sequoia National Park, Central Part, California

The following terms used in this report have specific meanings as used in: A. Geology; B. Pedology; and C. Vegetation studies (Soil-Vegetation Surveys of California)

A. Geology terms:

1. acid - said of igneous rocks that contain more than 60 percent silica; e.g. granite, granodiorite.

2. alluvium - general term for detrital deposits made in overbank flooding from stream channels.

3. amphibolitic schist - a foliated, metamorphic rock in which the mineral assemblages are mainly represented by hornblende and plagioclase.

4. basic - said of igneous rocks having relatively low silica content - roughly 45 to 50 percent; e.g. gabbro, diorite.

5. colluvium - a general term applied to loose and incoherent deposits on land slopes brought there chiefly by gravity and often lubricated by moisture. In this report, pertains mainly to earthy material, not rock fragments alone (see talus).

6. glacieret - a very small glacier on a mountain slope or in a cirque.

7. hillslope - an erosional land surface cut into the local rock of the countryside. In the singular, it includes a shoulder, backslope, and footslope. In this area, the summits, or ridge crests, are included in the context of discussion. Most commonly considered as part of a complex of hillslopes.

8. ice field - an extensive area of interconnected glaciers in a mountainous region.

9. intermediate - said of an igneous rock that is transitional between basic and acid; e.g. diorite.

10. joint - a surface of fracture or parting in a rock without displacement.

11. joint set - a group of more or less parallel joints.

12. joint system - two or more joint sets that intersect.

13. mafic - said of an igneous rock composed chiefly of dark ferromagnesian minerals; e.g. gabbro, diorite.

14. mica schist - a foliated metamorphic rock in which the mineral assemblages are mainly represented by biotite and plagioclase.

15. nunatak - an isolated knob or peak of bedrock that projects, or did project, well above the surface of a glacier or an ice field.

16. residuum - unconsolidated and partly weather mineral material accumulated by disintegration of consolidated rock in place.

17. schistose - said of a rock displaying the foliation of schist; e.g. mica schist.

18. strike - the direction taken by a structural surface.

19. talus - rock fragments lying at the base of the cliff or steep slope from which they have been derived.

B. Pedology terms:

1. argillic horizon - a mineral subsoil horizon that is characterized by accumulation of clay by translocation from overlying horizons, as well as by in-place formation. It must have a minimum thickness, a minimum increase in clay content in relation to the surface soils, and exhibit evidence of clay movement.

2. base saturation percentage - the extent to which the absorption complex of a soil is saturated with exchangeable cations other than hydrogen.

3. cambic horizon - a subsoil horizon of alteration by pedogenic processes rather than from significant accumulation by translocation within the soils.

4. dissimilar soils - significantly different from associated soils in one or more properties to the extent that behavior or major interpretations for various uses are appreciably different.

5. fine earth - mineral soil particles less than 2 mm in diameter.

6. lithic contact - a boundary between soil and underlying continuous, hard rock.

7. miscellaneous area - a mapping unit for areas of land that have little or no natural soil; e.g. rock outcrop.

8. paralithic contact - a boundary between soil and underlying continuous, coherent, soft or well-weathered rock.

9. particle size class - a grouping of textures that behave similarly in relation to soil-water/soil-air interaction.

   a. sandy-skeletal - rock fragments 2 mm or larger in diameter occupy 35 percent or more of soil volume; fine earth filling the interstices is sandy, as defined below.

   b. loamy-skeletal - rock fragments as above occupy 35 percent or more of soil volume; fine earth filling the interstices is loamy, as defined below.

   c. sandy - the texture of the fine earth is sand or loamy sand with less than 50 percent very fine sand; less than 35 percent rock fragments by volume.

   d. loamy - texture of the fine earth is loamy very fine sand, very fine sand, or finer, but amount of clay is less than 35 percent; rock fragments occupy less than 35 percent by volume.

      1. coarse-loamy - by weight, 15 percent or more of the sand is fine sand or coarser, including fragments to 7.5 cm in diameter; clay content is less than 18 percent.

      2. fine-loamy - by weight, 15 percent or more of the sand is fine sand or coarser, including fragments to 7.5 cm in diameter; clay content 18 to 35 percent.

   e. fine - textures that have 35 to 60 percent clay content.

10. pedon - the smallest practical volume that can be called "a soil", yet large enough to permit study of the nature of horizons present. Its vertical dimension is the depth of a complete profile; its area, roughly hexagonal in shape, ranges from 1 to 10 m^2, depending on the variability and continuity of its horizons.

11. similar soils - alike or much alike associated, but taxonomically distinct soils; can be expected to behave similarly, or there are no major differences in interpretation for various uses.

12. slope classes:

    reconnaissance map - nearly level: <5%; sloping to steep: 5 to 30%; very steep: 30 to 75%; extremely steep: >75%.

    order 1 map - nearly level: <5%; undulating to sloping: 5 to 15%; moderately steep: 15 to 30%; steep: 30 to 45%; very steep; 45 to 75%; extremely steep: >75%.

13. soil - bodies of unconsolidated mineral or organic matter on the surface of the earth, capable of serving as a medium for plant growth, whose unique properties are the product of processes controlled by factors of parent material, climate, organisms, and topography acting over a period of time.

14. soil association - a soil map unit in which two or more defined soil taxonomic units occurring together in a characteristic pattern are combined because the purpose of the map makes separate mapping impractical.

15. soil complex - a soil map unit consisting of two or more dissimilar soils or miscellaneous areas which cannot be mapped separately at the scale used. The components are identified in the unit name. Lesser areas of other kinds of soil or miscellaneous areas may occur as inclusions.

16. soil consociation - a soil map unit dominated by a single kind of soil, or by a single miscellaneous area. As a rule, at least half of each delineation of a soil consociation is of the same component providing the name for the map unit. Lesser areas of other kinds of soils or miscellaneous areas may occur as inclusions.

17. soil depth classes - very shallow: <25 cm; shallow: 25 to 50 cm; moderately deep: 50 to 100 cm; deep: 100 to 150 cm; very deep: >150 cm.

18. soil map unit - a cartographic representation of the perception of a phase of a soil taxonomic unit on the landscape. May represent one or more soil taxonomic units plus inclusions of other similar or dissimilar soils or miscellaneous areas.

19. soil moisture regime - presence or absence either of ground water, or water held at a tension of less than 15 bars, in a specific part of the soil (control section) by periods of the year.

    a. aquic - the whole soil is saturated and reducing conditions prevail for at least a few days when the soil temperature is above 5°C.

b. udic - the soil is not dry in any part of its control section for as long as 90 cumulative days in most years.

c. ustic - the soil is dry in some or all parts of its control section for 90 or more cumulative days, but it is usually moist more than half the time the soil temperature is above 5°C. The soil moisture pattern reflects significant summer rainfall or external sources of seepage water during the summer.

d. xeric - the soil is usually moist more than half the time the soil temperature is above 5°C, but is usually dry in all parts for 45 or more consecutive days during the summer, and is moist in all parts for 45 consecutive days during the winter. The soil moisture pattern reflects precipitation during the winter, but virtually none during the summer period.

20. soil phase - subdivision of a soil taxonomic unit on the basis of non-taxonomic criteria or properties that are important to the use or behavior or a soil.

21. soil temperature regime - classes of mean annual soil temperature that reflect the climate of the area, and relate to important behavior characteristics of the soil, as well as use potentials or limitations.

a. cryic - mean annual soil temperatures range from 0° to 8°C, and if well drained, have cool mean summer soil temperatures; if poorly drained, mean summer soil temperatures are cold.

b. frigid - mean annual soil temperatures range from 0° to 8°C, and have warm mean summer soil temperatures. The difference between mean summer and mean winter soil temperatures is greater than 5°C.

c. mesic - mean annual soil temperatures range from 8° to 15°C. The difference between mean summer and mean winter soil temperatures is greater than 5°C.

d. thermic - mean annual soil temperatures range from 15° to 22°C. The difference between mean summer and mean winter soil temperatures is greater than 5°C.

22. solum - the pedogenically developed part of the soil profile.

C. Vegetation terms:

1. cover class - defined range in percent of crown cover by woody vegetation of ground surface from a vertical view.

a. very open - less than 5 percent crown cover.

b. open - 5 to 20 percent crown cover.

c. semi-open - 20 to 50 percent crown cover.

d. semi-dense - 50 to 80 percent crown cover.

e. dense - 80 to 100 percent crown cover.

2. vertical zonality - effect of large mountainous areas on local climate through orographic uplift and increase in precipitation from lower to higher elevations, and decrease in mean air temperature through the adiabatic lapse rate in relation to elevation. The vegetation cover responds to and reflects this local climatic zonation. It is also an important influence on soil developmental differences in relation to elevation.

Abridged and adapted from:

1. Dictionary of Geologic Terms, 3rd. ed., 1984; prepared by the American Geological Institute, Bates, R.L. and L.A. Jackson, eds.

2. Glossary of Soil Science Terms, Jan 1978; Soil Science Society of America, Madison, WI.

3. Field manual for Soil-Vegetation Survey, California, Oct. 1954; U.S. Forest Service, California Forest and Range Experiment Station, Berkeley, CA.

4. Soil Survey Manual (Revised). 1979-1985. In-Service chapters prepared by staff Soil Conservation Service, Washington D.C. Appendix to National Soils Handbook.

7.4

Appendix IV

Map Errata for Pedologic Studies in Sequoia National Park, Central Part, California

General Soil Map

1. Soils of the Middle Mountain Zone

   Xf2 Xeralfs, mesic. This unit should be grouped with soils of the Foothill Zone.

Reconnaissance Soil Map

1. Sheet No. 2

   East edge of sheet at tic-mark 32'30": change symbol UhgF in delineation to UhhF.

2. Sheet No. 4

   a. Symbol missing in delineation WNW of Heather Lake and adjacent to delineation EdF. Add symbol JgnG.

   b. East edge of sheet at tic-mark 40-53. Delineation boundary missing closing off delineation JgnD just below 40-53; boundary should joint upper part of delineation Jg to the west and extend as a small loop on sheet No. 6, covering less than 1 ha of area. This correction produces a delineation without a symbol just west of 40-53. Label it JgnF.

   c. The word "Fork", in italics, is missing along north boundary of survey area northeast of "Lodgepole".

3. Sheet No. 5

   West edge of sheet; small partial delineation between tic-marks 32'30" and 40-45: change symbol JgpD to read JgpG.

4. Sheet No. 6

   a. Symbol missing in delineation on east side of Tamarack Lake. Add symbol JgnF.

b. West edge of sheet at tic-mark 40-53. Small part of delineation JgnD from sheet No. 4 is missing. A boundary line making a small loop covering less than 1 ha should enter sheet 200 m south of 40-53 and leave sheet 300 m south of same. Identify as JgnD.

c. Italic symbol "L" missing from lake delineation in PxdF NW of Hamilton Lake.

8.0 Literature cited

1. Harradine, F.F. 1954. Factors Influencing the Organic Carbon and Nitrogen Levels in California Soils. Thesis, Ph.D., University of California, Berkeley, California. 197 p., maps, diagrs., tables.

2. Huning, J.R. 1978. Hot, Dry, Wet, Cold and Windy. A. Weather Primer of the National Parks of the Sierra Nevada. Yosemite Natural History Association, Sequoia Natural History Association.

3. Soil Survey Staff. 1983-87. Revised Soil Survey Manual. Soil Conservation Service, USDA, Washington D.C.

4. _____. 1975 Soil Taxonomy. Soil Cons. Serv., USDA, USGPO, Washington D.C. (incl. periodic amendments through 1987).

5. _____. 1983. National Soils Handbook. Soil Conservation Service, USDA, Washington D.C. (periodically updated).

6. Survey Staff. 1954. Field Manual, Soil-Vegetation Surveys in California. US Forest Service, California Forest and Range Experiment Station, Berkeley, California.

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