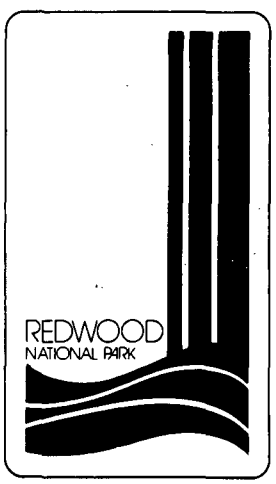
SOIL SERIES DESCRIPTIONS AND LABORATORY DATA FROM REDWOOD NATIONAL PARK



REDWOOD NATIONAL PARK
RESEARCH AND DEVELOPMENT

TECHNICAL REPORT **20**

AUGUST 1987

SOIL SURVEY PROJECT

In 1981, Redwood National Park began mapping soils in the lower Redwood Creek basin to support its watershed rehabilitation program. An interim soil survey is nearing completion. This report documents the classification of soils mapped in the park and provides representative soil laboratory data.

USING THIS REPORT

The section on soil series explains the rationale and historic context of soil classification in Redwood National Park. The section on laboratory investigations outlines the methods used, and then compares groups of soils from different environments in the park in terms of factors and processes responsible for soil formation.

For descriptions of the soil series, turn to Appendix A.

For laboratory data on the soils in Redwood National Park, turn to Appendix B, or call the Redwood National Park, South Operations Center Office in Orick, (707) 488-2911, to arrange for copies of the data in Lotus 123 worksheet format on 5.25 inch diskettes.

Appendix C contains a glossary of terms.

NOTICE

Information in this document is preliminary in nature, prepared on an interim basis. This information may be revised, updated and published as part of a U.S.D.A. Soil Conservation Service soil survey of Humboldt and Del Norte Counties, California.

-ERRATA-

Appendix B- page B-1, pedon 16:
Fine-mixed, mesic Ultic Hapludalf should be
Fine, mixed, mesic Mollic Hapludalf.

pages B-40 and B-41:
Pedon 16 is misclassified as Ultic Hapludalf.
It should be classified as Mollic Hapludalf.

SOIL SERIES DESCRIPTIONS AND LABORATORY DATA FROM REDWOOD NATIONAL PARK

JAMES H. POPENOE

Redwood National Park
Technical Report No. 20

U.S.D.I. National Park Service
Redwood National Park
Orick, California

In cooperation with
U.S.D.A. Soil Conservation Service National Soil Survey Laboratory
Oregon State University Soil Testing Laboratory
California Department of Forestry and
Fire Protection Soil-Vegetation Survey
University of California, Davis Soil Morphology Laboratory

August 1987

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

I am grateful to Dr. C.S. Holzhey for permission to publish results of laboratory investigations at the Soil Conservation Service (SCS) National Soil Survey Laboratory (NSSL) in Lincoln, Nebraska, and to Jim Mallory, Dave Smith and Gene Begg for permission to publish results from the Soil Morphology Laboratory at the University of California, Davis (UCD). The field and laboratory data represents the labors of more than 19 people over a period of eight years. The field personnel included Mark Alpert (MJA), Donna Cobb-Neillands (DC), Bruce Gordon (BRG), Jack Lewis (JL), Michael Minden (MM), Roy Martin (RWM), Kathy Pierce (KAP), Jim Popenoe (JHP), and Nancy Sturhan (NKS). The laboratory personnel included Mary Kay Amistadi (MKA), Lorrie Flint (LF), Patricia Gowland (PG), Barb Koepsell (BK), Ron Myhrum (RM) and Cindy Ziska (CZ) at Oregon State University (OSU); Bill Allardice (WRA), Tim Costello (TC), Mary Ann Menetrey (MAM) and Shelley Munn (SSM) at UCD; Bruce Gordon and Nancy Sturhan at Humboldt State University (HSU); and unknown workers at NSSL. Roy Martin prepared graphics for the figures. Joanne Moore and Sherry Romanini did the word processing. Sherry Romanini thought of using Lotus 1-2-3 spreadsheets for the laboratory printouts. She then created the spreadsheets and entered all the data.

ABSTRACT

This report describes and discusses ten forest soil series used in the Redwood National Park soil survey in the Redwood Creek basin, and laboratory investigations of 31 pedons sampled in the Redwood Creek basin and Little Bald Hills areas of the park.

Soil series concepts have changed since 1961, when the first Soil-Vegetation surveys of present park lands were published. New soil series are more narrowly defined, more categorical and more practical than the earlier ones. Of the ten series mapped in the park, the Atwell series is updated from a former description, and the Ahpah, Coppercreek, Devilscreek, Elfcreek, Fortyfour, Lackscreek, Slidecreek, Tectah and Trailhead series are new. All present series have been reviewed and given tentative status under the National Cooperative Soil Survey (NCSS).

The laboratory data provide support for identification of the soil series, and give baselines and comparisons for land management. Soil properties vary with differences in bedrock, subsurface drainage, vegetation and relief. The soils formed on serpentine in the Little Bald Hills have low Ca/Mg ratios. The soils formed on schist contain more iron oxide than those formed on sedimentary rocks. Imperfectly drained, mottled soils have higher subsurface base saturation and exchangeable Mg than well drained soils. Under forests and oak woodlands, exchangeable Ca and base saturation are higher near the soil surface than in the subsoil. In well drained soils under prairies, Ca and base saturation exhibit little change with depth. Surface horizons of prairie soils have higher C and N, and have lower C/N ratios than surface horizons under forest. The soils on gentle, upper mountain slopes are generally redder, higher in clay and lower in clast content than soils found on lower slopes and near stream channels.

I. INTRODUCTION

A. Purpose of report

This report is the first of three on soils in Redwood National Park. The second report will describe soil climate and the third will be a soil survey, describing the distribution and management of the soils.

This first report addresses two goals. One goal is to make public some fundamental, descriptive data on soil resources. The samples are primarily from natural, undisturbed soils. The numbers can be interpreted as baseline information, for assessment of degradational change under use, or as goal levels for assessment of recovery from a disturbance or success of rehabilitation. Quantification of soil properties helps scientists and managers to understand the role and relative significance of the biotic, hydrologic and geomorphic processes which shaped the soils. Management means human interaction in natural processes. Under National Cooperative Soil Survey standards, most predictions of soil behavior, potential for use, hazards and limitations are derived from interpretation of fundamental physical and chemical data.

A second goal is to document the soil concepts used in the soil survey of the Redwood Creek watershed. Our knowledge base is not standing still. The soil survey is based on concepts of the 1980's. Soil survey concepts and methods have changed and will continue to change as needs and knowledge grow. If conceptual criteria are well defined and, at the same time, the basic resource data are readily accessible, the survey is easier to update. The soils database is also easier to expand, adapt, and modify for uses by scientists and land managers.

B. Description of area

Redwood National Park is in the northwest corner of California along the Pacific coastline south of Crescent City (Figure 1). The terrain is varied and picturesque. There are broad beaches and nearly level, uplifted marine terraces around Crescent City and broad alluvial valleys at Klamath and Orick. Contrasting with these are the spectacular, high sea cliffs south of Crescent City and Klamath and the mountainous Coast Range, rising to a maximum of 944 m (3,097 feet) in the park at Schoolhouse Peak.

The park is within a tectonically active region, and much of it is undergoing rapid uplift. Janda et al. (1975) calculate that Redwood Creek has incised at an average rate of 0.4 mm yr^{-1} to 1.2 mm yr^{-1} from late Pleistocene to present. The combination of high relief with incoherent Franciscan bedrock and a rainy climate results in naturally high rates of erosion and susceptibility to accelerated erosion. Major geologic units in the park include mountains underlain by sedimentary

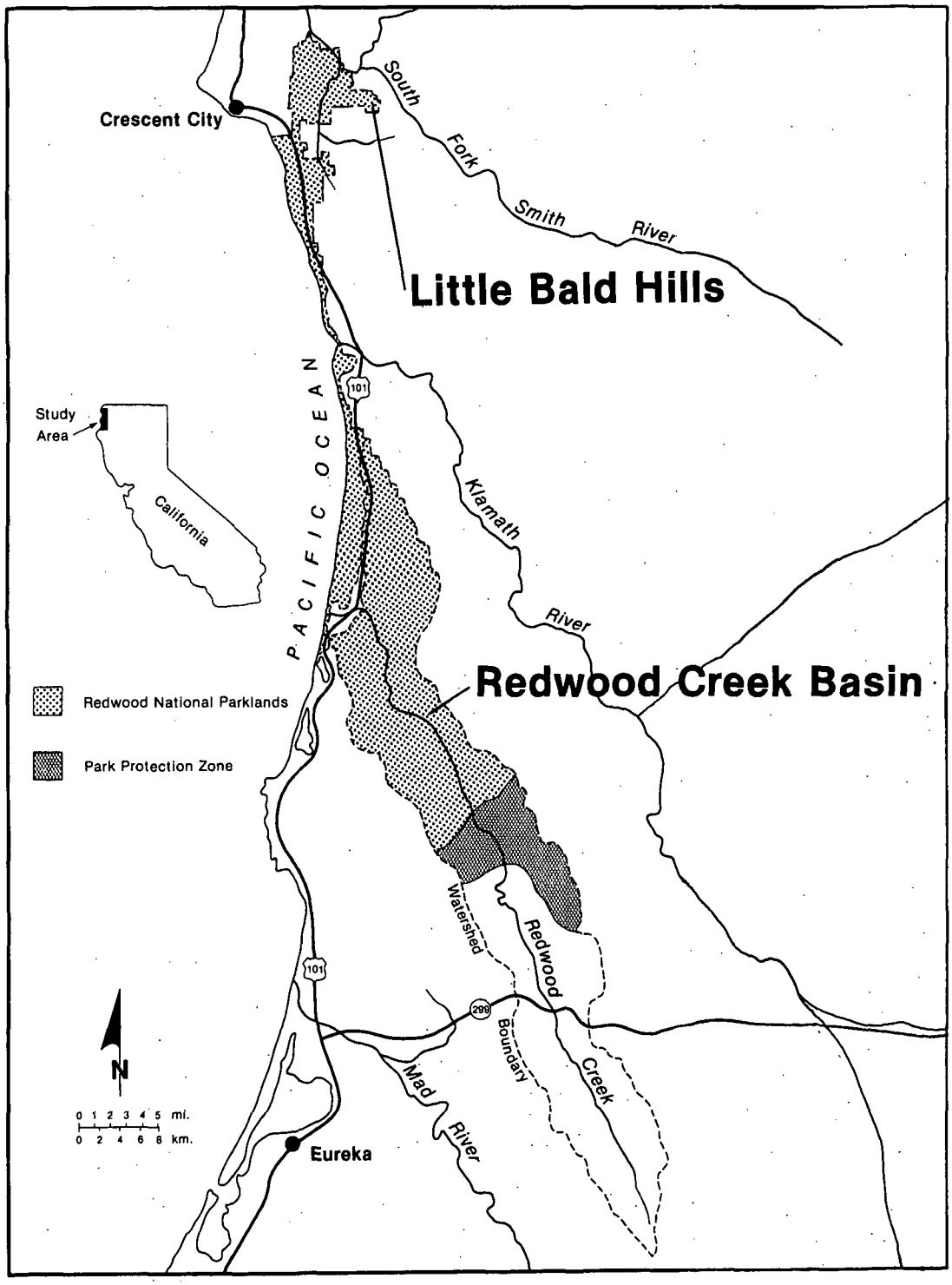


Figure 1. Redwood National Park location.

and schist rocks of the Franciscan Assemblage and serpentine rocks in the Little Bald Hills east of Crescent City. In addition, there are coastal plains sediments of the Gold Bluffs Formation north of Orick, which are primarily of Klamath (plutonic) origin (Strand, 1962), and alluvial valleys of mixed lithology. Each of these geologic units, and associated relief, strongly influences the nature of the soils, depending on their chemical and minerological composition, susceptibility to weathering and erosion. This report describes only the soils formed on Franciscan sedimentary and schist rocks and on serpentine. Figure 2 shows the sampling locations of soils on Franciscan terrain in the Redwood Creek basin. Figure 3 shows the sampling locations of soils on serpentine in the Little Bald Hills.

The climate of the park is characterized by mild temperatures with rainy winters and nearly rainless but foggy summers. Mean January temperature is 8.2°C (46.8°F) and mean July temperature is 14.8°C (58.7°F) in Klamath. The moderating effect of the Pacific ocean diminishes, going eastward, so the more inland areas have colder winters and warmer summers than Klamath. Yearly precipitation ranges from about 1800 to 2500 mm (70 to 100 inches), 95 percent of which falls from October to May (Elford and McDonough, 1974).

The vegetation most common on the Franciscan Assemblage in the park is old-growth or second-growth conifer forest. Important trees include coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*) and tanoak (*Lithocarpus densiflorus*). Understory shrubs include tanoak, black huckleberry (*Vaccinium ovatum*) and Pacific rhododendron (*Rhododendron macrophyllum*). There is an herb layer with dense swordfern (*Polystichum munitum*) in moist locations. Red alder (*Alnus rubra*) now dominates the canopy in most logged areas. Muldavin et al. (1981) provide more detail on climatic gradients and succession in forests of the lower Redwood Creek basin in Redwood National Park.

Grasslands, known locally as "bald hills prairies," occur on ridges and south-facing slopes above the forests east of Redwood Creek. Some of the more common species are California oatgrass (*Danthonia californica*), dogtail (*Cynosurus echinatus*), plaintain (*Plantago lanceolata*) and foxtail fescue (*Vulpia bromoides*) (Hektner et al., 1983). Many prairies are fringed by Oregon white oak (*Quercus garryana*) at the forest boundary. The oak fringe widens into an oak woodland further inland in the Copper Creek tributary basin and beyond. The oak woodlands are small in area, but have greater numbers of plant species than either the forests or the prairies (Reed and Sugihara, in press). The Bald Hills area was home to the Chilula Indians until the time of the gold rush and white settlement (Goddard, 1914). The use of fire in this Native American culture, and subsequent changes in burning practices, have exerted a strong influence on vegetation patterns and dynamics in the Bald Hills (Sugihara and Reed, in press) and probably on the underlying soils.

Special vegetation occurs on the serpentine soils in the Little Bald Hills. The ridgetops have pine savannas with Jeffrey pine (*Pinus jeffreyi*) and Idaho fescue (*Festuca idahoensis*). Downslope, on deeper soils, there is a greater density of trees and a shrub understory. Douglas-fir is dominant so that the vegetation is a Douglas-fir/ Jeffrey-pine forest. Coffeeberry (*Rhamnus californica*), western azalea (*Rhododenron occidentale*) and black huckleberry (*Vaccinium ovatum*) are typical understory shrubs.

The soil climate depends on the kind of vegetation, elevation and distance from the coast. Soils beneath redwood forest average isomesic soil temperature regimes (terminology follows that of Soil Survey Staff 1975) and udic soil moisture regimes. The difference between mean summer and mean winter soil temperature averages slightly less than 5°C (9°F) (Hauxwell et al., 1981; Sturhan, in preparation). The grasslands and oak woodlands offer less thermal cover. Annual fluctuations in soil temperature are wider, and the soil temperature regimes are mesic or thermic. Soils lose moisture during the dry summers. However, under redwood forests, the drying is very gradual. Sturhan (in preparation) found that drying is incomplete in most years, even at depths as shallow as 10 cm below the soil surface. In the oak woodlands, she found thorough drying, but only for a period of 30 to 40 days before onset of fall rains. Thus, soils under the oaks are udic/mesic. Soils under prairies are assumed to dry more quickly and stay dry for a longer time; these are tentatively judged xeric/mesic near the coast and above 600 m (2000 feet) inland; they are xeric/thermic at lower elevations, inland.

C. Review of literature

The earliest published soil study in northwestern California is the soil survey of the Eureka area by Watson et al. (1925). This survey names soil series and contains one or more descriptions of each of the named soils. There are tables on particle-size distribution for each soil. Although the soil descriptions are fragmentary by today's standards, there is enough information to recognize central series concepts, based on the major diagnostic horizons and particle-size classes.

The most extensive soil investigations for the region are the cooperative Soil-Vegetation Surveys of upland soils (Alexander et al., 1952-1978) and the University of California surveys of alluvial and terrace soils (McLaughlin and Harradine, 1965, 1966; Singer and Begg, 1975). The investigators describe soil profiles in standard format (Soil Survey Staff, 1951) and sample 15 profiles in Del Norte County and 69 profiles in Humboldt County for characterization. The laboratory data were published recently in Begg et al. (1984). Just as today, these soil investigators adapted or introduced soil series with names and formal descriptions correlated through the Soil Conservation Service. McLaughlin and Harradine published series descriptions in their survey reports, but the Soil-Vegetation Survey did not. Some series descriptions used in the Soil-Vegetation Surveys were published

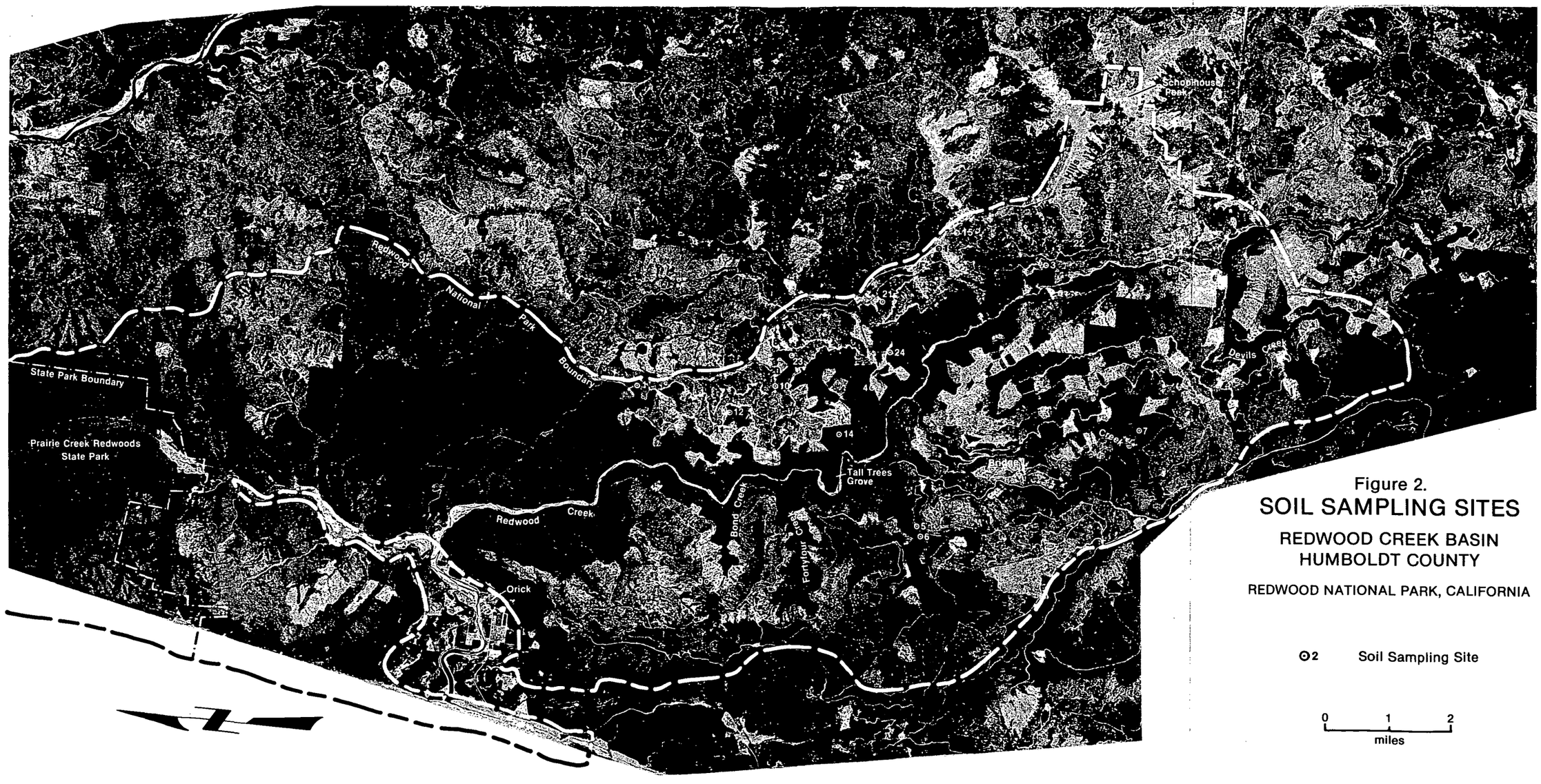


Figure 2.
SOIL SAMPLING SITES
REDWOOD CREEK BASIN
HUMBOLDT COUNTY
REDWOOD NATIONAL PARK, CALIFORNIA

⊙2 Soil Sampling Site

0 1 2
miles

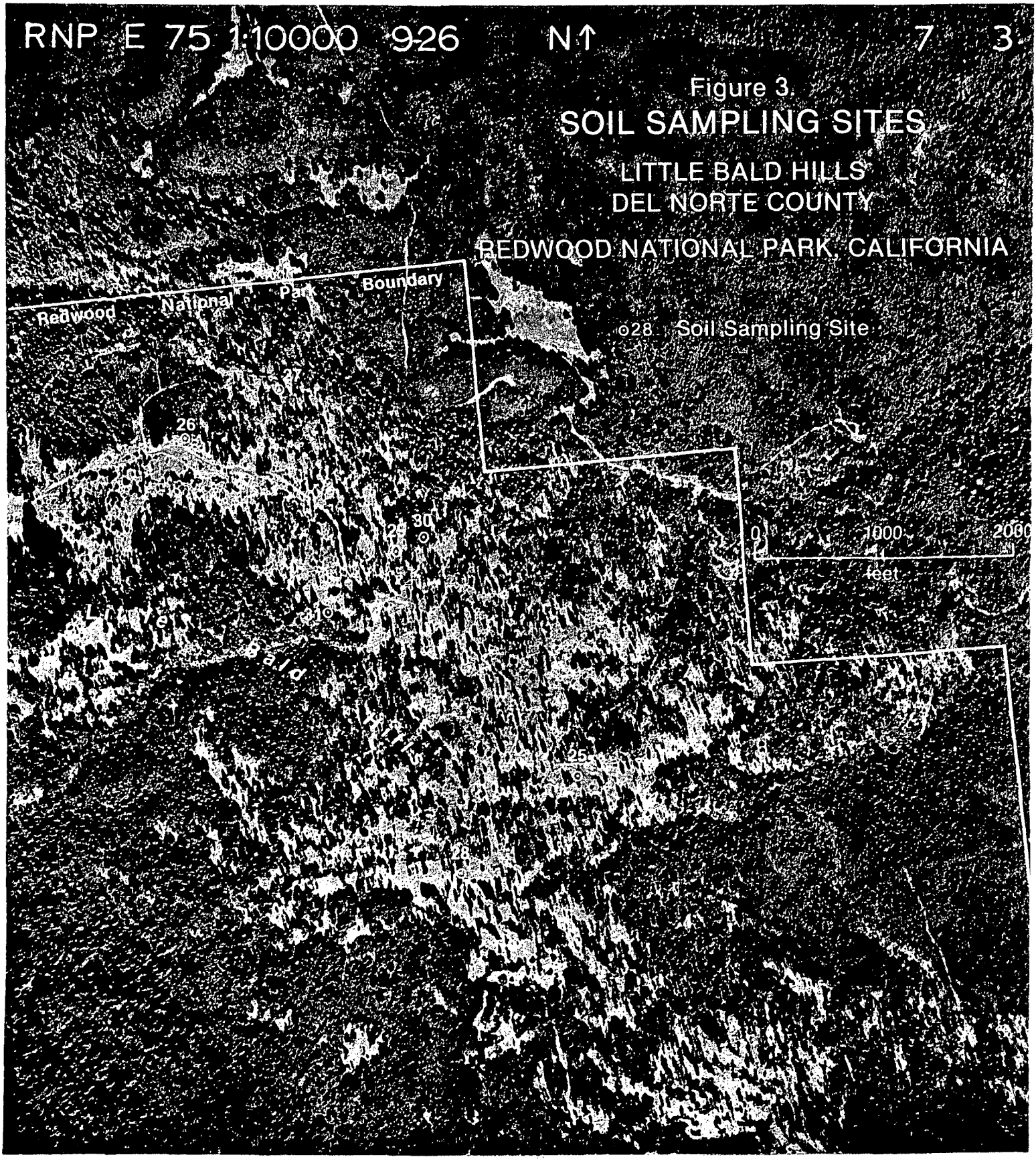

RNP E 75 1:10000 9-26 N↑ 7 3
Figure 3.
SOIL SAMPLING SITES
LITTLE BALD HILLS
DEL NORTE COUNTY
REDWOOD NATIONAL PARK, CALIFORNIA
Redwood National Park Boundary
28 Soil Sampling Site
27
26
30
29
25
0 1000 2000
feet

Table 1. Depth ranges of some major forest soils mapped in 1961 Soil-Vegetation Survey.

Series	Symbol	Depth range
Atwell	823	36 - 72"
Hugo	812	30 - 60"
Masterson	821	30 - 60"
Melbourne	814	30 - 60"
Orick*	813	40 - 70"
Sites	816	40 - 70"

*Name never appraised by State Soil Correlation Committee.

Data are from Table C., of Legend and Supplemental information to accompany Soil-Vegetation maps of California, Quadrangles 10D-4 and 11C-2, 1961.

Table 2. Modern classifications and depth ranges of series mapped in 1961 Soil-Vegetation Survey.

Series	Classification	Depth and Other
Atwell	Fine, mixed, isomesic Mollic Hapludalfs	>60", mottled at 30 - 60 inches
Hugo	Fine-loamy, mixed, mesic Dystric Xerochrepts	40 - 60" to a paralithic contact
Masterson	Loamy-skeletal, micaceous, mesic Typic Xerumbrepts	20 - 40" to a lithic contact
Melbourne	Fine, mixed, mesic Ultic Haploxeralfs	>40" to bedrock
Orick	None, Never appraised	
Sites	Clayey, oxidic, mesic Xeric Haplohumults	60 - 80" to a paralithic contact

series are all extensive in areas with schist bedrock, formerly mapped as Masterson. Therefore, these series now replace both the Masterson and Hugo soils mapped in the 1961 Soil-Vegetation Survey.

Another consideration in updating old soil mapping is to insure that soils in the survey area are really enough like soils at the series type locale to manage them in the same way. Soil climate is one important factor, and it is taken into account in the modern classification system. Table 2 shows the modern classifications and depth classes of soil series named in the 1961 Soil-Vegetation Survey legends. The modern Hugo, Masterson, Melbourne and Sites series have been defined with xeric soil moisture regimes and mesic soil temperature regimes. These soil climatic regimes occur under forest vegetation in the inner coast range, Klamath, southern Cascade and Sierra Nevada mountains in California. In those locations, the seasonal variation in temperatures and the intensity and duration of summer drought are much greater than under the redwood forests of the north coast. While morphological similarities exist among the soils, management is quite different, and it would not be appropriate to map these series in Redwood National Park today.

The original Atwell series, located under redwood forest in Humboldt County, is considered unambiguous and valid, so it is simply updated to current standards. In addition, new Devilscreek and Elfcreek series were introduced, replacing the Atwell, schist phase (symbol 823m) on the 1960's Soil-Vegetation maps. All of these soils are wet and subject to mass movement. However, the Atwell soils are clayier and formed in materials rich in argillites that are cohesive and very slowly permeable. Atwell soils most commonly undergo slump-earthflow failures after long, wet periods. Devilscreek and Elfcreek soils have much lower clay contents are more permeable and less cohesive and are most susceptible to debris flows and debris slides associated with intense, but typically shorter, periods of precipitation. The obvious differences in soil properties, processes and management warranted separate series for the soils.

Efforts to update the proposed Orick series, initially favored, were abandoned on closer examination. Field evidence suggested that areas mapped as Orick did not represent a single, natural population on the landscape and that the Orick concept actually straddled several higher taxa. Laboratory data from the proposed Orick type profile appear in Begg et al. (1984), pp. 203-204. This pedon is in the Trailhead series. It is located in Redwood National Park in the Fortyfour Creek sub-basin near the A-9-9 road. It has moist hue of 5YR and CEC/clay ratio of less than 24 meq/100g throughout the Bt horizon. In the range of characteristics for the proposed Orick series (Laacke, 1979, p. 174), the Bt horizon has hues of 7.5YR to 5YR, sometimes 2.5YR in the lower part. However, laboratory data from Bt horizons of deep Humults with clayey particle-size class and 7.5YR or yellower hues, both in Begg et al. (1984) and in this report, show that the clays have moderate exchange activity, ranging from 24 to 40 meq/100g. They are assumed to have

mixed mineralogy and are now in the Tectah series. The redder Humults, with hues of 5YR or 2.5YR, have clays with lower exchange activity, ranging from 16 to 24 meq/100g, and oxidic mineralogy. If 7.5YR and 5YR soils are in different higher taxa, they cannot be in the same series. On re-mapping, it is apparent that Tectah soils are relatively uncommon on schist bedrock. Soil transects in areas previously mapped as Orick in Redwood National Park during the 1961 Soil-Vegetation Survey average about 45 percent Trailhead, 20 percent Coppercreek and only 4 percent Tectah soils. In all likelihood, some of the 7.5YR soils mapped as Orick were Coppercreek soils, with a fine-loamy particle-size class.

C. Official series descriptions

Soil series and classifications for the soil survey in the Redwood Creek watershed are given in Appendix A. The series are described in standard format (USDA, 1983a), with a supplement to explain how the soil was classified (USDA, 1978), following the Soil Taxonomy (Soil Survey Staff, 1975), amendments (USDA, 1983b, 1986) and California State Correlation Committee proposals. The descriptions were submitted to the Soil Conservation Service and reviewed prior to adoption of the tentative series. Series names have been reserved under the National Cooperative Soil Survey, but these series will remain in a tentative status until a soil survey is completed for the region.

Classifications of the series are revised from earlier drafts (Weaver et al., in press; Marron and Popenoe, 1986), based on new laboratory data and changes in taxonomy. During field mapping, although some clay films were noted, the clay increases seemed too gradual in Coppercreek and Lackscreek soils to meet the criterion of an argillic horizon. Laboratory data showed that a weak argillic is actually present, making these Humults, rather than Tropepts. The Trailhead series, recognized already for its very thick, red argillic horizon, was found to have slightly less than 10 percent weatherable minerals in the control section. Given this new information, the Trailhead series is in the Palehumults, according to the USDA (1983b) key.

The USDA (1986) amendment to the Soil Taxonomy affects classifications of six of the soil series in Redwood National Park. The main purpose of this amendment is to create new taxa for some tropical soils missed in the Soil Survey Staff (1975) system. However, in addition, certain great groups have been eliminated, including the Tropudalfs, Tropudults, Tropohumults and Palehumults. Using the new key, soils in Redwood National Park that were in these great groups are now Hapludalfs, Hapludults, Haplohumults, and Haplohumults, respectively. Table 3 lists the series, classified according to the USDA (1983b) key. Table 4 shows classifications according to the USDA (1986) key. Unfortunately, the Tectah and Trailhead series are both in limbo under this new amendment. According to the key they are Haplohumults. However, the Haplohumults have been re-defined to have an argillic horizon with clay decreasing "...from its maximum amount by more than 20 percent of that maximum

Table 3. Classifications of soil series in Redwood National Park (USDA 1983b key).

Series	Classification	Depth and Other
Ahpah	Fine-loamy, mixed, isomesic Typic Humitropepts	20-40" to paralithic contact
Atwell	Fine, mixed, isomesic Typic Tropudalfs	>60", mottled at 30-60"
Coppercreek	Fine-loamy, mixed, isomesic Typic Tropohumults	>40" to paralithic contact
Devilscreek	Fine-loamy, mixed, isomesic Typic Humitropepts	>60" to paralithic contact, mottled at 20-60"
Elfcreek	Loamy-skeletal, mixed, isomesic Typic Eutropepts	>60" to paralithic contact
Fortyfour	Clayey, oxidic, isomesic Typic Tropudults	20-40" to paralithic contact
Lackscreek	Loamy-skeletal, mixed, isomesic Typic Tropohumults	20-40" to lithic contact
Slidecreek	Loamy-skeletal, mixed, isomesic Typic Humitropepts	>40" to lithic contact
Tectah	Clayey, mixed, isomesic Typic Tropohumults	>60" to paralithic contact, 10YR to 7.5YR Bt
Tectah Variant	Fine-loamy, mixed, isomesic Typic Tropohumults	20-40" to paralithic contact
Trailhead	Clayey, oxidic, isomesic Orthoxic Palehumults	>60" to paralithic contact, 5YR to 2.5YR Bt

Table 4. Classifications of soil series in Redwood National Park (USDA 1986 key).

Series	Classification	Depth and Other
Ahpah	Fine-loamy, mixed, isomesic Typic Humitropepts	20-40" to paralithic contact
Atwell	Fine, mixed, isomesic Mollic Hapludalfs	>60", mottled at 30-60"
Coppercreek	Fine-loamy, mixed, isomesic Typic Haplohumults	>40" to paralithic contact
Devilscreek	Fine-loamy, mixed, isomesic Typic Humitropepts	>60" to paralithic contact, mottled at 20-60"
Elfcreek	Loamy-skeletal, mixed, isomesic Typic Eutropepts	>60" to paralithic contact
Fortyfour	Clayey, oxidic, isomesic Typic Hapludults	20-40" to paralithic contact
Lackscreek	Loamy-skeletal, mixed, isomesic Typic Haplohumults	20-40" to lithic contact
Slidecreek	Loamy-skeletal, mixed, isomesic Typic Humitropepts	>40" to lithic contact
Tectah	Clayey, mixed, isomesic Typic Haplohumults	>60" to paralithic contact, 10YR to 7.5YR Bt
Tectah Variant	Fine-loamy, mixed, isomesic Typic Haplohumults	20-40" to paralithic contact
Trailhead	Clayey, oxidic, isomesic Typic Haplohumults	>60" to paralithic contact, 5YR to 2.5YR Bt

within 150 cm of the soil surface..." The Tectah and Trailhead series have thick argillic horizons with clay remaining at least 80 percent of its maximum to depths of 150 cm or more. Other series in California have the same characteristic. The California State Soil Correlation Committee is currently drafting a proposal to reinstate the Palehumults great group for Humults with thick argillic horizons. Alternatively, the definition for the Haplohumults could be broadened to include Humults with thick argillic horizons. It seems likely that there will be more proposals and adjustments before the USDA (1986) amendment is fully refined and widely known. The pedon and series classifications given in the Appendices are based on the proposal from California to reinstate the Palehumults, although it is uncertain if the proposal will be adopted.

The forest soil temperature regimes assigned to series in Redwood National Park are based on the average of five years of data in western Humboldt County. Further re-classification is possible, depending on the outcome of soil climate monitoring now in progress. Hauxwell et al. (1981) found isomesic soil temperature regimes under forest in western Humboldt County from 1977 to 1980. Sturhan (in preparation) found mesic soil temperature regimes under forest in Redwood National Park from 1984 to 1986. The average of the studies is isomesic, but the cause of the difference is still unresolved. Another year of monitoring at both sets of sites will help in deciding which soil temperature regime is correct in Redwood National Park.

III. SOIL LABORATORY INVESTIGATIONS

A. Background

The soil laboratory data reported here were collected initially for a variety of reasons. For about half of the pedons, samples were analyzed to facilitate watershed rehabilitation and help characterize soil series. Pedons in the prairies and oak woodlands of the Bald Hills were sampled to help fill gaps in knowledge so that these types of vegetation could be maintained. Natural, undisturbed soil profiles were sampled in the vicinity of the W-Line watershed rehabilitation unit (80-5) for comparison with experimental vegetation plots on the treated road. Soils in the Little Bald Hills, on serpentine, were sampled for baseline data, against which to measure potential air-quality impacts. Clearly, there is no one hypothesis than can be tested by an analysis of this collection of data. However, all the pedons are valuable in the context of a survey of soils in the park and the region. Pedons can be grouped logically, and comparisons can be made and discussed. It was not practicable to discuss every kind of difference in a survey report, such as this, but an effort was made to address the major points.

B. Methods

Procedures and results were described in the traditional units of measurement for laboratory investigations in soil science in the United States (SCS, 1972). Use of these units facilitated direct comparison with other published laboratory data from California (Begg et al., 1984, 1985; SCS, 1973; Soil Survey Staff, 1975). However, there were minor differences between these units and units of the SI system (Le Systeme International d'Unites), used in publications such as the Journal of the Soil Science Society of America. The concept of "equivalents" translated to "moles of charge" in the SI system, so the traditional unit, "meq/100g", used to measure cation retention in soils, became "cmol(+)kg^{-1}" in the SI system.

Sampling generally followed recommended soil survey procedures (SCS, 1972, p. 7). A departure was that pedons 9, 11, 13, 15 and 22 were sampled from bankcuts on abandoned logging spurs, dug back to expose fresh soil. All other pedons were described and sampled from backhoe- or hand-dug pits. Sample volumes ranged from about 2 to 4 liters (1/2 to 1 gallon). Each sample included material taken from the whole cross section of the sample horizon in order to best represent its mean properties. On returning from the field, samples were split. Part of the sample was archived in quart cannisters and part shipped to the soil testing laboratory. Wet samples were allowed to dry at room temperature for two weeks before shipping.

The volume percent rock fragments > 2 mm was calculated from laboratory data, when available, by converting the weight estimate to a volume estimate using bulk density:

$$\text{Vol.\% > 2 mm} = \frac{Dp\ (1 - y) \times 100}{Dp\ (1 - y) + Dbm\ (y)}$$

where Dp = particle density, > 2 mm fraction
Dbm = moist bulk density, < 2 mm fraction
y = weight fraction, < 2 mm fraction

Field estimates of volume > 2 mm were used when bulk density and weight percentages were not determined. Rock fragment percentages were the only data reported as volume fractions. All the other lab data were weights or weight fractions.

Particle-size distribution of the < 2 mm fraction was determined by the pipette method and by sieving and weighing the sand fractions (SCS 1972, pp. 10-12). The majority of the work was done at the Soil Physics Laboratory at OSU. However, the Atwell and Tectah pedons were done at UCD. NSSL did particle-size distributions as noted.

Moist bulk densities were determined by Nancy Sturhan at HSU using duplicate saran-coated clods (SCS 1972, pp. 14-15).

Moisture retention was determined by pressure-plate extraction (SCS 1972, pp. 16-17). All of the laboratories did some moisture retention work, but those published here were determined by Nancy Sturhan at HSU, unless otherwise noted, or if her initials were absent.

Soil pH was measured by glass electrode at all labs. The glass-electrode field measurements at RNP and the lab measurements at OSU employed a 2:1 ratio of distilled water to soil (Berg and Gardner 1978, pp. 3-4). However, NSSL used a 1:1 ratio (SCS 1972, p. 59), and UCD used a saturated paste. Some difference in pH may have resulted from the different methodology.

Cations were extracted using 1N ammonium acetate at pH 7.0 and measured by atomic absorption or emission spectrophotometry (Berg and Gardner 1978, pp. 11-12; SCS 1972, p. 24).

Cation exchange capacity (CEC) was determined by the ammonium acetate method (Berg and Gardner 1978, pp. 19-20; SCS 1972, pp. 22-23). In addition, for the Coppercreek and Lackscreek pedons (pedons 3 and 10), cations were summed with exchangeable hydrogen to obtain the sum-of-cations CEC (SCS 1972, p. 23). This was necessary to ascertain the taxonomic placement of the soils. NSSL always determined CEC by both methods.

Base saturation was calculated from meq extractable cations and CEC:

$$B.S. = \frac{(Ca + Mg + Na + K)}{CEC} \times 100\%$$

Organic carbon was determined at all the laboratories by the Walkley-Black (acid dichromate) method (Berg and Gardner, 1978, pp. 15-16; SCS, 1972, p. 26), and total nitrogen was determined by micro-Kjeldahl digestion and distillation (Berg and Gardner, 1978, pp. 21-22; SCS, 1972, pp. 29-30). Weights of carbon and nitrogen per square meter area were calculated, if bulk density and > 2 mm data were available:

$$\text{Kg O.C. } m^{-2} = 10\ t\ (1 - Rf)\ Cf\ Dbm$$

$$\text{Kg O.N. } m^{-2} = 10\ t\ (1 - Rf)\ Nf\ Dbm$$

where t = horizon thickness (cm)
Rf = fraction > 2mm, by volume
Cf = fraction O.C., by weight, in < 2 mm
Nf = fraction O.N., by weight, in < 2 mm
Dbm = moist bulk density in < 2 mm

Extractable phosphorus was determined by the dilute-acid fluoride method at OSU (Berg and Gardner, 1978, p. 9-10).

Tables reporting data from NSSL include code letters (such as 1B1A, 2A1, 2B), documenting each analytical procedure used. Most of the procedures are described in either SCS (1972) or in SCS (1984). Although some refinements are not yet published, NSSL can provide the most recent information.

C. Statistical analysis

The purpose of the statistical analyses was to ascertain whether soil properties differed significantly from one environment to another and, if so, to describe how they differed. Data from the soils described by Gordon (1980) were included with the more recent data for a more complete picture of soil resources in the south area of the park. Pedons were grouped on the basis of two factors, vegetation and drainage. Five vegetation types and two drainage classes were used in the analysis. The vegetation types were prairie, Douglas-fir-invaded former prairie, oak woodland, old-growth forest greater than 100 m from prairie boundaries, and old-growth forest within 100 m (downslope) of prairies. The drainage classes were well drained and imperfectly drained. Soils in the imperfectly drained class had water-related mottles, with matrix or mottle chroma of 2 or less, within 150 cm of the soil surface. Soils in the well drained class lacked water-related mottles within 150 cm.

The number of pedons, by treatment, is given in Table 5. Enough pedons were sampled from the Redwood Creek basin in Humboldt County to make multiple comparisons on the soil chemical data. However, too few pedons from the Little Bald Hills in Del Norte County were available to compare in this way and, overall, there were too few physical characterizations to compare physical soil properties by environment.

Besides grouping by factor, the data were recalculated at standard depths, because soil properties varied greatly by depth and the horizons recorded for different pedons varied in the depth of their horizon boundaries. The depths selected were 10, 25, 50, 100 and 150 cm below the mineral soil surface. Soil test levels at each of these depths were interpolated by a computer program that constructed a smooth curve through levels at the centerpoints of each horizon. Recalculated data were then analyzed on the HSU Cyber computer using SPSS (Nie et al., 1975). First, the ANOVA procedure tested for the presence of differences. Since no imperfectly drained soils were characterized in Douglas-fir-invaded prairies, the data set was not balanced, and two separate analyses of variance were necessary to compare all classes of treatments. Two criteria were used to judge the relevance of differences identified in the analysis of variance. The F statistic had to be significant at the 95 percent level and the sum of squares for the test factor had to be at least 10 percent of the total sum of squares. Whenever both criteria were met, the ONEWAY procedure, with Duncan's multiple range test, was run to identify the elements that differed, and the differences were described and discussed.

D. Results

Results of the individual laboratory measurements are presented in Appendix B. Summaries of analyses of variance on the recalculated data appear in Tables 6 and 7. Table 8 summarizes the elemental content of pedons to a depth of 1 m where data allowed the calculations.

Mean soil pH varied most by vegetation type, as follows:

Vegetation type	Douglas-fir	Prairie	Oak woodland	Forest	Adjacent forest
pH	5.11	5.36	5.48	5.52	5.92

Douglas-fir-invaded prairies were the most acid; old-growth forests adjacent and downslope from prairies were the least acid. Lines beneath data connect pH values which were not statistically different (p = .95), according to Duncan's multiple range test. Variation in pH by depth and drainage class was small.

Table 5. Number of pedons, by vegetation type and drainage class.

Vegetation type	Well drained 1/	Imperfectly drained 2/
Prairies	9	6
Douglas-fir invaded prairies	10	
Oak woodlands	1	2
Adjacent forest 3/	1	2
Forest 4/	11	4

1/ No water-related mottles, chroma of 2 or less, within 150 cm of mineral soil surface.

2/ Mottles present, chroma of 2 or less, within 150 cm of mineral soil surface.

3/ Within 100 m of prairie boundary, downslope.

4/ Further than 100 m from prairie boundary.

Table 6. Summary of analyses of variance on all but the Douglas-fir-invaded (former prairie) soils.

Soil test	Summary of significant effects					
	Veg.	Drain	Depth	Veg. x drain	Veg. x depth	Drain x depth
pH	**11.0	** 8.7		* 5.6		
Ca	**19.9	**18.3	**10.6	** 4.6	** 8.6	
Mg	** 6.2	**10.1	**10.2	* 4.2	* 9.8	
K	** 9.4	* 2.3	**39.2			
Na	* 6.1					
BS	**18.4	**29.5	** 5.4	** 10.8		** 4.6
CEC	**20.5	* 1.3	**41.0	** 3.6		
OC	** 7.6	** 1.9	**65.0	** 3.4	** 3.5	
N	**27.8	* 0.6	**38.8	** 3.4	**10.2	
C/N	** 7.4		**39.8		** 9.4	
P	* 6.8					

*,** Significant at the 0.05 and 0.01 probability levels, respectively. Number is percent of total sum of squares.

Table 7. Analyses of variance on chemistry of well drained soils in all five vegetation types.

Soil test	Summary of significant effects		
	Veg. type	Sample depth	Veg. x depth
pH	** 25.3		
Ca	** 21.7	** 18.8	* 14.1
Mg	** 28.9	** 12.1	
Na	* 8.8		
K	** 19.5	** 39.0	
CEC	** 15.8	** 50.0	
BS	** 52.0	* 4.5	
OC	** 13.7	** 63.5	** 4.7
N	** 31.3	** 36.4	** 9.3
P	* 8.7		

*, ** Significant at the 0.05 and 0.01 probability levels, respectively. Number is percent of total sum of squares.

Table 8. Elemental content of mineral soils to depth of one meter.

Pedon Number	Soil	Wt. (Kg ha^{-1} m^{-1})				
		O.C.	Total N.	Exch. Ca	Exch. Mg	Exch. K
Forest soils:						
2	Atwell	227,500	19,242	16,800	4,853	3,761
3	Coppercreek	117,500	4,800	1,568	801	1,325
5	Coppercreek	241,200	15,443	9,400	1,015	1,415
6	Devilscreek	150,058	11,726	4,825	897	562
10	Lackscreek	133,500	5,800	2,327	866	1,068
12	Tectah	162,089	9,306	3,349	1,492	1,449
14	Trailhead	227,280	7,580	6,510	1,298	1,371
All forest	$\bar{x}$	179,875	10,557	6,397	1,603	1,564
	s	50,864	5,274	5,306	1,455	1,017
Prairie and oak woodland soils:						
17	Umbrept 1/	188,800	13,330	2,129	535	674
21	Humult 2/	432,684	26,847	741	174	338

1/ Loamy-skeletal, mixed, mesic Typic Haplumbrept in oak woodland.

2/ Fine-loamy, mixed, mesic Xeric Haplohumult in prairie.

Significant differences were found in the exchangeable cations, Ca, Mg and K, by vegetation type, drainage class and depth. However, the differences in Na were minor. Mean Ca and Mg levels were lowest in the Douglas-fir-invaded prairies, highest in the old-growth forest adjacent to prairies. Ca levels were highest near the soil surface in all the woody vegetation types, decreasing to minima at depths of 30 to 70 cm, but they did not vary significantly with depth in the prairies. Mean Ca levels were lower in well drained than imperfectly drained soils. Mg levels increased with depth from 100 cm to 150 cm in imperfectly drained soils, but they did not vary significantly with depth in well drained soils. K levels were highest near the soil surface, decreasing with depth to minima at 100 cm and below. Mean K levels were highest in the forest and lowest in the prairies. Base saturation patterns largely reflected the patterns of the constituent cations, especially Ca and Mg.

CEC, OC and N exhibited the greatest variation with depth. All had their maximum levels near the soil surface, and decreased regularly with depth. The type of vegetation influenced this pattern. Prairies and Douglas-fir-invaded prairies had the highest CEC, OC and N, old-growth forests the lowest. Soils in prairies and Douglas-fir-invaded prairies also showed more gradual decreases in levels with depth for these tests than soils under forest. The ratio C/N was widest in soils under forest, narrowest in soils in prairies. The differences in levels of acid-fluoride extractable P were minor for the factors considered in the analysis.

E. Discussion

1. Organic matter distribution

The distribution of organic matter, by depth, is a reflection of the biological and surficial processes active at each site. Organic carbon and nitrogen have similar distributions (Figures 4 and 5). The distribution for CEC is also much like carbon and nitrogen because, with the soils so rich in organic matter, a large fraction of the exchange capacity of the upper horizons is due to exchange sites on organic molecules.

The pattern of OC, N and CEC, by depth, differs among vegetation types. Prairies and former prairies invaded by Douglas-fir are darker in color, richer in OC, N and CEC than old-growth forests to a depth of at least 50 cm. Moreover, OC falls off more rapidly with depth in the forest soils than in the prairie soils (Figure 4). The reason for these differences may be the dominant modes of organic matter accretion. Forest trees cycle much organic matter through litterfall, and they have woody, often coarse roots. Grassland species have dense, fine, fibrous root systems. Growth and death of small roots is the primary pathway for soil organic turnover in the prairies. Ratios of C/N are wider in the upper horizons of soils in the forest than in the upper horizons of soils in the prairies and oak woodlands (Figure 6). The wider C/N ratios under forest probably reflect a higher proportion of lignin and other resistant woody

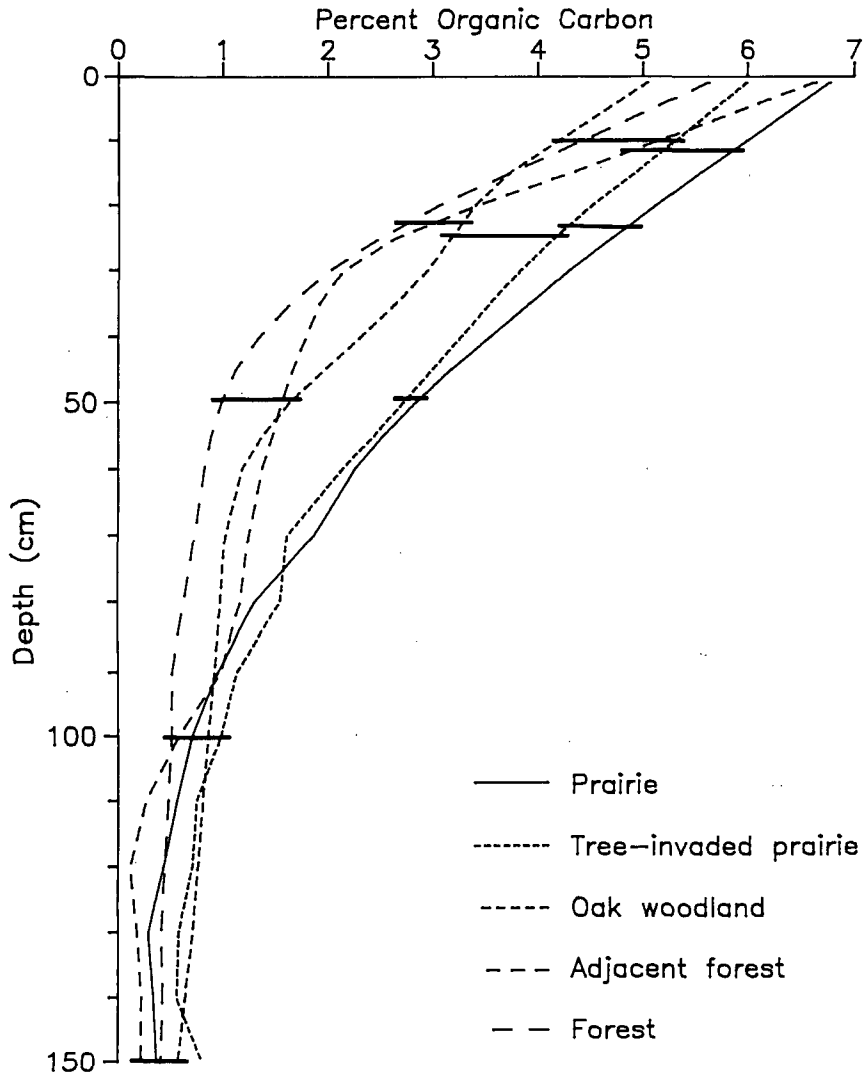


Figure 4. Organic carbon by depth and vegetation type. Horizontal bars show range overlaps, according to Duncan's multiple range test ($p = 0.95$), at depths of 10, 25, 50, 100 and 150 cm.

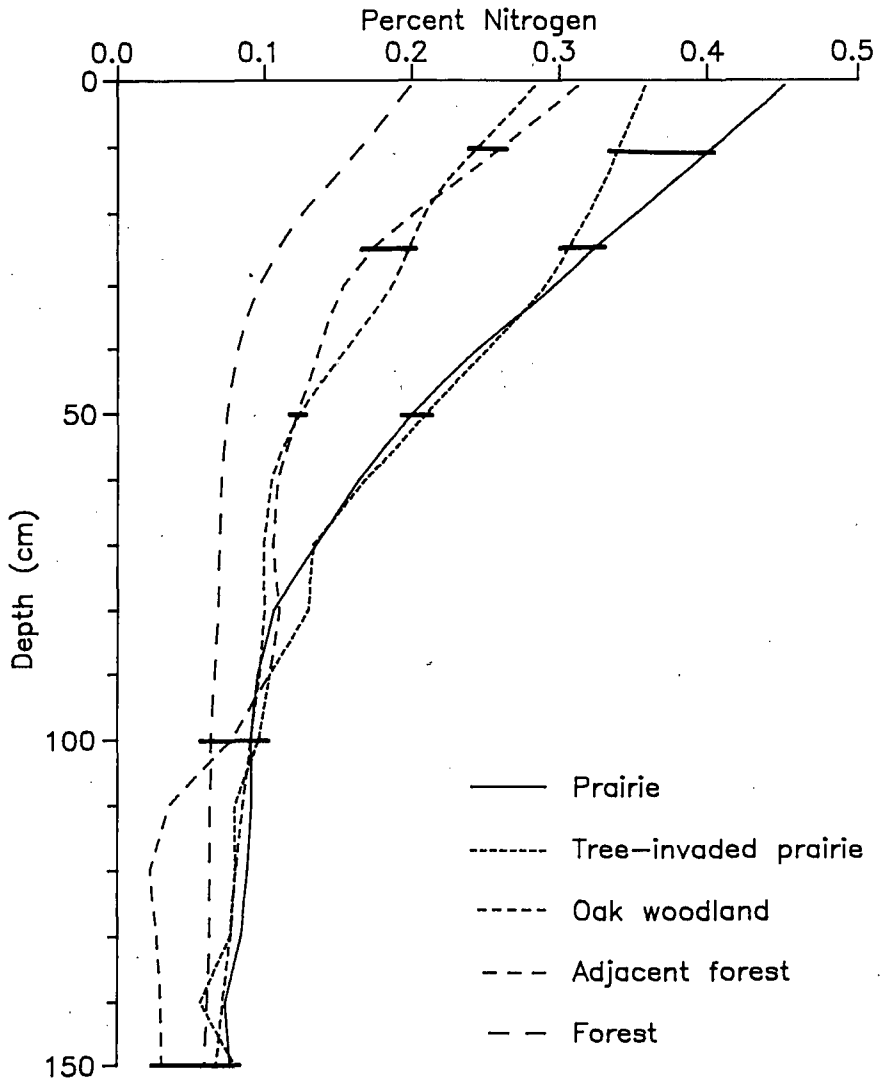


Figure 5. Total nitrogen by depth and vegetation type. Horizontal bars show range overlaps, according to Duncan's multiple range test ($p = 0.95$), at depths of 10, 25, 50, 100 and 150 cm.

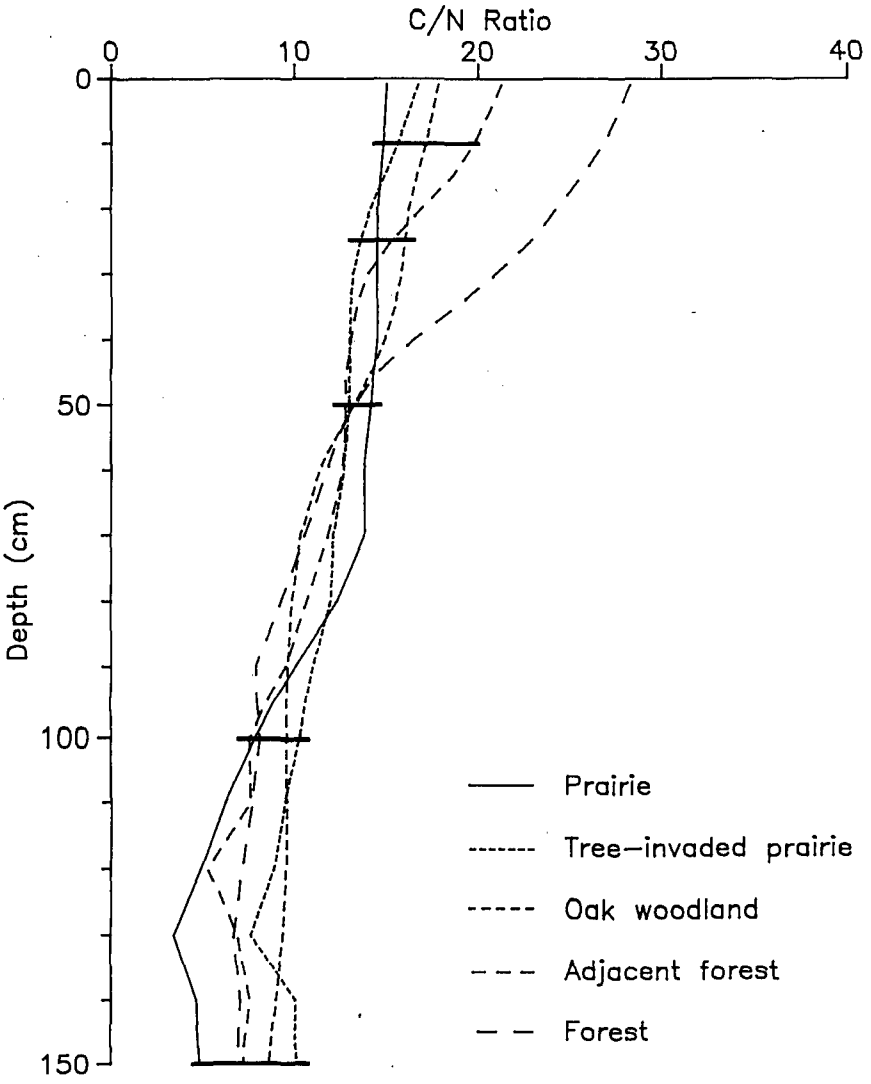


Figure 6. Ratio C/N by depth and vegetation type. Horizontal bars show range overlaps, according to Duncan's multiple range test (p = 0.95), at depths of 10, 25, 50, 100 and 150 cm.

residues in the organic matter of the forest soils. Geist and Strickler (1970) and Begg et al. (1984, 1985) also report wider C/N ratios under conifer forests than grasslands, so this is apparently a common soil-vegetation relationship in the western United States.

The rates of input and output from the soil carbon and nitrogen pools are unknown. However, there are clues associated with disruptive historic changes in the vegetation. Douglas-fir began encroaching into the prairies and oak woodlands about 50 to 100 years ago (Reed and Sugihara, in press). The lack of difference in soil color, OC and N between Douglas-fir-invaded and prairie vegetation types implies that soil organic matter turnover took longer than 100 years. If the turnover were more rapid, patterns of organic matter in the young Douglas-fir forests would more closely resemble those in the old-growth forests. The vegetation patterns had to have been spatially stable over a longer time to achieve such a distinctive pattern of soils. It would be valuable to know how long the vegetation was actually stable. Measurements of ^{14}C ages, interpreted as reflecting mean residence time for soil C (Hurst and Burges, 1967), could be used to estimate the rate of organic turnover in soils beneath the different plant communities. This information would help in evaluating the stability of the plant-community boundaries in the past and in formulating long-term management objectives for the prairies and oak woodlands.

2. Cation distribution and pH

The distributions of cations, by depth, are quite complex, and probably reflect a number of processes, both biotic and abiotic. Potential sources of cation enrichment for soil horizons include biological cycling, weathering of primary minerals, wind-blown ash from fires, cation-rich baseflows in seepage waters and salty aerosols from the ocean. The depletion of cations is generally caused by leaching.

The simplest case is Na. A number of facts suggest that soil exchangeable Na is in approximate equilibrium with the Na in atmospheric precipitation, and that the primary source of the atmospheric and soil Na is ocean salt. First, the exchangeable Na in the soil does not vary appreciably by vegetation type, drainage class or depth. Thus, there is no evidence that Na is actively accumulated and cycled by the vegetation, that it is a major constituent in weathering products or that it concentrates in seepage waters. Second, Na levels in the waters of Redwood Creek and its tributaries are remarkably constant through the year and throughout the hydrograph of individual storms (Bradford and Iwatsubo, 1978). Finally, the average Na level of 0.174 meq/100g in soils of Redwood National Park is more than twice the average found in soils under a similar preciptation regime in the Sierra Nevada Mountains (Begg et al., 1985; SCS, 1973). Ocean salt contains other cations, too, so the pattern in Na is useful for comparison. Ca levels (in ppm) in

precipitation in Redwood National Park are of the same order of magnitude as Na, whereas K and Mg levels are roughly a tenth as high (Bradford and Iwatsubo 1978). Ratios of Ca/Mg reflect the elemental ratios of the parent materials, modified by subsequent processes, including leaching and nutrient cycling. The low Ca/Mg ratios in samples from the Little Bald Hills are typical of soils on serpentine. Higher Ca/Mg ratios are near the soil surface than at depth due to active cycling of Ca by woody vegetation.

a. Effect of vegetation on cations in upper horizons

Overall, levels of all macronutrient cations, Ca, Mg and K, and resulting base saturation are higher in old-growth forest communities than in prairies and invaded prairies (Figures 7, 8, 9, and 10). Oak woodlands average intermediate levels. Forest and oak woodland communities exhibit higher Ca and base saturation at a depth of 10 cm than at 50 cm. Concentration of Ca in upper horizons of the woody plant communities can be accounted for by biological cycling. Ca is an integral part of the pectate material between cell walls of wood. Once there, Ca is not readily translocated from senescing tissues. Therefore, Ca must annually accumulate in the new growth of trees and return to the forest floor as leaves are shed (Powers, 1976). Much more Ca is returned to the soil surface by annual litterfall of woody vegetation than is returned by the annual dieback of herbaceous foliage. In Redwood National Park, the process is apparently most intense under the conifer forests, although all the woody plant communities show higher Ca near the mineral soil surface. In the Douglas-fir-invaded prairies, the increase in Ca near the soil surface is smaller than in the old-growth forests. Biological cycling has apparently raised the concentration of Ca at the surface, but overall Ca for the Douglas-fir profiles is still low, compared to old-growth forests. This suggests that more time is required to accumulate than to redistribute Ca or, perhaps, that because biomass is increasing, the trees are accumulating Ca in the manner of an aggrading ecosystem, as described by Bormann and Likens (1979).

In most pedons found under woody vegetation, a minimum in Ca and base saturation is at a depth of 30 to 70 cm below the mineral soil surface (Figure 11). Since these minima vary in depth, they are only weakly detected by the statistical procedure, which compares levels at a fixed depth of 50 cm. A procedure using the actual minimum would have been more powerful statistically, but not all pedons exhibit minima. In any given pedon, a minimum in Ca and base saturation can be interpreted as a zone of high permeability and intense biological activity, separated from the zone of accretion at the forest floor. The high pore density of the A and upper B horizons facilitates movement of water and oxygen. There are many roots and other biota in this zone respiring and generating CO_2. Ballard (1968) estimates that CO_2 in well drained forest soils can build to as much as 10 to 15 times levels in the ambient atmosphere. McColl and Cole (1968) demonstrated experimentally that CO_2 mobilizes cations in soil solution. High levels of CO_2 and rapid flux of water are both conducive to cation leaching and probably account for the low base

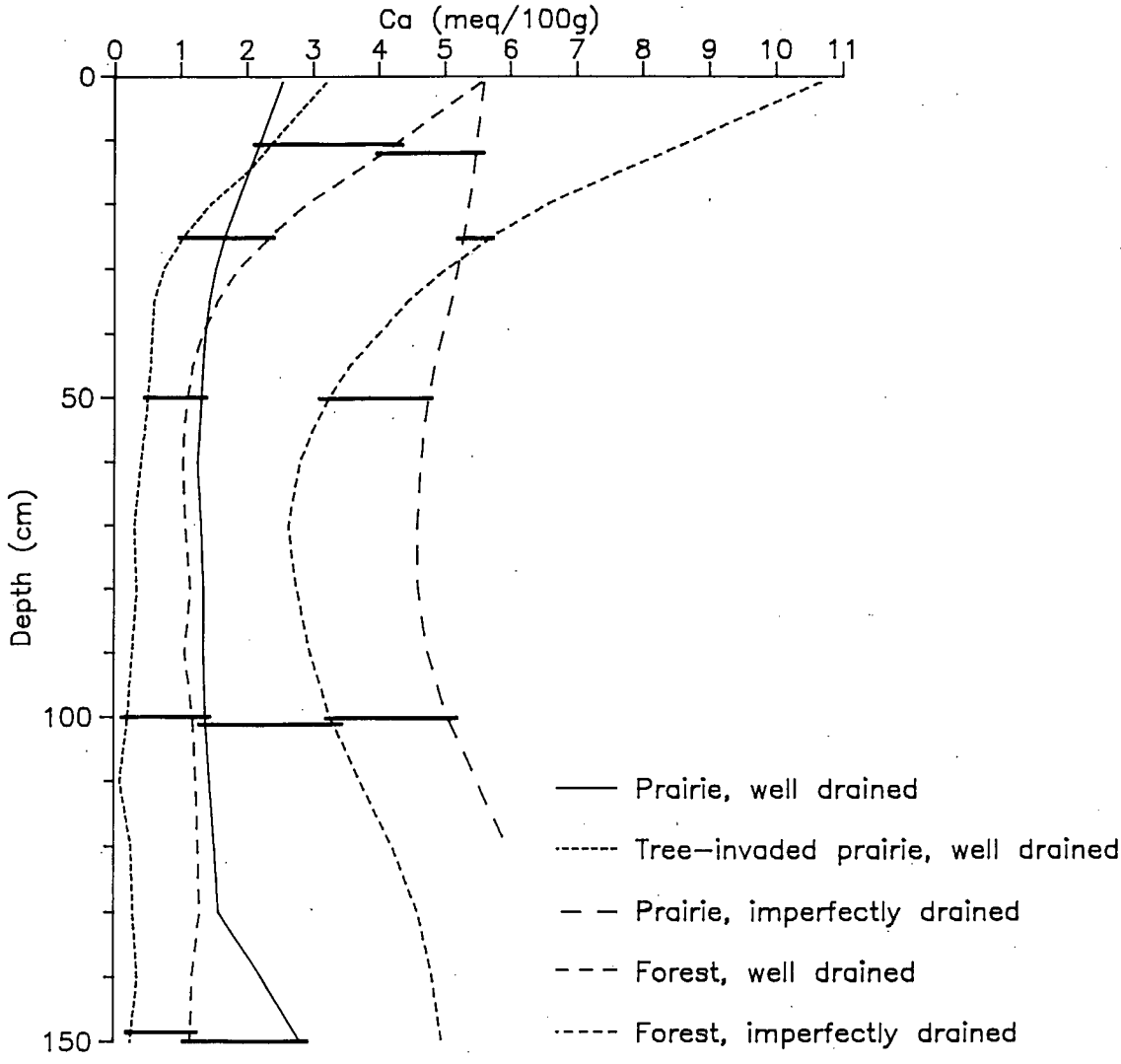


Figure 7. Exchangeable calcium by depth, vegetation type and drainage class. Horizontal bars show range overlaps, according to Duncan's multiple range test (p = 0.95), at depths of 10, 25, 50, 100 and 150 cm.

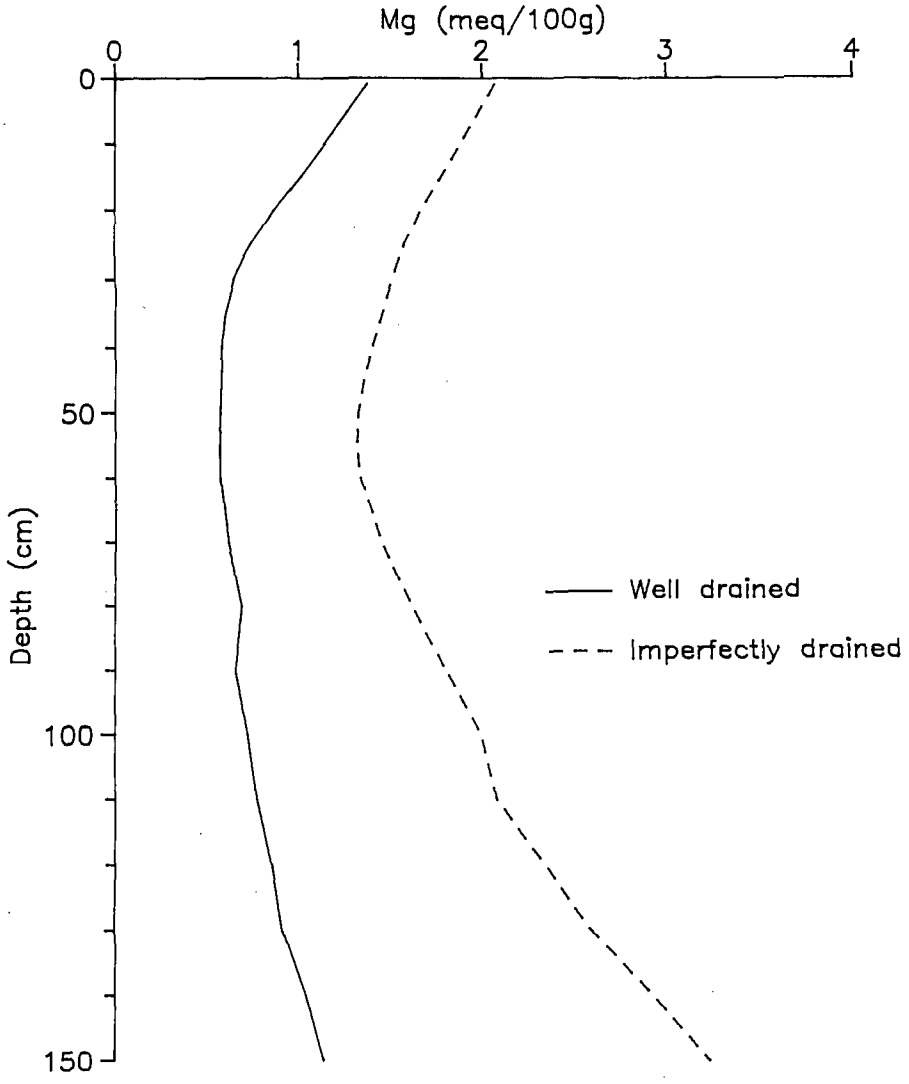


Figure 8. Exchangeable magnesium by depth and drainage class. Differences are statistically significant at all depths.

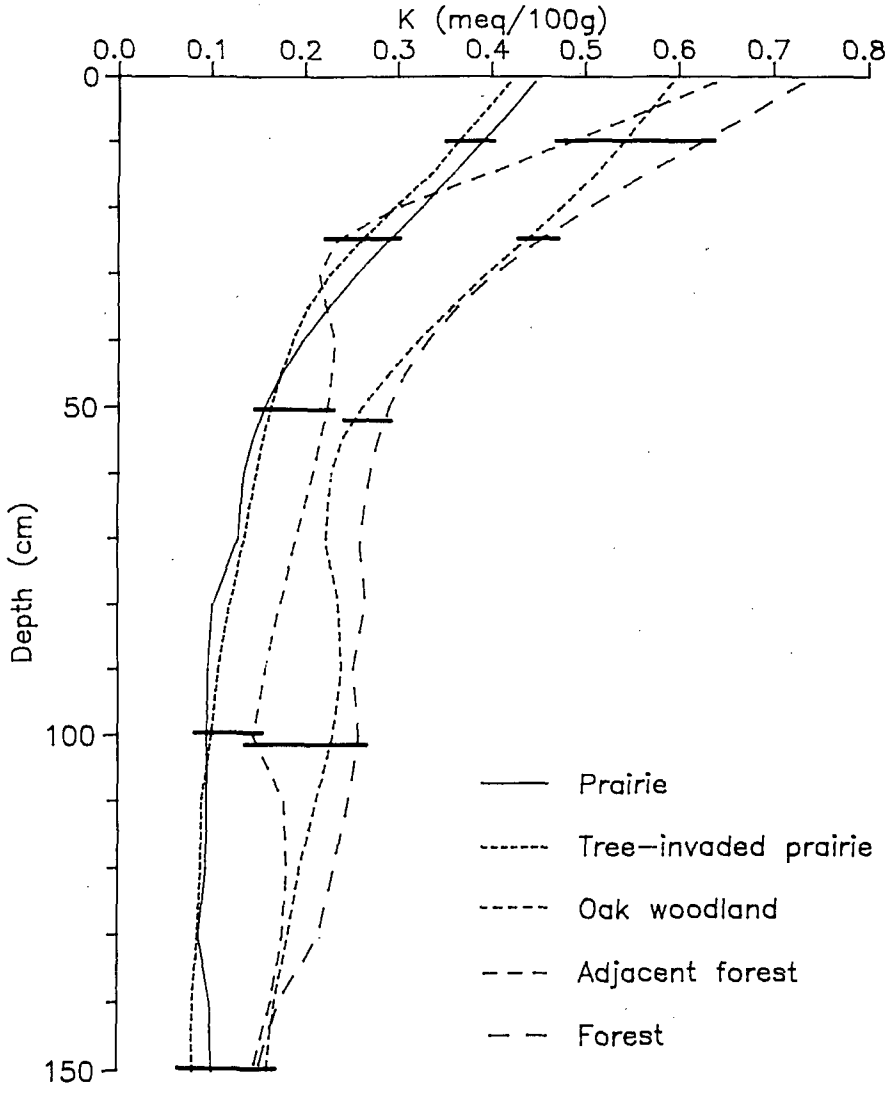


Figure 9. **Exchangeable potassium by depth and vegetation type. Horizontal bars show range overlaps, according to Duncan's multiple range test (p = 0.95), at depths of 10, 25, 50, 100 and 150 cm.**

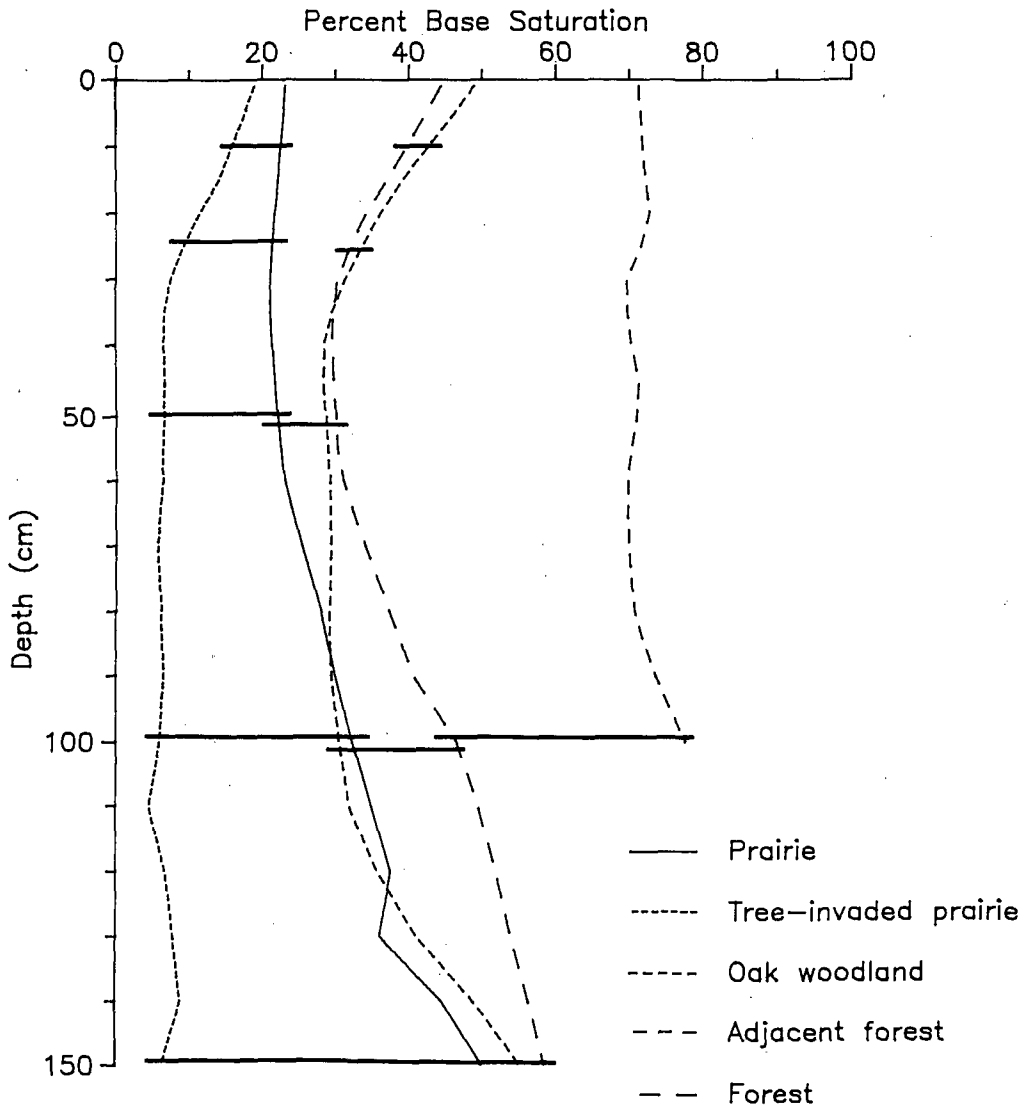


Figure 10. Mean base saturation by depth and vegetation type. Horizontal bars show range overlaps, according to Duncan's multiple range test (p = 0.95), at depths of 10, 25, 50, 100 and 150 cm.

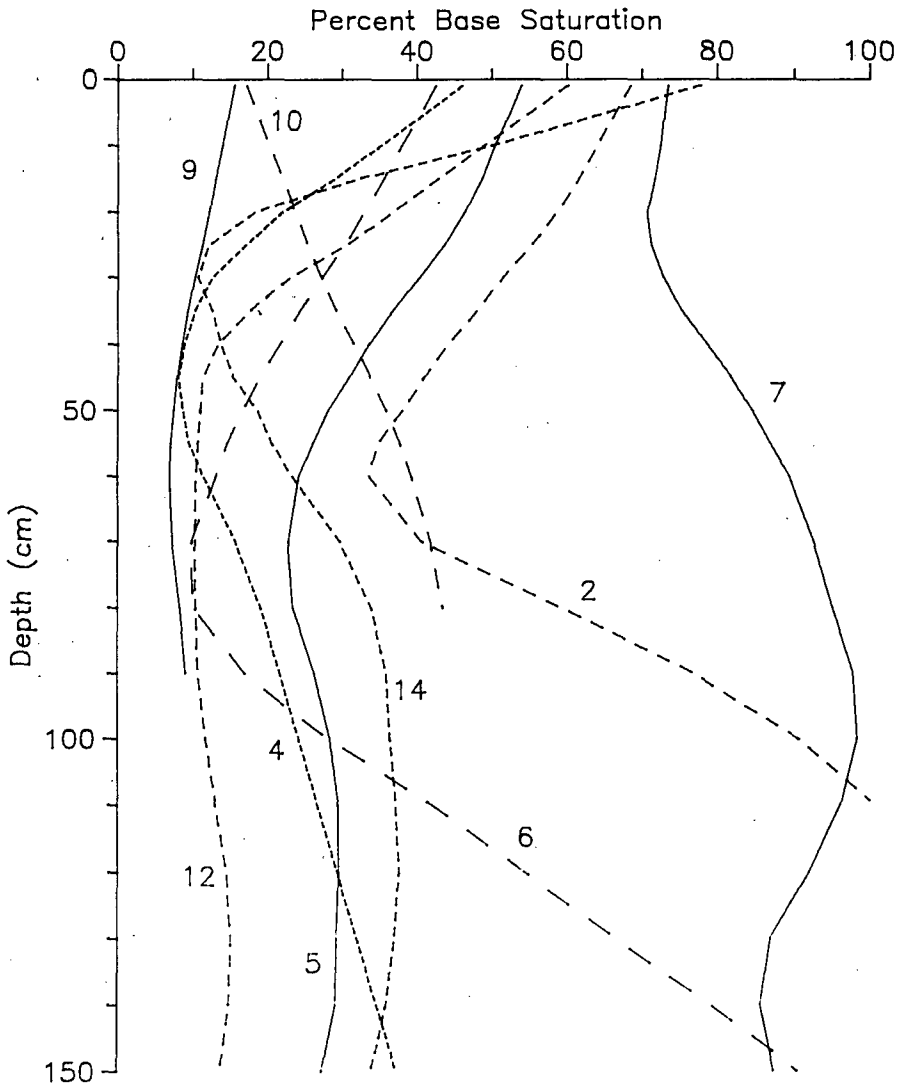


Figure 11. Base saturation of individual pedons under forest by depth. Number next to each line is the pedon number.

saturation in this zone. Depths of minimum Ca and base saturation may also correspond well to a zone of quick-return flow. "Quick-return flow" is an unsaturated, subsurface, lateral flow occurring typically under relatively intense precipitation, that re-emerges within one hour. It is pictured by Jamieson and Amerman (1969) as a lateral flux above a B horizon. The B horizon can act as a partial impediment to seepage down into the groundwater recharge zone. The high density of macropores in the lower A and upper B horizons, coupled with the decrease in pore density and increase in clay further down in the B horizon, may provide conditions favoring quick-return flows. Quick-return flows may also contribute to leaching of this zone.

Levels of K are greater in soils under conifer forest than under prairie. This difference is probably also associated with nutrient cycling via litterfall, although K is much more readily retranslocated among plant tissues than Ca (Powers, 1976). K decreases steeply with depth under all vegetation types. Organic matter greatly increases the number of exchange sites available for K, and this may be an major reason why levels of K are so well correlated with levels of OC, N and CEC.

b. Effects of hydrology and geology on cations in lower horizons

Cation distributions in B and C horizons may reflect variation in drainage, permeability and the chemical composition of the parent material. Cation distributions vary also from place to place within individual drainage basins.

Insofar as parent material remains constant, hydrology can be the primary determinant of cation distribution in the subsoils of mountain watersheds. Dry, convex slopes and ridges around basins are places of hydrologic (geochemical) removal. Rainfall leaches away cations, leaving the subsoils lower in base saturation. Since Ca is more mobile in soil solution than Mg (Parsons et al., 1968), it is more thoroughly leached and Ca/Mg ratios are lowered. In contrast, the wet slopes in hollows and near drainages are places of hydrologic and geochemical convergence. Seepage water has percolated through regolith and saprolite for long distances from surrounding slopes. This water has been in intimate contact with weathering minerals for so long that it is near chemical equilibrium. The level of saturated flow rises in winter and blocks leaching by rain water. Popenoe (1983) documents a soil pattern fitting this model in the upper Dolason Creek watershed, a small tributary to Redwood Creek in Redwood National Park. In the Dolason Creek samples, Ca and Mg average 6.5 meq/100g and 2.6 meq/100g, respectively, in the imperfectly drained subsoils near streams, versus 3.2 meq/100g and 1.6 meq/100g, respectively, in the well drained soils nearer to divides.

There are close parallels between the subsoil chemistry at Dolason and stream water chemistry, as reported by Bradford and Iwatsubo (1978). Winter stream flows are lower in dissolved solids than summer flows. The winter discharge rate is higher. In winter, much of the subsurface flow is via macropores. This groundwater moves too rapidly to equilibrate

with the soil's chemical environment. The water is undersaturated with respect to weathering minerals and low in dissolved solids. The water table lowers gradually once the rainy season ends. At low flows, what remains is seepage water more nearly in chemical equilibrium with weathering bedrock.

Besides position in a watershed, cation distributions reflect the chemical composition of the parent material. This, in turn, may reflect the parent material's hydrologic properties and depositional history. In this report, overall Ca and base saturation are higher in the imperfectly drained soils than the well drained soils. Imperfect drainage is not necessarily associated with places of hydrologic convergence, such as near streams and in topographic hollows. Imperfect drainage occurs generally in the mountains of the park wherever the soils overlie sheared argillite and mudstone or, in schist, their metamorphic equivalents. These rocks are relatively weak and susceptible to mass failure. The Cg layer of soils, such as Atwell (pedon 2) and Devilscreek (pedon 6), consists mostly of pulverized rock. Shearing within the failing mass disrupts the rock macrostructure and the continuity of pores, greatly decreasing permeability. Water becomes perched above the sheared rock, which is saturated with seepage water. The gray matrix colors and brown mottles show that reducing conditions exist while the material is saturated with water and oxygen returns when it is unsaturated or dry. Slow seepage parallel to the ground surface is not conducive to leaching of cations. In contrast, water percolates rapidly downward through voids in fractured, unsheared rocks. Consequently, in this material, B and C horizons are leached and base saturations are low.

The two most youthful pedons described in this report (7 and 8) formed in colluvium on landslide scars and deposits. In these, the measured base saturation is high throughout, although the Elfcreek pedon (7) is well drained. This high base saturation is partially a consequence of fresh minerals in the colluvium which are easily removed by NH_4OAc extraction. By comparison, in youthful alluvial soils, the minerals have been water-worked and base saturation tends to be lower. An examples of such an alluvial soil is the Kerr pedon (Begg et al., 1984, p. 141) on the Redwood Creek floodplain in Orick. The implication is that the stratigraphic (depositional) ages of soil parent materials may have less bearing on cation distribution than mode of deposition (for example, landslide versus flood) and hydrology prior to deposition (for example, well versus imperfectly drained).

Mg and base saturation increase with depth at depths between 100 cm and 150 cm in soils with imperfect drainage (Figure 8). The ratio Ca/Mg is lower for substrata of imperfectly drained soils than substrata of well drained soils. This result is different from what was found at Dolason Creek and is not predicted by the cation mobility model of Parsons et al. (1968). Since the soil samples collected for this report came from a number of subbasins in the park, one would expect more variation in parent material than within the Dolason Creek subbasin. Within the Franciscan Assemblage, variation in parent material among tributary

basins may affect soil Mg more than variation due to sampling position within each hydrologic unit. On the basis of local field observations in the Redwood Creek basin, imperfect drainage is commonly associated with a lithologic discontinuity, particularly when a dominantly sandstone layer overlies a layer of finer textured rock. In gross analysis, shales average a higher proportion of Mg than sandstones (Mason 1966), so that the difference in chemical composition of the parent material may account for the increase in exchangeable Mg with depth.

c. Effects of vegetation boundaries

In their classic paper, White and Reicken (1955) describe "transitional" soils near forest-prairie boundaries in Iowa and Illinois. These soils have colors, textures and chemical properties intermediate between those of soils under forest and soils under prairie. Birkeland (1984) reviews this common pattern and suggests mechanisms to account for it. The soils in Douglas-fir-invaded prairies in Redwood National Park can be viewed as "transitional." However, soils near vegetation boundaries do not necessarily have intermediate properties. Some may have unique properties resulting from edge effects. The smallest group of pedons identified in the statistical analysis is under old-growth forest downslope and within 100 m of prairie boundaries. These pedons stand out from all the others because of their unique A horizons. The A horizon colors are dark and grayish (hue and chroma <4, moist), like those in the prairies. However, base saturation in the A horizon is high (>50 percent throughout). The prairie pedons all have lower base saturation in the A horizon. The soils under forest near prairies are also distinct from soils under forest more than 100 m from prairie boundaries because the more typical forest soils have lighter, browner colors and lower base saturation.

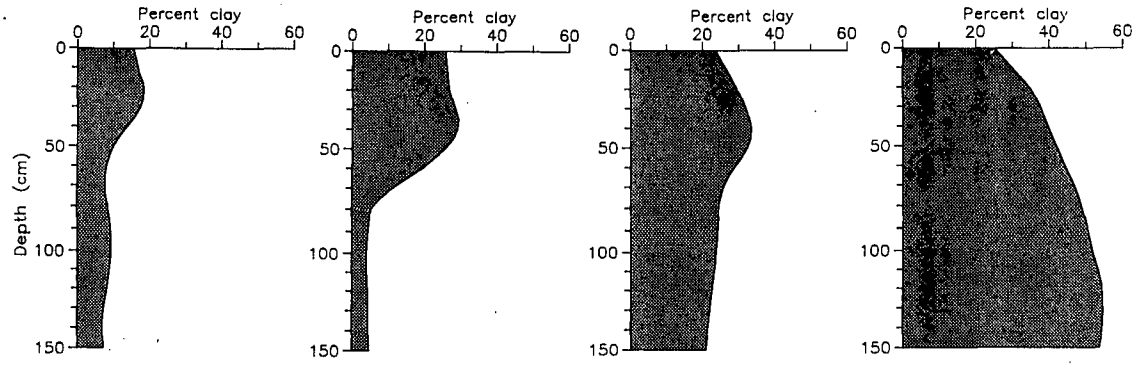
A number of possibilities can be explored concerning the origin of this group of soils in forest downslope from prairie. Dark, thick A horizons could be either the result of encroachment by trees into prairie margins or transport of surface sediment from prairie down into forest. Processes that could transport the prairie soil include rainsplash, surface wash and blowing dust and fire ash. All of these could be active after prairie fires. High Ca and base saturation throughout the A and B horizons of the soils in the adjacent forest is unique and more difficult to explain. Soil moved downslope by rainsplash or sheetwash is likely to have cation concentrations similar to the source material. Since prairie A horizons are low in cations, surface transport by water does not account for the pattern. Cation concentrations can be high as result of seepage, but these high cation concentrations are confined to the seepage zone, rather than coming up to the soil surface. This fact is most clearly evident in the prairies, where biological base cycling is minimal (pedons 18 and 20 in this report, and pedons P1, P3, P4, P6, and P12 in Gordon, 1980). Base cycling by trees increases base saturation in the A horizon. However, base saturation decreases steeply in the B horizon in most of the forest soils (Figure 11), while it decreases less steeply and remains above 50 percent in the soils adjacent to prairie.

Perhaps the soils in forests near prairies were enriched by wind-blown ash and dust from prairie fires. Turbulence decreases abruptly once air currents enter a tree canopy, so that suspended material would tend to settle out. The canopy could also intercept eolian material, which could be brought to earth by rain and accumulate. Prairie fires are thought to have occurred more frequently prior to about 1900 than since. Both the Native Americans and early white settlers practiced burning. Sugihara and Reed (in press) estimate a fire interval of 5 years as about the longest for effective maintenance of the oak woodlands. The hypothesized enrichment by wind-blown ash would require that fires burn under windy conditions or, at least, early enough in the dry season for ash to blow, rather than be washed directly into the soil. This soil pattern and its possible implications are intriguing and warrant further investigation.

3. Particle-size distribution and clay mineralogy

Particle-size distributions and clay mineralogy tend to reflect differences in parent materials from which soils formed and the length of time that the material has undergone pedogenesis (Zinke and Colwell, 1965). Surface horizons form in less than 1000 years. As discussed previously, some surface processes near a steady state within a century. In contrast, subsurface reddening and in-place clay formation occur typically over millenia or tens of millenia (Birkeland, 1984). Figure 12 shows the clay distributions, with depth, for four upland pedons under forest vegetation in Redwood National Park. They are ranked in order of increasing clay content. The soils all formed in regolith more than 150 cm thick. The graphs were output from a computer program that draws a smooth curve through data at horizon midpoints. Table 9 summarizes some properties of the four soils commonly used to measure soil development. From one pedon to the next, the maximum clay percentage increases and the depth to the clay maximum increases. The B horizons exhibit redder hues and smaller fractions of rock fragments > 2 mm in the more strongly developed soils. Clay films are visible in the field, using a hand lens, in the Coppercreek and Trailhead pedons, but not in the Elfcreek and Devilscreek pedons. The soils tend to occur on specific positions on the landscape (Popenoe 1985). Trailhead soils are confined to higher, gentler slopes. Coppercreek soils predominate on steep middle and lower slopes. Devilscreek and Elfcreek soils are along streams and in wet hollows underlain by failing, imcompetent bedrock. On slopes in the Bond Creek tributary basin, Marron and Popenoe (1986) relate differing degrees of soil development to counterbalancing, concurrent erosional processes and mixing of weathered with unweathered regolith.

Parent material has a major influence on the clay content of the substratum on wet, unstable slopes. The C subhorizons of the Devilscreek and Elfcreek pedons (6 and 7), formed in colluvium from schist, have from 4.5 to 12.3 percent clay. Sonnevil et al. (in press) report substratum particle-size data for landslide investigations on schist in the park. Their 26 samples average 14.3 percent clay (s = 4.1 percent), with a range from 5.7 to 22.5 percent for individual samples. In contrast, C subhorizons of the Atwell pedon (2) and two other pedons on slump-



Pedon 7. Elfcreek series.

Pedon 6. Devilscreek series.

Pedon 5. Coppercreek series.

Pedon 14. Trailhead series.

Figure 12. Clay distribution by depth of four soils formed on schist.

Table 9. Some physical properties of four soils formed on schist.

Soil Profile	Maximum clay(%)	Depth of clay maximum(cm)	Fraction > 2 mm (% Vol. in PSCS)	Reddest hue in B
Pedon 7. Elfcreek	18.7	21	51.8	10 YR
Pedon 6. Devilscreek	28.8	39	26.6	7.5 YR
Pedon 5. Coppercreek	33.2	43	21.8	7.5 YR
Pedon 14. Trailhead	54.6	131	1.2	2.5 YR

earthflow features on unmetamorphosed mudstone (16 and 23) have from 29.0 to 37.7 percent clay. Iverson (1984) collected approximately 47 samples from boreholes at depths of 3 to 5 m in the Minor Creek earthflow, which is also located in the Redwood Creek basin on mudstone, upstream from the park. Corrected for gravel content, Iverson's samples average about 28 percent clay. The fact that deep-seated mass movements are primarily block slides on schist and earthflows on mudstone is most likely a function of a difference in lithologic controls. However, the wide difference in clay percentages between substrata on schist versus mudstone probably accounts for differences in timing of hydrologic and geomorphic processes. Movement of deep-seated block slides on schist is episodic and storm-related, whereas movement of earthflows on mudstone is more prolonged or seasonal in nature. Higher clay content and consequent lower permeability may delay saturation and onset of failure, increase water retention and extend the duration of movement in earthflows (Sonnevil et al., in press).

The same kinds of clay minerals are reported by NSSL and UCD from soils on sedimentary rocks as soils on schist. In each case, there is a mixture of minerals, typically including vermiculite, kaolinite, chlorite and mica. One notable mineralogical difference between soils formed on the two rock types is in the proportion of dithionite-citrate extractable Fe (Table 10). Oxides of iron are the primary bright pigments in soils, so the comparatively iron-rich B horizons of soils on schist tend to be more brightly colored (chromas of 6-8) than those on sedimentary rocks (chromas of 4-6). The average difference in Fe is not enough to affect taxonomic placement of the soils in the fine-loamy and loamy-skeletal soil families. Since the same clay minerals occur in soils on both rock types, and since behavior and management are the same, bedrock is not a good basis for different series in fine-loamy and loamy-skeletal families. The Coppercreek and Lackscreek series are the most extensive fine-loamy and loamy-skeletal soils mapped on both sedimentary and schist bedrock.

The difference in parent rock influences the mineralogy class of the Ultisols in clayey families. Unlike the Ultisols in fine-loamy families, they have a significant proportion of DTA-measured gibbsite in their clay fractions. Given a mixture of clays with no one dominant mineral, the mineralogy class is "mixed" if the ratio, $(Fe_2O_3 + GI)$/ clay, is < 0.2; it is "oxidic" if the ratio is 0.2 or more (Soil Survey Staff, 1975, p. 387). The ratio is > 0.2 for all three Trailhead pedons on schist. The abundance of iron oxides and gibbsite probably contribute to the low CEC/clay ratios, ranging from 16 to 24 meq/100g clay, in Trailhead soils. Generally higher CEC/clay ratios, from 24 to 40 meq/100g clay, occur in Bt horizons of the Tectah soils on sedimentary rocks.

Table 10. Colors, iron and gibbsite content of some fine-loamy and loamy-skeletal soils on schist and sedimentary bedrock. Samples are from Redwood National Park. Analysis is by NSSL.

Pedon	Depth(cm)	Colors Dry	Colors Moist	D.C. Fe	GI clay	Pipette clay	Sesquioxides Clay 1/
Schist bedrock							
S-85-CA-12-01	28-45	10YR 6/6	10YR 5/6	2.1	-	23.1	.130
Coppercreek	45-68	7.5YR 6/6	7.5YR 5/8	1.4	tr	22.1	.155
series	68-101	10YR 7/8	10YR 5/8	1.6	tr	17.2	.133
S-85-CA-12-02	24-45	7.5YR 5/4	7.5YR 3/4	3.7	-	25.1	.211
Coppercreek	45-85	7.5YR 6/7	7.5YR 4/6	3.5	.02	23.6	.232
Taxadjunct 2/							
S-83-CA-12-04	31-59	7.5YR 6/6	7.5YR 4/6	3.5	-	33.1	.102
Coppercreek	59-79	10YR 7/6	10YR 5/8	3.5	-	26.1	.117
Taxadjunct 3/	79-128	10YR 7/6	10YR 5/8	3.1	-	23.7	.121
Sedimentary bedrock							
S-82-CA-12-01	23-83	10YR 6/6	10YR 5.4	1.7	-	27.9	.087
Coppercreek series							
S-83-CA-12-05	24-40	10YR 5/4	10YR 3/4	2.4	-	29.8	.115
Lackscreek	40-56	7.5YR 6/4	7.5YR 4/4	2.5	-	30.0	.119
series							
S-83-CA-12-06	26-41	10YR 7/4	10YR 4/4	1.5	-	29.2	.073
Coppercreek	41-75	2.5YR 7/2	10YR 5/4	1.3	-	27.4	.068
series	75-100	2.5YR 7/2	2.5YR 5/4	1.0	-	27.9	.051

1/ Ratio = $\frac{(1.43 \times \text{D.C. Fe} + \text{DTA Gibbsite})}{\text{Measured clay}}$

2/ Mineralogy class is oxidic.

3/ Particle-size class is clayey. Sesquioxide/clay ratio is measured to 2.5 x 15-bar H_2O because 15-bar H_2O/clay is > 0.6.

IV. RECOMMENDATIONS

A. Soil survey interpretations for land management

The SCS has developed a standard method of predicting soil behavior for specified land uses and management practices. Most of the predictions are readily computer-generated from soil laboratory and field data. The National Soils Handbook (USDA, 1983a) gives specific interpretations for septic systems, dwellings, reconstruction materials for drastically disturbed areas, camp and picnic areas, paths, trails and roads, as well as many other applications. These interpretations are almost universally applicable, and they should be used in the soil survey in Redwood National Park.

Because of the the high rate of geologic uplift, erodible terrain and rainy climate, sediment is lost at a much greater rate from watersheds in northwestern California than the average for the United States. Controlling erosion was one of the objectives in expanding Redwood National Park in 1978, and it is a major goal of the park's watershed rehabilitation program. The park should draw on this experience in refining land-use interpretations for the region. Weaver et al. (in press) find that most of the gullies in acquired logged lands were caused by diversion of small streams, and that the volume of material eroded is closely associated with physical soil characteristics. Field and laboratory investigations have also demonstrated relationships between the soils and incidence of debris flows, debris slides and earthflows. Mass-wasting processes are not addressed by the standard soil survey interpretations (USDA, 1983a). Relationships between soils and dominant erosional processes should be documented in the park's soil survey, isofar as possible, and used to recommend management options within and among the map units in the survey area.

B. Suggestions for future soil investigations

1. Relationships discovered between soil patterns and patterns and processes of soil erosion should be documented, as highlighted in Part A.

2. Investigations of the material, hydrologic and chemical properties of regolith and rock below what is normally considered in soil surveys (about 150 to 200 cm) can substantially improve understanding of mass wasting processes.

3. In reviewing the literature, no laboratory information was found on soils formed in the Gold Bluffs formation. The Gold Bluffs formation consists mostly of presumed Plio-Pleistocene marine sediments of Klamath lithology (Harden et al., 1982), and it is likely to have distinctive soils. Much of the formation is within RNP. The soils should be mapped and characterized.

4. Detailed physical characterizations of alluvial soils would help park scientists understand the dynamics of flood deposition and sediment transport in Redwood Creek.

5. A wealth of published information is available on biogeochemical cycling in the Douglas-fir region, but little for the redwood region. Better information is needed to understand and manage these magnificent forests and to manage the soils beneath them.

6. More soil information could resolve issues in managing vegetation boundaries. Studies of soil opal phytoliths, which persist hundreds of years, as well as ^{14}C ages on organic carbon, could help in documenting the history of vegetation patterns. Soils transects across soil boundaries could help determine the extent of transitional soils or unique soils with "boundary effects," leading to better understanding of the boundary processes and conditions.

7. A more detailed study of soil macropore size, distribution and frequency would increase our understanding of the watershed's hydrologic response to storms.

V. REFERENCES

Alexander, E., W. Colwell, J. DeLapp, E. Gladish, R. Nelson, R. Skolmen and B. Smith. 1952-1978. Humboldt - Del Norte County soil-vegetation surveys. California Department of Forestry. Redding, California. 75 maps, 1:31,680 scale, and legends.

Ballard, T.M. 1968. Carbon dioxide production and diffusion in forest floor material - a study of gas exchange in biologically active, porous media. Ph.D. thesis, University of Washington. Seattle, Washington. 136 pp.

Begg, E.L., W.R. Allardice, S.S. Munn and J.I. Mallory. 1984. Laboratory data and descriptions for some typical pedons of California soils. Volume II. North Coast. Department of Land, Air and Water Resources, University of California, Davis and Soil-Vegetation Survey - California Department of Forestry. Davis, California. 478 pp.

Begg, E.L., W.R. Allardice, S.S. Munn and J.I. Mallory. 1985. Laboratory data and descriptions for some typical pedons of California soils. Volume III. Southern Cascades and Northern Sierras. Department of Land, Air and Water Resources, University of California, Davis and Soil-Vegetation Survey - California Department of Forestry. Davis, California. 424 pp.

Berg, M.G. and E.H. Gardner. 1978. Methods of soil analysis used in the soil testing laboratory at Oregon State University. Special Report 321. Agricultural Experiment Station, Oregon State University. Corvallis, Oregon. 44 pp.

Birkeland, P.W. 1984. Soils and geomorphology. Oxford University Press. New York. 372 pp.

Bormann, F.H. and G.E. Likens. 1979. Pattern and process in a forested ecosystem. Springer-Verlag. New York. 253 pp.

Bradford, W.L. and R.T. Iwatsubo. 1978. Water chemistry of the Redwood Creek and Mill Creek basins, Redwood National Park, Humboldt and Del Norte Counties, California. U.S.G.S. Water-Resources Investigations 78-115. Menlo Park, California. 112 pp.

Coppermith, K.J. 1980. Summary of exploration locality investigations. Appendix B. An evaluation of the potential for resolving the geologic and seismic issues of the Humboldt Bay Power Plant Unit No. 3. Woodward-Clyde Consultants. San Francisco, California. pp. B-29 - B-40.

Durgin, P.B. and J.E. Tackett. 1981. Erodibility of forest soils - a factor in erosion hazard assessment. In R.N. Coates (ed.). Watershed rehabilitation in Redwood National Park and other Pacific coastal areas. August 24-28, 1981. Center for Natural Resource Studies of John Muir Institute. Berkeley, California. pp. 118-127.

Elford, C.R. and M.R. McDonough. 1974. The climate of Humboldt and Del Norte Counties. Agricultural Extension Service, University of California. Eureka, California. 52 pp.

Ficklin, J.K., M.E. Harward and C.T. Youngberg. 1977. Redwood Creek 1975 sediment study. Winzler and Kelly, Consulting Engineers. Eureka, California. 41 pp.

Geist, J.M. and G.S. Strickler. 1970. Chemical characteristics of some forest and grassland soils of northestern Oregon. I. Results of profile sampling on the Starkey Experimental Forest and Range. Research Note PNW-137. U.S. Forest Service Pacific Northwest Range and Experiment Station. Portland, Oregon. 11 pp.

Goddard, P.E. 1914. Notes on the Chilula Indians of northwestern California. University of California Publications in American Archaeology and Ethnology 10(6): 265-288.

Gordon, B.R. 1980. Soils of the Bald Hills area of Redwood National Park. M.S. Thesis, Humboldt State University. Arcata, California. 76 pp.

Harden, D.R., H. M. Kelsey, S.D. Morrison and T.A. Stephens. 1982. Geologic map of the Redwood Creek drainage basin, Humboldt County, California. U.S.G.S. Water-Resources Investigations 81-496. Menlo Park, California. Map, 1:62,500 scale, and legend.

Hauxwell, D.H., S.P. Bulkin, and C.A. Hanson, 1981. The influence of elevation, vegetation type and distance from the coast on soil temperature in Humboldt County, California. Agronomy Abstracts, American Society of Agronomy. p. 198.

Hektner, M.M., R.W. Martin and D.R. Davenport. 1983. The Bald Hills prairies of Redwood National Park. In C. Van Riper III, L.D. Whittig and M.L. Murphy (eds.). Proceedings of the first biennial conference of research in California's National Parks. September 9-10, 1982. University of California. Davis, California. pp. 70-78.

Hurst, H.M. and N.H. Burges. 1967. Lignin and humic acids, In D.A. McLaren and G.H. Peterson (eds.). Soil biochemistry. Marcel Dekker, Inc. New York. pp. 260-286.

Iverson, R.M. 1984. Unsteady, non-uniform landslide motion: theory and measurement. Ph.D. Thesis, Stanford University. Stanford, California. 303 pp.

Janda, R.J., M. Nolan, D.R. Harden and S.M. Colman. 1975. Watershed conditions in the drainage basin of Redwood Creek, Humboldt County, California as of 1973. U.S.G.S. Open-file report 75-568. U.S. Geological Survey. Menlo Park, California. 266 pp.

Jamieson, D.G. and C.R. Amerman. 1969. Quick-return subsurface flow. Journal of Hydrology. 8:122-136.

Laacke, R.J. (ed.) 1979. California forest soils. Publication 4094. Division of Agricultural Sciences. University of California. Berkeley, California. 180 pp.

Marron, D.C. 1982. Hillslope evolution and the genesis of colluvium in Redwood National Park, northwestern California: The use of soil development in their analysis. Ph.D. Thesis, University of California. Berkeley, California. 187 pp.

Marron, D.C. and J.H. Popenoe. 1986. A soil catena on schist in northwestern California. Geoderma 37: 307-324.

Mason, B. 1966. Principles of geochemistry. Third edition. John Wiley and Sons. New York. 329 pp.

McColl, J.G. and D.W. Cole. 1968. A mechanism of cation transport in a forest soil. Northwest Science 42: 134-141.

McLaughlin, J.C. and F. Harradine. 1965. Soils of Western Humboldt County, California. Department of Soils and Plant Nutrition. University of California. Davis, California. 85 pp., 36 maps, 1:31,680 scale.

McLaughlin, J.C. and F. Harradine. 1966. Soils of coastal Del Norte County, California. Department of Soils and Plant Nutrition, University of California. Davis, California. 57 pp., 6 maps, 1:31,680 scale.

Muldavin, E.H., J.M. Lenihan, W.S. Lennox and S.D. Veirs, Jr. 1981. Vegetation succession in the first ten years following logging of coast redwood forests. Redwood National Park Technical Report 6. National Park Service, Redwood National Park. Arcata, California. 69 pp.

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner and D.H. Bent. 1975. SPSS. Statistical package for the Social Sciences. Second edition. McGraw-Hill, Inc. New York. 675 pp.

Parsons, R.B., G.H. Simonson and G.A. Balster. 1968. Pedogenic and geomorphic relationships of associated Aqualfs, Albolls and Xerolls in western Oregon. Soil Science Society of America Journal 32: 556-563.

Popenoe, J.H. 1983. Soil properties of the W-Line (80-5) revegetation experimental area. Unpublished, on file. Resource Management Division, Redwood National Park. Orick, California. 32 pp.

Popenoe, J.H. 1985. Soil-topography relationships on schist in Redwood National Park. In M.E. Savina (ed.). Redwood Country. American Geomorphological Field Group Field Trip Handbook. Department of Geology, Carleton College. Northfield, Minnesota. p. 200.

Powers, R.F. 1976. Principles and concepts of forest soil fertility. In Proceedings of the 1st Annual Earth Science Symposium. November 8-12, 1976. Fresno, California. U.S. Forest Service, California Region. San Francisco, California. pp. 1-33.

Reed, L.J. and N.G. Sugihara. In press. Northern oak woodlands: Resource in jeopardy or is it already too late? In Proceedings of the Symposium on Multiple-Use Management of California's Hardwood Resources. November 12-14, 1986. California Polytechnic State University, San Luis Obispo, California.

Singer, B.C. and E.L. Begg. 1975. Soil survey of Hoopa Valley, California. Department of Land, Air and Water Resources, University of California. Davis, California. 51 pp., 1 map, 1:12,000 scale.

Soil Conservation Service. 1972. Soil survey laboratory methods and procedures for collecting soil samples. Soil Survey Investigation Report No. 1. U.S. Government Printing Office. Washington, D.C. 63 pp.

Soil Conservation Service. 1973. Soil survey laboratory data and descriptions for some soils of California. Soil Survey Investigations Report 24. U.S. Government Printing Office. Washington, D.C. 637 pp.

Soil Conservation Service. 1984. Soil survey laboratory methods and procedures for collecting soil samples. Soil Survey Investigation Report No. 1, Second Edition. U.S. Government Printing Office. Washington, D.C. 68 pp.

Soil Survey Staff. 1951. Soil survey manual. Agricultural Handbook 18. U.S. Government Printing Office. Washington, D.C. 503 pp.

Soil Survey Staff. 1960. Soil classification. A comprehensive system. 7th approximation. U.S. Government Printing Office. Washington, D.C. 265 pp.

Soil Survey Staff. 1975. Soil taxonomy. A basic system of soil classification for making and interpreting soil surveys. Agricultural Handbook 436. U.S. Government Printing Office. Washington, D.C. 754 pp.

Sonnevil, R., R. Klein, D. Short and W. Weaver. In press. Forested block slides in the lower Redwood Creek basin, northwest California. *In Proceedings of Symposium on Erosion and Sedimentation in the* Pacific Rim, August 3-7, 1987. Oregon State University. Corvallis, Oregon.

Strand, R.G. 1962. Geologic map of California. Redding sheet. California Division of Mines and Geology. Sacramento, California. Map, 1:250,000 scale, and legend.

Sturhan, N.K. In preparation. Soil moisture and temperature regimes in Redwood National Park. M.S. Thesis, Humboldt State University. Arcata, California.

Sugihara, N.G. and L.J. Reed. In press. Prescribed fire for restoration and maintenance of bald hills oak woodlands. In Proceedings of the Symposium on Multiple-Use Management of California's Hardwood Resources. November 12-14, 1986. California Polytechnic State University. San Luis Obispo, California.

U.S.D.A. 1978. California national soils handbook supplement. Notice 2. Soil Conservation Service State Office. Davis, California. 7 pp.

U.S.D.A. 1983a. National soils handbook. Soil Conservation Service Publication 430. U.S. Government Printing Office. Washington, D.C. 586 pp.

U.S.D.A. 1983b. Keys to soil taxonomy. Soil Management Support Services Technical Monograph No. 6. Agronomy Department, Cornell University. Ithaca, New York. 244 pp.

U.S.D.A. 1986. National soil taxonomy handbook. Publication 430-VI. Issue No. 8. Part 615 - Amendments to soil taxonomy. Washington, D.C. 98 pp.

Watson, C.B., S.W. Cosby and A. Smith. 1925. Soil survey of the Eureka area, California. U.S.D.A., Bureau of Soils. Washington, D.C. pp. 851-881.

Weaver, W.E., D.K. Hagans and J.H. Popenoe. In press. Magnitude and causes of gully erosion in the lower Redwood Creek basin. In Nolan, K.M., H.M. Kelsey and D.C. Marron (eds.). Geomorphic processes and aquatic habitat in the Redwood Creek basin, northwestern California. U.S. Geological Survey Professional Paper 1454. Menlo Park, California.

White, E.M. and F.F. Riecken. 1955. Brunizem-gray brown podzolic soil biosequences. Soil Science Society of America Journal 19: 504-509.

Winzler and Kelly. 1975. Redwood Creek Sediment Study, 1973-1974. Water Laboratory, Winzler and Kelly, Consulting Engineers. Eureka, California. 44 pp.

Zinke, P.J. and W.L. Colwell, Jr. 1965. Some general relationships among California forest soils. In Youngberg, C.T. (ed.). Forest-Soil Relationships in North America. Proceedings of Second North America Forest Soils Conference, Oregon State University, August 26-31, 1963. Oregon State University Press. Corvallis, Oregon. pp. 353-365.

TAXONOMIC LEGEND
(Alphabetic)

National Park Service
Redwood National Park - Redwood Creek Basin
Revised Draft
April 1987

Series	Classification	Depth and Other
Ahpah	Fine-loamy, mixed, isomesic Typic Humitropepts	20-40" to paralithic contact
Atwell	Fine, mixed, isomesic Mollic Hapludalfs	>60", mottled at 30-60"
Coppercreek	Fine-loamy, mixed, isomesic Typic Haplohumults	>40" to paralithic contact
Devilscreek	Fine-loamy, mixed, isomesic Typic Humitropepts	>60" to paralithic contact, mottled at 20-60"
Elfcreek	Loamy-skeletal, mixed, isomesic Typic Eutropepts	>60" to paralithic contact
Fortyfour	Clayey, oxidic, isomesic Typic Hapludults	20-40" to paralithic contact
Lackscreek	Loamy-skeletal, mixed, isomesic Typic Haplohumults	20-40" to lithic contact
Slidecreek	Loamy-skeletal, mixed, isomesic Typic Humitropepts	>40" to lithic contact
Tectah	Clayey, mixed, isomesic Typic Palehumults *	>60" to paralithic contact, 10YR to 7.5YR in Bt
Tectah Variant	Fine-loamy, mixed, isomesic Typic Haplohumults	20-40" to paralithic contact
Trailhead	Clayey, oxidic, isomesic Orthoxic Palehumults *	>60" to paralithic contact, 5YR to 2.5YR in Bt

* Classification is based on a proposal of California State Soil Correlation Committee to reinstate the Palehumults great group. Series classifies to Typic Haplohumults, using USDA (1986) key.

LOCATION AHPAH

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

AHPAH SERIES

The Ahpah series consists of moderately deep, well drained soils formed in material weathered from schist. Ahpah soils are on mountains and have slopes of 15 to 75 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, isomesic Typic Humitropepts.

Typical Pedon: Ahpah gravelly clay loam - on a northeast-facing convex slope of 32 percent under second-growth Douglas-fir, redwood, tanoak, hemlock, red alder, huckleberry, salal and rhododendron at 1560 feet elevation. (Colors are for dry soil unless otherwise stated. When described February 22, 1984, the soil was moist throughout.)

O--2 to 0 inches; fresh and decomposing tanoak leaves, conifer needles and twigs.

A--0 to 7 inches; brownish yellow (10YR 6/6) gravelly clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky, slightly plastic; common very fine, fine and medium roots; few very fine interstitial, and common very fine and fine tubular pores; 18 percent pebbles; moderately acid (pH 6.0); clear wavy boundary. (4 to 13 inches thick)

Bw1--7 to 19 inches; yellow (10YR 7/6) gravelly silty clay loam, yellowish brown (10YR 5/6) moist; weak medium and moderate fine subangular blocky structure; soft, friable, sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; common very fine and fine, and few medium tubular pores; 19 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary. (6 to 15 inches thick)

Bw2--19 to 26 inches; yellow (10YR 7/6) gravelly clay loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable, sticky, slightly plastic; few very fine, fine and coarse, and common medium roots; few very fine and fine tubular pores; krotovina, 6 inches by 12 inches, filled with reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; 21 percent pebbles; strongly acid (pH 5.5); clear irregular boundary. (0 to 9 inches thick)

C--26 to 32 inches; light gray (2.5Y 7/2) very gravelly loam, variegated olive gray (5Y 5/2) and yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine, fine and medium roots; few very fine and fine tubular pores; 42 percent pebbles, consisting mostly of bedrock fractured in place; strongly acid (pH 5.5); clear wavy boundary. (0 to 13 inches thick)

Cr--32 to 43 inches; highly weathered schist saprolite, easily cut with knife, schist foliation and rock macrostructure still evident; contains pockets of hard (lithic) rock, amounting to approximately 5 percent of the area exposed.

TYPE LOCATION: Humboldt County, California; 0.4 miles east on G-Line Road from intersection of G-Line and C-Line Roads, then 175 feet south, up hill to bank cut on abandoned secondary logging haul road; southeast quarter, southwest quarter, Section 10, T. 10 N., R. 1 E., HBLM; Rodger's Peak Quadrangle.

RANGE IN CHARACTERISTICS: Depth to a paralithic contact is 20 to 40 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section is continuously moist in all parts in most years, but it becomes nearly dry in the upper part from about September 15 to October 15 in most years. The cambic horizon is 8 to 17 inches thick. The soil from a depth of 10 inches to the paralithic contact is 25 to 35 percent clay and contains 10 to 35 percent gravel and cobbles. There is 12 to 20 Kg per square meter of organic carbon above the paralithic contact. Reaction is moderately or strongly acid, and the base saturation is less than 50 percent throughout.

The A horizon has dry color of 10YR 5/3, 5/4 or 6/6. Moist color is 10YR 4/4 or 7.5YR 3/2, 3/3, 4/4. The value, chroma or both, increase to 4 or more, moist, within 10 inches of the soil surface. Texture is loam, gravelly loam, cobbly loam or gravelly clay loam. There is 20 to 30 percent clay, 10 to 20 percent gravel and 0 to 15 percent cobbles.

The Bw horizon has dry color of 10YR 6/6, 7/4, 7/6 or 7.5YR 5/4. Moist color is 10YR 5/4, 5/6 or 7.5YR 4/4, 4/6, 5/6, 5/8. Texture is loam, clay loam, gravelly clay loam or gravelly silty clay loam. There is 25 to 35 percent clay, 5 to 25 percent gravel and 0 to 5 percent cobbles.

COMPETING SERIES: These are the Carlotta, Devilscreek (T), Ettersburg, Hely, Mues, Reedsport and Svensen series. Carlotta, Ettersburg, Hely, Mues, Reedsport and Svensen soils have umbric epipedons. Devilscreek (T), Carlotta, Ettersburg, Hely and Mues soils are more than 40 inches deep. Devilscreek (T) soils have low-chroma mottles within 60 inches of the soil surface.

GEOGRAPHIC SETTING: Ahpah soils occur on rounded main and spur ridges and convex slopes on mountains. Slopes are 15 to 75 percent. Elevations are 100 to 2800 feet. The soils formed in material weathered from quartz-mica schist. The climate is humid with cool, foggy summers and cool, moist winters. Coastal influence limits the annual and diurnal range in temperature. Mean annual precipitation ranges from 70 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 58 degrees F; and the mean annual temperature is about 52 degrees F. Frost-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coppercreek (T), Lackscreek (T) and Tectah (P) soils. All have argillic horizons. Lackscreek soils are skeletal and 20 to 40 inches deep to a lithic contact. Tectah soils have an argillic horizon, clayey particle-size class, and are more than 60 inches deep to a paralithic contact. Coppercreek soils occur on straight slopes below the Ahpah soils on sloping spur ridges. Tectah soils occur on ridge shoulders below the Ahpah soils on ridge crests. The Lackscreek soils are on narrow ridges and on locally steeper, or more strongly convex slopes.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: This soil has been used for commercial timber, wildlife and watershed. Natural vegetation consists of redwood, Douglas-fir, western hemlock, tanoak, rhododendron and huckleberry.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California, 1984. Source of name is from Ahpah Creek, located 18 miles northeast of the town of Orick.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from 0 to 7 inches (A horizon).

Cambic horizon - the zone from 7 to 26 inches (Bw1, Bw2 horizons).

Paralithic contact - the bedrock interface at 32 inches depth.

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD: JHP/DJE
4/87

AHPAH SERIES

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Humitropepts.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 7 inches (A) ranges from 4 to 13 inches thick.

    1.1 The value, chroma, or both increase to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by field estimate is 28 percent.

2. Cambic horizon - 7 to 26 inches (Bw1, Bw2) ranges from 8 to 17 inches thick.

    2.1 Alteration is evident from subangular blocky pedogenic Structure, absence of rock structure, and decreasing chroma and redness with depth.

3. Contact

    3.1 Depth to a paralithic contact is 20 to 40 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell, et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is assumed to be udic, since similar soils are udic in the survey area, according to Sturhan (in preparation).

2. Humitropepts great group

    2.1 Organic carbon is assumed to be 12 to 20 kilograms per square meter to 1 meter depth, based on carbon measured in similar, nearby soils.

    2.2 Base saturation is assumed to be less than 50 percent throughout, based on data from similar, nearby soils.

3. Fine-loamy particle-size class

   3.1 Control section is from 10 inches to paralithic contact.

   3.2 Clay content by field estimate is 28 percent in Bw1, 31 percent in Bw2 and 16 percent in C.

   3.3 Control section averages 26.4 percent fragments coarser than 2 mm, by volume.

4. Other series characteristics

   4.1 Bw horizon is 10YR or 7.5YR in hue, with 25 to 35 percent clay.

LOCATION ATWELL

Tentative Series
RD:JAD/JHP/DJE
4/87
MLRA:4

ATWELL SERIES

The Atwell series consists of very deep, moderately well or somewhat poorly drained soils that formed in material from sheared sedimentary rocks. Atwell soils are on mountains and have slopes of 15 to 50 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine, mixed, isomesic Mollic Hapludalfs.

TYPICAL PEDON: Atwell clay loam - on a concave, southwest facing slope of 24 percent under second growth redwood, Douglas-fir, grand fir and swordfern at 1,400 feet elevation. (Colors are for dry soil unless otherwise stated. When described October 12, 1956, the soil was moist throughout.)

O--1/2 to 0 inches; partially decomposed forest litter from redwood and Douglas-fir conifers.

A--0 to 6 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky; hard, friable; many fine roots; many fine tubular pores; strongly acid (pH 5.3); clear wavy boundary. (3 to 10 inches thick)

BAt--6 to 17 inches; light yellowish brown (10YR 6/4) clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky; slightly hard, friable; many fine roots; many fine and few medium pores; thin patchy clay films on faces of peds; thin faint, continuous clay films in pores; very strongly acid (pH 4.7); gradual wavy boundary. (10 to 20 inches thick)

Bt1--17 to 30 inches; pale brown (10YR 6/3) gravelly clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular to angular blocky; slightly hard, firm; few roots; common fine and few medium tubular pores; moderately thick distinct, continuous clay films on faces of peds and in pores; very strongly acid (pH 4.6); clear wavy to irregular boundary. (10 to 14 inches thick)

Bt2--30 to 40 inches; light yellowish brown (2.5Y 6/3) clay, faintly mottled, olive brown (2.5Y 4/3) moist; moderate fine subangular blocky, hard, firm; few roots; common fine and medium tubular pores; distinct moderately thick, continuous clay films on faces of peds and in pores; very strongly acid (pH 4.5); clear wavy boundary. (9 to 14 inches thick)

2BCtg1--40 to 45 inches; light yellowish brown and light brownish gray (2.5Y 6/3 and 6/2) silty clay, mottled, olive brown and dark grayish brown (2.5Y and 10YR 4/2) moist; moderate fine subangular blocky to massive; very firm, sticky and plastic; few roots; common fine and medium tubular pores; distinct moderately thick, continuous clay films on faces of peds and in pores; very strongly acid (pH 4.3); clear wavy boundary. (5 to 8 inches thick)

2BCtg2--45 to 54 inches; gray and light brownish gray (2.5Y 5/1 and 6/2) silty clay, mottled, dark gray and olive brown (10YR 4/1 and 2.5Y 4/3) moist; massive; very firm, sticky and plastic; thin, faint, nearly continuous, clay films on peds and in pores; very strongly acid (pH 5.5); gradual wavy boundary. (6 to 12 inches thick)

2Cg--54 to 62 inches; horizon similar to one above, but reaction is neutral to slightly alkaline. Grades into a shear zone consisting of dense gray clay matrix with gray, lenticular and subangular rocks (1/2 to 24 inches diameter of hard sandstone and shale often with calcite seams). (Many feet thick)

TYPE LOCATION: Humboldt County, California; 2.5 miles southwest of Scotia near the head of Atwell Creek; in the northeast quarter of section 23, T. 1 N., R. 1 W., Taylor Peak Quadrangle.

RANGE IN CHARACTERISTICS: Depth to bedrock is greater than 60 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section, between depths of 5 to 19 inches, is continuously moist in all parts in most years. Base saturation is more than 60 percent 50 inches below the soil surface and increases with depth. The upper 20 inches of the argillic horizon is 35 to 50 percent clay with 15 to 35 percent gravel and cobbles. Depth to mottles of low chroma is 30 to 60 inches.

The A horizon is 10YR 5/2, 5/3, 6/3 or 2.5Y 6/2. Moist color is 10YR 3/2, 3/3 or 4/3; value, chroma or both increase to 4 or more within 10 inches of the soil surface. Texture is clay loam, gravelly clay loam, silty clay loam or gravelly silty clay loam. There is 27 to 35 percent clay and 2 to 25 percent mostly angular pebbles. It is medium to strongly acid.

The Bt horizon is 10YR 6/3, 7/4 or 2.5Y 6/3, 6/4, 7/4 with 10YR 6/6 mottles in the lower part. Moist color is 10YR 5/4 or 2.5Y 4/3, 4/4, 5/4 with 7.5YR 5/6 mottles. Texture is clay loam, gravelly clay loam, clay or gravelly clay. There is 35 to 50 percent clay and 5 to 35 percent gravel. It is medium to very strongly acid.

The 2Cg horizon is N 5/, 6/, 7/, 5Y 6/2, 7/2 or 2.5Y 6/2 and has 10YR 6/6 or 7.5YR 6/6 mottles. Moist color is N4/, 5/, 6/, 5Y 4/2, 5/2 or 2.5Y 4/2 with 10YR 5/4, 5/6 or 7.5YR 5/6 mottles. Mottling decreases with depth. Texture is clay, gravelly clay, very gravelly

clay or silty clay. There is 40 to 60 percent clay and 5 to 35 percent rounded to subangular pebbles, cobbles and stones. Reaction is neutral to moderately alkaline. Slickensides are common in some profiles.

COMPETING SERIES: This is the Yorkville series in another family. Yorkeville soils have a mollic epipedon, xeric soil moisture regime and a thermic soil temperature regime.

GEOGRAPHIC SETTING: Atwell soils are on mountains. They occupy concave to irregular, unstable slopes in areas of high drainage density. Slips and slides are common. Seeps and springs are common. Slopes are 15 to 50 percent. Elevations are 50 to 3,000 feet. These soils formed in colluvium from sheared graywacke sandstone and shale. The climate is humid with cool, foggy summers and cool, rainy winters. Mean annual precipitation is 50 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 57 degrees F; and the mean annual temperature is about 53 degrees F. Frost-free season is about 270 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coppercreek soils. Coppercreek soils are fine-loamy and lack low-chroma mottles within 60 inches of the soil surface. The Coppercreek soils are on drier slopes above the Atwell soils.

DRAINAGE AND PERMEABILITY: Moderately well or somewhat poorly drained; medium runoff; moderately slow permeability in the A horizon, very slow in the 2Cg horizon. Subsoils are continuously moist.

USE AND VEGETATION: This soil has been used for commercial timber, wildlife and watershed. Natural vegetation consists of redwood, Douglas-fir, grand fir, western redcedar, California laurel, tanoak, bigleaf maple, huckleberry, salal and swordfern.

DISTRIBUTION AND EXTENT: Coast Range mountains, northern coastal California. The series is moderately extensive.

SERIES PROPOSED: Humboldt County, California, 1957. Source of name is Atwell Creek, located south of the town of Rio Dell.

REMARKS: The Atwell series was originally placed in the fine, vermiculitic, mesic Typic Hapludalfs. Reclassification to a mixed mineralogy class is based on re-examination of old laboratory data and on more recent investigations of soil mineralogy by Dr. Phillip Durgin (USFS, Arcata), who found that authigenic chlorite, mica and several clay-mineral intergrades are about as abundant as vermiculite in many pedons. Reclassification to the isomesic temperature class is based on a recent soil temperature study by Dr. Donald Hauxwell, who found that, in Humboldt County, the isomesic temperature class extends from the coast through the redwood belt and well into the Douglas-fir region.

ADDITIONAL DATA: California Soil-Vegetation Survey samples 56-CA-12-14X and 57-CA-12-11X were collected at the type location. California Soil- Vegetation Survey sample 82-CA-12-03X was collected from the survey area modal pedon in Redwood National Park. California Soil-Vegetation Survey sample 62-CA-12-28X was collected from another Atwell pedon in Humboldt County.

National Cooperative Soil Survey
U.S.A.

LOCATION COPPERCREEK

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

COPPERCREEK SERIES

The Coppercreek series consists of deep to very deep, well drained soils that formed in colluvium and residuum from sandstone and schist. Coppercreek soils are on mountains and have slopes of 15 to 75 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, isomesic Typic Haplohumults.

TYPICAL PEDON: Coppercreek very gravelly loam - on a uniform northwest facing slope of 39 percent under tanoak, coast redwood, Douglas-fir, madrone and huckleberry at 940 feet elevation. (Colors are for dry soil unless otherwise stated. When described June 13, 1983, the soil was moist throughout).

O--1 to 0 inches; fresh and decomposing tanoak leaves, redwood needles and twigs.

A--0 to 4 inches; pale brown (10YR 6/3) very gravelly loam, dark yellowish brown (10YR 3/4) moist; weak fine granular and subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine, and many medium roots; many very fine interstitial and common very fine and fine tubular pores; 36 percent pebbles; strongly acid (pH 5.3); clear smooth boundary. (3 to 10 inches thick)

AB--4 to 10 inches; light yellowish brown (10YR 6/4) gravelly clay loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine, fine and coarse, many medium roots; common very fine and fine tubular pores; 20 percent pebbles and 5 percent cobbles; very strongly acid (pH 5.0); gradual smooth boundary. (0 to 8 inches thick)

BAt--10 to 16 inches; very pale brown (10YR 7/4) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, sticky, slightly plastic; few very fine and fine, common medium and coarse roots; common very fine and fine tubular pores; 14 percent pebbles and 10 percent cobbles; very strongly acid (pH 5.0); gradual wavy boundary. (0 to 14 inches thick)

Bt1--16 to 30 inches; pale yellow (2.5Y 7/3) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky, plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; 38 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2); gradual wavy boundary. (0 to 13 inches thick)

Bt2--30 to 39 inches; white (2.5Y 8/2) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky, plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; few faint clay films on ped faces; 38 percent pebbles and 5 percent cobbles; very strongly acid (pH 4.8); gradual smooth boundary. (7 to 11 inches thick)

BCt--39 to 67 inches; light gray (2.5Y 7/2) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky, plastic; few very fine fine, medium and coarse roots; few very fine tubular pores; common faint clay films on ped faces; 43 percent pebbles and 5 percent cobbles; strongly acid (pH 5.3). (7 to 30 inches thick)

TYPE LOCATION: Humboldt County, California; 900 ft NNW of junction between 2005 Road and K&K Road, Redwood National Park; southeast quarter, southwest quarter, section 15, T. 9 N., R. 2 E., HBLM, Bald Hills Quadrangle.

RANGE OF CHARACTERISTICS: Depth to a paralithic contact is 40 to 60 inches or more. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section, between depths of 10 to 35 inches, is continuously moist in all parts in most years. There is 12 to 20 kg organic carbon per square meter to a depth of one meter. The base of the argillic horizon is within 40 inches of the soil surface. The upper 20 inches of the argillic horizon is 25 to 35 percent clay and contains 15 to 35 percent gravel. Reaction is medium or strongly acid throughout. Base saturation is 15 to 35 percent at the critical depth.

The A horizon is 10YR 4/2, 4/3, 5/3, 5/4, or 7.5YR 5/4. Moist color is 10YR 3/2, 3/3, 3/4, 4/3, or 7.5YR 3/2, 3/4 and the value, chroma or both increase to 4 or more, moist, within 10 inches of the soil surface. Texture is gravelly loam, very gravelly loam, or gravelly clay loam. There is 20 to 30 percent clay, 15 to 50 percent gravel and 0 to 10 percent cobbles.

The Bt horizon is 2.5Y 7/3, 10YR 6/4, 6/6, 7/4, 7/6 or 7.5YR 4/6, 5/6, 6/6. Moist color is 10YR 4/4, 4/6, 5/4, 5/6, or 7.5YR 4/4, 4/6, 5/6. Texture is gravelly clay loam or cobbly clay loam. There is 27 to 35 percent clay, 15 to 35 percent gravel and 0 to 15 percent cobbles.

COMPETING SERIES: This is the Empire series. Empire soils have argillic horizons that extend more than 40 inches below the soil surface.

GEOGRAPHIC SETTING: Coppercreek soils are on mountain sideslopes. Slope gradients are 15 to 75 percent. Elevations are 600 to 2,600 feet. These soils formed in colluvium and residuum from sandstone and schist. The climate is humid with cool, foggy summers and cool, rainy winters. Mean annual precipitation is 70 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 57 degrees F; and the mean annual temperature is about 52 degrees F. Frost-free season is about 270 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ahpah (T), Atwell (T), Devilscreek (T), Lackscreek (T), Slidecreek (T), Tectah (T), and Trailhead (T) soils. Ahpah, Devilscreek and Slidecreek soils lack argillic horizons. Atwell, Tectah and Trailhead soils have more than 35 percent clay in their control sections. Lackscreek and Slidecreek soils have loamy-skeletal control sections. Ahpah and Lackscreek soils are 20 to 40 inches deep to bedrock. The Atwell and Devilscreek soils are in wet hillslope hollows below the Coppercreek soils. The Ahpah and Lackscreek soils are on convex slopes or on spur ridges above the Coppercreek soils. The Slidecreek soils are alongside the Coppercreek soils on very gravelly colluvium. The Tectah and Trailhead soils are above the Coppercreek soils on gentler slopes.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: This soil has been used for commercial timber production, wildlife and watershed. Natural vegetation includes redwood, Douglas-fir, tanoak, western hemlock, rhododendron and huckleberry.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is moderately extensive.

SERIES PROPOSED: Humboldt County, California, Redwood National Park 1983. The source of the name is from Copper Creek, Redwood National Park, California.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from 0 to 7 inches (A, upper AB horizons)

Argillic horizon - the zone from 7 to 39 inches (lower AB, BAt, Bt1, Bt2 horizons)

Ultisol feature - base saturation of 20.1 percent, by sum of cations, in BCt horizon

Humult feature - organic carbon is 1.22 percent or more from 0 to 16 inches (A, AB, BAt, Bt1 horizons)

The Coppercreek series was originally placed in the Typic Humitropepts. Reclassification is based on analysis of laboratory data which shows a weak argillic horizon to be present. This revision also moves the type location to a pedon better representing the concept of the series.

ADDITIONAL DATA: Soil sample 83-RNP-12 was collected at the type location and analyzed at the Oregon State University soil testing laboratory. Soil sample S83-CA-12-06, from the type location, was analyzed by NSSL for clay mineralogy class placement. Soil samples 721, 81-RNP-68-73 and S82-CA-12-01 were collected at other Coppercreek locations in Redwood National Park.

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD:JHP/DJE
4/87

COPPERCREEK SERIES

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Haplohumults.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 7 inches (A, upper AB) ranges from 6 to 11 inches thick.

    1.1 Organic carbon is 5.68 percent in the A and 2.84 percent in the AB of the type pedon. However, the value and chroma increase to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by pipette method is 22.1 percent in the A and 27.0 percent in the AB.

2. Argillic horizon - 7 to 39 inches (lower AB, BAt, Bt1, Bt2) ranges from 6 to 30 inches thick.

    2.1 Clay content by pipette method is 27.0 percent in AB, 29.2 percent in BAt, 27.4 percent in Bt1 and 27.9 percent in Bt2.

    2.2 There are faint clay films on faces of peds in the Bt2 and BCt.

3. Contact

    3.1 Depth to a paralithic contact is greater than 40 inches, and greater than 60 inches in most pedons.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is udic, based on data from Sturhan (in preparation). Pedon is her site IIB. The moisture control section, from depths of 10 to 35 inches, remained moist in all parts throughout 1984 and 1985.

2. Ultisol order

   2.1 Base saturation is 20.1 percent, by sum, at depth of 57 inches.

3. Humult suborder

   3.1 Organic carbon is 1.22 percent or more in the upper 6 inches of the argillic horizon.

4. Fine-loamy particle-size class

   4.1 Control section is 7 to 27 inches.

   4.2 There is 27.8 percent clay (wt. average).

   4.3 There is 31.0 percent rock fragments, by volume.

5. Other series characteristics

   5.1 The Bt horizon has hue of 10YR or 7.5YR, with 27 to 35 percent clay.

   5.2 The argillic horizon is weakly expressed, and its base is within 40 inches of the soil surface.

LOCATION DEVILSCREEK

Tentative Series
RD:JL/JHP/DJE
4/87
MLRA:4

DEVILSCREEK SERIES

The Devilscreek series consists of very deep, moderately well or somewhat poorly drained soils that formed in colluvium from schist. Devilscreek soils are on mountains and have slopes of 30 to 75 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, isomesic Typic Humitropepts.

TYPICAL PEDON: Devilscreek gravelly clay loam - on a north facing uniform slope of 68 percent under redwood, hemlock, tanoak, dogwood, rhododendron, salal, swordfern, deer fern and five-finger fern at 500 feet elevation. (Colors are for dry soil unless otherwise stated. When described July 22, 1983, the soil was moist throughout.)

O--1 inch to 0; litter of fresh and decomposing redwood twigs, leaves and bark, tanoak leaves and fern fronds.

A--0 to 5 inches; light yellowish brown (10YR 6/4) gravelly clay loam, dark yellowish brown (10YR 4/6) moist; weak medium granular and subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common fine interstitial and many very fine and fine tubular pores; 33 percent pebbles; strongly acid (pH 5.4); gradual wavy boundary. (2 to 22 inches thick)

BA--5 to 13 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine, fine and medium and few coarse roots; common very fine and fine tubular pores; 6 percent pebbles; strongly acid (pH 5.4); gradual wavy boundary. (8 to 11 inches thick)

Bw--13 to 21 inches; brownish yellow (10YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine and medium and few coarse roots; common very fine, fine and medium tubular pores; 6 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary. (5 to 30 inches thick)

BC--21 to 29 inches; yellowish brown (10YR 5/6) cobbly clay loam, yellowish brown (10YR 5/8) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; 12 percent pebbles and 10 percent cobbles; strongly acid (pH 5.2); gradual smooth boundary. (6 to 15 inches thick)

Cg1--29 to 37 inches; light gray (2.5Y 7/2) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; common medium faint pale brown (10YR 6/6) mottles, yellowish brown (10YR 5/8) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; 40 percent pebbles and 10 percent cobbles; strongly acid (pH 5.2); clear wavy boundary. (7 to 32 inches thick)

Cg2--37 to 67 inches; light gray (5Y 7/1) very gravelly loam, variegated olive (5Y 5/3) and gray (5Y 6/1) moist; common medium distinct strong brown (7.5YR 5/6) and common medium prominent strong brown (7.5YR 5/8) mottles moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; few very fine tubular pores; 38 percent pebbles and 10 percent cobbles; strongly acid (pH 5.1). (4 to 30 inches thick)

TYPE LOCATION: Humboldt County, California; approximately 250 feet due east of G-6 Road bridge over Tom McDonald Creek in the northwest corner of the SE quarter, NE quarter, Section 11, T. 9 N., R. 1 E., HB&M; Rodger's Peak Quadrangle.

RANGE IN CHARACTERISTICS: Depth to a paralithic contact is 60 inches or more. Depth to low-chroma mottles is 20 to 60 inches . The mean annual soil temperature is 50 degrees to 56 degees F. The difference between mean summer and winter temperature is 5 to 8 degrees F. The soil moisture control section, between depths of 6 to 13 inches, is continuously moist in all parts in most years. The particle-size control section, between depths of 10 to 40 inches, is 20 to 30 percent clay and contains 15 to 35 percent gravel and cobbles. There is 12 to 20 kg of organic carbon per square meter to a depth of 1 meter. Base saturation is less than 50 percent in the top 40 inches but, in some profiles, increases to above 50 percent in the mottled layers.

The A horizon is 10YR 5/4, 6/4, or 6/6. Moist color is 10YR 3/4, 3/6, or 4/6. Texture is gravelly loam or gravelly clay loam. It has 25 to 32 percent clay, 15 to 35 percent gravel and 0 to 5 percent cobbles.

The B horizon has hue of 10YR or 7.5YR, value of 6 or 8 dry, value of 4 or 6 moist, and chroma of 4 to 6 moist and dry. Texture is clay loam or gravelly clay loam. It has 27 to 35 percent clay, 5 to 35 percent gravel, and 0 to 15 percent cobbles.

The C horizon is 5Y 6/2, 7/1, 7/2, 8/1 or 2.5Y 7/2 in the matrix, 5Y 4/1, 5/2, 5/3, 6/1, 6/2 or N 6/ moist. It has mottles 5YR to 10YR in hue and 6 to 8 in chroma. It is gravelly sandy loam, gravelly loam, gravelly silty loam or very gravelly loam. It has 10 to 25 percent clay, 15 to 40 percent gravel and 0 to 10 percent cobbles.

COMPETING SERIES: These are the Ahpah (T), Carlotta, Ettersburg, Hely, Mues, Reedsport and Svensen series. None have low-chroma mottles within 60 inches of the soil surface. All but Ahpah and Coppercreek soils have umbric epipedons. Ahpah and Reedsport soils are 20 to 40 inches deep to a paralithic contact.

GEOGRAPHIC SETTING: Devilscreek soils are on mountains near drainage headwaters. Slopes are 30 to 75 percent. Elevations are 250 to 2,300 feet. These soils formed in colluvium weathered from schist. The climate is humid with cool, foggy summers and cool, rainy winters. Mean annual precipitation is 70 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 57 degrees F; and mean annual temperature is about 53 degrees F. Frost-free season is about 270 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOIL: These are the Coppercreek (T) and the Elfcreek (T) soils. Coppercreek soils have an argillic horizon and lack low-chroma mottles. Elfcreek soils have loamy-skeletal control sections. The Elfcreek soils are near creeks downstream from the headwaters. The Coppercreek soils are on drier slopes above the Devilscreek soils.

DRAINAGE AND PERMEABILITY: Moderately well or somewhat poorly drained; medium runoff; moderate permeability.

USE AND VEGETATION: This soil has been used for commercial timber production, wildlife, and watershed. Natural vegetation includes redwood, western hemlock, tanoak, rhododendron, huckleberry, swordfern, and deer fern.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is not extensive.

SERIES PROPOSED: Humboldt County, California, Redwood National Park 1983. The source of the name is from Devils Creek, Redwood National Park, California.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface to 5 inches (A horizon).

Cambic horizon - the zone from 5 to 29 inches (BA, Bw, BC horizons).

Mottles of low chroma - in the zone from 29 to 67 inches (Cg1, Cg2).

ADDITIONAL DATA: Soil sample 82-RNP-8 was collected at the type location and analyzed at the Oregon State University soil testing laboratory.

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD:JL/JHP/DJE
4/87

DEVILSCREEK SERIES

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Humitropepts.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 5 inches (A) ranges from 5 to 22 inches thick.

    1.1 Organic carbon is 3.89 percent in the A and 1.62 percent in the BA of the type pedon. However, the value and chroma increase to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by pipette method is 26.2 percent in the A.

2. Cambic horizon - 5 to 29 inches (BA, Bw, BC) ranges from 9 to 24 inches thick.

    2.1 Alteration is evident from subangular blocky pedogenic structure, absence of rock structure, decreasing clay, redness and chroma with depth. Clay increases less than 1.2 times, and no clay films were seen.

3. Contact

    3.1 Depth to a paralithic contact is greater than 60 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is assumed to be udic, since other soils are udic in the Redwood National Park survey area, according to Sturhan (in preparation).

2. Humitropepts great group

    2.1 Organic carbon is 15.0 Kilograms per square meter to 1 meter depth.

    2.2 Base saturation is less than 50 percent, by ammonium acetate, between 10 and 37 inches.

3. Fine-loamy particle-size class

   3.1 Control section is 10 to 40 inches.

   3.2 The ratio of 15-bar water to clay is >0.60 throughout the control section.

   3.3 Weighted average clay, estimated by 2.5 times 15-bar water is 33 percent.

   3.4 Control section averages 26.6 percent fragments coarser than 2 mm, by volume.

4. Other series characteristics

   4.1 Bw horizon is 10YR or 7.5YR in hue, with 27 to 35 percent clay.

   4.2 Depth to low-chroma mottles is 20 to 60 inches.

LOCATION ELFCREEK

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

ELFCREEK SERIES

The Elfcreek series consists of very deep, well or moderately well drained soils that formed in colluvium from schist. Elfcreek soils are on mountains and have slopes of 15 to 90 percent. The mean annual precipitation is about 80 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Loamy-skeletal, mixed, isomesic Typic Eutropepts

TYPICAL PEDON: Elfcreek gravelly loam - on an uneven, northeast-facing slope of 22 percent under redwood, hemlock, tanoak, Douglas-fir, swordfern, deer fern and oxalis at 960 feet elevation. (Colors are for dry soil unless otherwise stated. (When described July 12, 1984, the soil was moist throughout.)

O--2 to 0 inches; fresh and decomposing redwood needles, tanoak leaves and twigs.

A--0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine, fine and few medium roots; many very fine and fine interstitial pores; 34 percent pebbles; medium acid (pH 5.8); clear wavy boundary. (4 to 17 inches thick)

Bw--4 to 14 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine, and few fine, medium and coarse roots; many very fine and fine interstitial, and few very fine tubular pores; 17 percent pebbles and 7 percent cobbles; medium acid (pH 6.0); gradual wavy boundary. (10 to 28 inches thick)

C1--14 to 31 inches; gray (5Y 6/1) extremely gravelly loam, dark gray (5Y 4/1) moist; massive; soft, very friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; 62 percent pebbles; slightly acid (pH 6.2); diffuse wavy boundary. (5 to 32 inches thick)

C2--31 to 47 inches; gray (5Y 5/1) very gravelly loam, dark gray (5Y 4/1) moist; massive; hard, very friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; 43 percent pebbles; slightly acid (pH 6.1); diffuse wavy boundary. (7 to 22 inches thick)

C3--47 to 65 inches; gray (5Y 5/1) very gravelly loam, dark gray (5Y 4/1) moist; massive; hard, friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; 40 percent pebbles; slightly acid (pH 6.1); gradual smooth boundary. (9 to 18 inches thick)

C4--65 to 87 inches; gray (N 5/) gravelly loam, dark gray (N 4/) moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine, fine and medium roots; common very fine interstitial pores; 33 percent pebbles; neutral (pH 6.6). (0 to 22 inches thick)

TYPE LOCATION: Humboldt County, California; approximately 650 feet downslope from end of M-4 logging road, 100 feet above middle fork of Bridge Creek, Redwood National Park; center of north half, southeast quarter, Section 30, T. 9 N., R. 2 E., HBLM; Rodger's Peak Quadrangle.

RANGE IN CHARACTERISTICS: Depth to a paralithic contact is greater than 60 inches. Depth to low-chroma mottles is 40 to 60 inches or more. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section is continuously moist in all parts in most years. The particle-size control section, between depths of 10 to 40 inches, is 10 to 20 percent clay and contains 35 to 60 percent gravel and cobbles. Base saturation, by ammonium acetate, is 70 to 100 percent throughout.

The A horizon has dry color of 2.5Y 5/2, 6/2 or 10YR 5/2, 5/3. Moist color is 2.5Y 4/2 or 10YR 3/2, 3/3, 4/2. The value, chroma or both, increase to 4 or more within 10 inches of the soil surface. Texture is gravelly loam or very gravelly loam. It has 15 to 25 percent clay and 20 to 50 percent gravel. Reaction is slightly to moderately acid.

The Bw horizon has dry color of 2.5Y 7/2, 7/3, 7/4 or 10YR 6/3. Moist color is 2.5Y 4/3, 5/3 or 10YR 4/3, 5/2. Texture is gravelly loam, very gravelly loam, or extremely gravelly loam. It has 15 to 25 percent clay, 15 to 65 percent gravel and 0 to 10 percent cobbles. Reaction is slightly to moderately acid.

The C horizon, to a depth of 40 inches, has dry color of N 5/, 6/ or 5Y 5/1, 6/1, 7/1, 7/2. Moist color is N 4/ or 5Y 4/1, 5/2, 5/3. Texture is very gravelly sandy loam, very gravelly loam or extremely gravelly loam. It has 8 to 20 percent clay, 40 to 70 percent gravel and 0 to 10 percent cobbles. Reaction is neutral to moderately acid. The C horizon becomes more variable and stratified with depth. Many pedons contain mottled layers at depths greater than 40 inches.

COMPETING SERIES: This is the Slidecreek (T) series in another family. Slidecreek soils have more than 25 percent clay in the particle-size control section, and base saturation of less than 50 percent throughout.

GEOGRAPHIC SETTING: Elfcreek soils are in steep-sided mountain valleys near creeks. Slopes are 15 to 75 percent. Elevations are 100 to 1500 feet. These soils formed in colluvium weathered from schist. The climate is humid with cool, foggy summers and cool, rainy winters. Mean annual precipitation is 70 to 90 inches. Mean January temperature is about 48 degrees F.; mean July temperature is about 57 degrees F., and mean annual temperature is about 53 degrees F. Frost-free season is about 280 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coppercreek (T) and Devilscreek (T) soils. Coppercreek and Devilscreek soils are fine-loamy and have more than 25 percent clay in the control section. The Coppercreek soils are on gentler, drier slopes above the Elfcreek soils. The Devilscreek soils are near drainage headwaters upstream from the Elfcreek soils.

DRAINAGE AND PERMEABILITY: Well or moderately well drained; medium runoff; moderately rapid permeability.

USE AND VEGETATION: This soil is used for wildlife and watershed. Natural vegetation includes redwood, western hemlock, tanoak, big-leaf maple and red alder in the overstory, and rhododendron, huckleberry, salmonberry, thimbleberry, swordfern, oxalis and coltsfoot in the understory.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California, 1984. Source of name is Elf Creek, a tributary to Redwood Creek in Redwood National Park 11 miles south of the town of Orick.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 4 inches (A horizon).

Cambic horizon - the zone from 4 to 14 inches (Bw horizon).

ADDITIONAL DATA: Soil sample 84-RNP-8 was collected at from the type pedon and analyzed at the Oregon State University Soil Testing and Soil Physics Laboratories.

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD:JHP/DJE
4/87

ELFCREEK SERIES

Taxonomic Class: Loamy-skeletal, mixed, isomesic Typic Eutropepts.

Major Diagnostic Horizons:

1. Ochric Epipedon - 0 to 4 inches (A) ranges from 4 to 17 inches thick.

    1.1 The value, chroma, or both increase to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by pipette method is 16.3 percent.

2. Cambic horizon - 4 to 14 inches (Bw) ranges from 10 to 28 inches thick.

    2.1 Clay content by pipette method decreases from 18.6 percent in Bw to 8.6 percent in C1 and 9.5 percent in C2.

    2.2 Alteration is evident from subangular blocky pedogenic structure, absence of rock structure, and decreasing chroma and redness with depth.

3. Contact

    3.1 Depth to a paralithic contact is greater than 60 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is assumed to be udic, since other soils are udic under similar vegetation in the survey area (Sturhan in preparation).

2. Eutropept great group

    2.1 Base saturation is 71.1 perent in Bw, 88.3 percent in C1, and 98.8 percent in C2 by ammonium acetate.

3. Loamy-sketetal particle-size class

3.1 Control section is 10 to 40 inches.

3.2 Control section averages 10.8 percent clay, by weight, and 51.8 percent fragments coarser than 2 mm, by volume.

LOCATION FORTYFOUR

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

FORTYFOUR SERIES

The Fortyfour series consists of moderately deep, well drained soils formed in material weathered from schist. Fortyfour soils are on mountains and have slopes of 9 to 50 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Clayey, oxidic, isomesic Typic Hapludults.

TYPICAL PEDON: Fortyfour clay loam - on a southeast-facing convex slope of 20 percent under second-growth Douglas-fir, hemlock, redwood, tanoak, red alder, rhododendron, huckleberry and salal at 1230 feet elevation. (Colors are for dry soil unless otherwise stated. When described June 30, 1982, the soil was moist throughout.)

O--1 to 0 inches; fresh and decomposing Douglas-fir needles and twigs.

A--0 to 12 inches; strong brown (7.5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky, parting to moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, common medium roots; many very fine and fine interstitial, and common fine and medium tubular pores; 14 percent pebbles; very strongly acid (pH 5.0); gradual wavy boundary. (5 to 12 inches thick)

BAt--12 to 18 inches; yellowish red (5YR 5/8) clay loam, yellowish red (5YR 4/8) moist; moderate coarse subangular blocky, parting to moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine, medium and few coarse roots; few very fine and fine interstitial, and common fine and medium tubular pores; 14 percent pebbles; very strongly acid (pH 5.0); gradual wavy boundary. (6 to 9 inches thick)

Bt--18 to 30 inches; yellowish red (5YR 5/8) gravelly clay, yellowish red (5YR 4/8) moist; moderate coarse subangular blocky structure; hard, firm, sticky, slightly plastic; common fine and medium, and few coarse roots; common fine, medium and coarse tubular pores; common distinct red (2.5YR 4/6) moist, clay films on faces of peds; 20 percent pebbles; strongly acid (pH 5.2); gradual wavy boundary. (8 to 15 inches thick)

BCt--30 to 39 inches; variegated reddish yellow (5YR 6/6) and yellow (10YR 7/8) clay loam, yellowish red (5YR 5/8) moist; moderate medium subangular blocky, parting to moderate fine subangular blocky structure; hard, firm, sticky, slightly plastic; few fine, medium and coarse roots; few fine, medium and coarse tubular pores; few distinct clay films on faces of peds; 10 percent pebbles; very strongly acid (pH 4.9); abrupt wavy boundary. (0 to 10 inches thick)

Cr--39 to 49 inches; strongly reddened, fractured, weathered schist with a few narrow seams of red clay.

TYPE LOCATION: Humboldt County, California; roadcut on M-11-1-1 logging road, 750 feet south of junction of L-1 and M-11-1-1 roads in Redwood National Park; southwest quarter, southeast quarter, Section 22, T. 10 N., R. 1 E., HBLM; Rodger's Peak Quadrangle.

RANGE IN CHARACTERISTICS: Depth to a paralithic contact is 20 to 40 inches; The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section is continuously moist in all parts in most years, but it becomes nearly dry in the upper part from about September 15 to October 15 in most years. The argillic horizon is 20 to 27 inches thick. The upper 20 inches of the argillic horizon is 35 to 45 percent clay. It contains 5 to 25 percent gravel and the sequioxide to clay ratio is 0.20 to 0.30. CEC to clay ratio is 24 to 40 meq/100g in the argillic horizon. Reaction is strongly or very strongly acid, and base saturation is 5 to 25 percent throughout.

The A horizon has dry color of 7.5YR 5/4, 5/6 or 5YR 5/4. Moist color is 7.5YR 4/6 or 5YR 3/4, 4/4, 4/6. Texture is clay loam, gravelly clay loam or silty clay loam. There is 27 to 35 percent clay and 10 to 25 percent gravel.

The Bt horizon has dry color of 7.5YR 5/6, 5/8, 6/6, 6/8, 7/6 or 5YR 5/8, 6/8. Moist color is 7.5YR 5/6 or 5YR 4/6, 4/8, 5/8. Texture is silty clay loam, gravelly silty clay loam, silty clay, clay or gravelly clay. There is 40 to 50 percent clay and 5 to 20 percent gravel.

COMPETING SERIES: This is the Trailhead (T) series in another family. Trailhead soils are more than 40 inches deep and have CEC to clay ratios of 16 to 24 meq/100g in the argillic horizon.

GEOGRAPHIC SETTING: Fortyfour soils occur on rounded spur ridges and convex, upper sideslopes of mountains. Slopes are 9 to 50 percent. Elevations are 300 to 2600 feet. The soils formed in material weathered from quartz-mica schist. The climate is humid with cool, foggy summers and cool, moist winters. Coastal influence limits the annual and diurnal range in temperature. Mean annual precipitation ranges from 70 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 58 degrees F; and the mean

annual temperature is about 52 degrees F. Frost-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Trailhead (T) soils. The Trailhead soils are on straight, smooth slopes above and below the Fortyfour soils.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderately slow permeability.

USE AND VEGETATION: This soil has been used for commercial timber, wildlife and watershed. Natural vegetation consists of redwood, Douglas-fir, western hemlock, tanoak, madrone, huckleberry and rhododendron.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California, 1984. Source of name is from Fortyfour Creek, a tributary to Redwood Creek five miles south of the town of Orick.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 12 inches (A horizon).

Argillic horizon - the zone from 12 to 39 inches (BAt, Bt, BCt horizons).

Paralithic contact - the bedrock interface at 39 inches.

Oxidic mineralogy class - sesquioxide to clay ratio of 0.20 to 0.30 in the upper 20 inches of the argillic horizon.

ADDITIONAL DATA: The Fortyfour type pedon was sampled under field numbers S82-CA-12-05X and 84-RNP-12 for analysis at the University of California soil morphology laboratory, and the Oregon State University soil testing and soil physics laboratories. Sample numbers 84-RNP-1 and 84-RNP-2 were collected from other Fortyfour pedons. Soil profile 5, described by Marron (1982), is also a Fortyfour pedon.

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD:JHP/DJE
4/87

FORTYFOUR SERIES

Taxonomic Class: Clayey, oxidic, isomesic Typic Hapludults.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 12 inches (A) ranges from 5 to 15 inches thick.

    1.1 Organic carbon is 2.38 percent but moist and dry value and chroma are too high for an umbric or mollic epipedon.

    1.2 Clay content by pipette is 34.0 percent in the type pedon.

2. Argillic horizon - 12 to 39 inches (BAt, Bt, BCt) ranges from 22 to 27 inches thick.

    2.2 Clay content is pipette is 41.5 percent in the BAt, 44.0 percent in the Bt, and 43.0 percent in the BCt.

    2.3 The Bt and BCt have distinct clay films on faces of peds.

3. Contact

    3.1 Depth to a paralithic contact is 20 to 40 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell, et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is assumed to be udic, since other soils are udic under similar vegetation in the Redwood National Park survey area (Sturhan in preparation).

2. Ultisol order

    2.1 Base saturation is 11.6 percent at the paralithic contact.

3. Udult suborder

    3.1 Organic carbon is 10.8 Kilograms per square meter to 1 meter depth.

4. Typic subgroup, based on CEC/clay ratio ranging from 28 to 40 in argillic horizon. (Not Orthoxic, like Trailhead).

5. Clayey particle-size class

   5.1 Control section is 12 to 32 inches.

   5.2 Control section averages 43.1 percent clay, by weight, and 17 percent fragments coarser than 2 mm, by volume.

6. Oxidic mineralogy assumed, based on iron oxide/clay ratio of 0.17, similar color to Trailhead series, and approximately 2:1 iron oxide/gibbsite ratio in Trailhead soils.

LOCATION LACKSCREEK

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

LACKSCREEK SERIES

The Lackscreek series consists of moderately deep, well drained soils formed in material weathered from graywacke sandstone, shale and schist. Lackscreek soils are on mountains and have slopes of 15 to 75 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Loamy-skeletal, mixed, isomesic Typic Haplohumults.

TYPICAL PEDON: Lackscreek gravelly loam - on a uniform south facing slope of 56 percent under tanoak, Douglas-fir, madrone, and sparse huckleberry at 2,000 feet elevation. (Colors are for dry soil unless otherwise stated. When described May 4, 1982, the soil was moist throughout.)

O1--2 to 1/2 inches; fresh Douglas-fir needles, twigs, cones, and tanoak leaves.

O2--1/2 to 0 inch; decomposing leaves, humus and fungal mycelia.

A1--0 to 9 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; common very fine and fine interstitial and common very fine and fine tubular pores; about 15 percent fine and 5 percent coarse pebbles; very strongly acid (pH 5.0); clear wavy boundary. (2 to 10 inches thick)

A2--9 to 16 inches; yellowish brown (10YR 5/4) gravelly clay loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine, medium and coarse roots; common very fine interstitial and common very fine, fine and medium tubular pores; 15 percent fine and 8 percent coarse pebbles; strongly acid (pH 5.5); abrupt wavy boundary. (0 to 7 inches thick)

2BA--16 to 22 inches; light brown (7.5YR 6/4) very cobbly clay loam, brown (7.5YR 4/4) moist; weak fine subangular bloc[y structure; hard, slightly firm, sticky, slightly plastic; few very fine and fine, common medium and few coarse roots; few very fine interstitial and few very fine and fine tubular pores; 20 percent cobbles, 25 percent fine and 10 percent coarse pebbles; strongly acid (pH 5.5); clear wavy boundary. (5 to 10 inches thick)

2Bt1--22 to 31 inches; very pale brown (10YR 7/4) extremely cobbly clay loam, yellowish brown (10YR 5/6) moist; weak fine subangular blocky structure; slightly hard, firm, sticky, plastic; few very fine, fine and coarse, and common medium roots, few very fine tubular pores; common distinct clay films on ped faces; 50 percent cobbles, 20 percent coarse and 15 percent fine pebbles; strongly acid (pH 5.5); clear broken boundary. (7 to 16 inches thick)

2Bt2--31 to 35 inches; light yellowish brown (10YR 6/4) extremely gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky, plastic; few fine and medium roots; few very fine tubular pores; common distinct clay films on ped faces; 50 percent fine and 25 percent coarse pebbles; strongly acid (pH 5.5); abrupt irregular boundary. (0 to 4 inches thick)

2R--35 to 43 inches; fractured shale, fractures mostly less than 1 mm across and 1/2 to 4 inches apart. About 1 percent soil material in fractures and pockets; few medium and fine roots; few very fine interstitial pores; common prominent clay films on fracture faces; strongly acid (pH 5.5). (8 to 28 inches thick)

TYPE LOCATION: Redwood National Park, Humboldt County, California; 0.5 mile on W-Line Road from Bald Hills Road and 1,000 feet west along the ridge from W-Line Road; southwest quarter, southwest quarter, Section 29, T. 10 N., R. 2 E.; Bald Hills Quadrangle.

RANGE IN CHARACTERISTICS: Depth to a lithic contact is 20 to 40 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soils are usually moist, but the soil moisture control section, between depths of 8 to 35 inches, becomes dry in the upper part for a time less than 30 days cumulative from about September 15 to October 15. There is 12 to 20 Kg organic carbon per square meter to a depth of one meter. The top 20 inches of the argillic horizon is 25 to 35 percent clay and contains 35 to 75 percent gravel and cobbles. Reaction is medium or strongly acid throughout. Base saturation is 15 to 35 percent at the lithic contact.

The A horizon is 10YR 4/3, 5/3 or 5/4. Moist color is 10YR 2/2, 3/3, 3/4 or 7.5YR 3/2 or 4/4 and the value, chroma or both increase to 4 or more, moist, within 10 inches of the soil surface. Texture is very gravelly loam, gravelly loam, gravelly clay loam or very gravelly clay loam. It has 20 to 30 percent clay, 15 to 45 percent gravel, and 0 to 5 percent cobbles.

The Bt horizon is 10YR 5/4, 6/4, 7/4, 7/6 or 7.5YR 6/4. Moist color is 10YR 3/4, 4/4, 4/6, 5/6 or 7.5YR 4/4. Texture is very gravelly loam, very gravelly clay loam, extremely gravelly clay loam or extremely cobbly clay loam. It has 25 to 35 percent clay, 35 to 75 percent gravel and 0 to 50 percent cobbles.

COMPETING SERIES: This is the Hotel series in another family. Hotel soils have base saturations of 35 to 50 percent at the lithic contact.

GEOGRAPHIC SETTING: Lackscreek soils are on strongly convex mountain sideslopes in highly dissected terrain. Slopes are 15 to 75 percent. Elevations are 800 to 2800 feet. The soils formed in colluvium and residuum weathered from sandstone, shale and schist. The climate is humid with cool, foggy summers and cool, rainy winters. Mean annual precipitation is 80 to 100 inches. Mean January temperature is about 47 degrees F; mean July temperature is about 57 degrees F; and the mean annual temperature is about 52 degrees F. Frost-free season is about 240 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coppercreek (T), Slidecreek (T) and Ahpah (T) soils. Coppercreek and Ahpah soils are fine-loamy. Coppercreek and Slidecreek soils are more than 40 inches deep to bedrock. The Coppercreek and Slidecreek soils are on straight to gently concave slopes, often below the Lackscreek soils. The Ahpah soils are on gentler slopes, softer bedrock or higher positions than the Lackscreek soils.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: This soil has been used for commercial timber, wildlife and watershed. Natural vegetation consists of Douglas-fir, redwood, tanoak, madrone and huckleberry.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California 1983. Source of name is from Lacks Creek, a major tributary to Redwood Creek about 15 miles east of the town of Trinidad.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 9 inches (A1 horizon).

Argillic horizon - the zone from 9 to 35 inches (A2, 2BA, 2Bt1, 2Bt2).

Lithic contact - the bedrock interface at 35 inches depth.

Ultisol feature - base saturation of 34 percent at lithic contact.

Humult feature - 13.35 kg per square meter organic carbon to a depth of 35 inches.

The Lackscreek series was originally placed in the Typic Humitropepts. Reclassification is based on analysis of laboratory data which shows a weak argillic horizon to be present.

ADDITIONAL DATA: Soil profile samples 82-RNP-10 and 83-RNP-14 were collected at the type location and analyzed at the Oregon State University Soil Testing and Soil Physics Laboratories. Soil sample S83-CA-12-05, from the type location, was analyzed at NSSL for clay mineralogy.

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD:JHP/DJE
4/87

LACKSCREEK SERIES

Taxonomic Class: Loamy-skeletal, mixed, isomesic Typic Haplohumults.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 9 inches (A1) ranges from 3 to 16 inches thick.

    1.1 Organic carbon is 4.29 percent in the A1 and 2.84 percent in the A2 of the type pedon. However, the chroma increases to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by pipette method is 20.7 percent in the A1.

2. Argillic horizon - 9 to 35 inches (A2, 2BA, 2Bt1, 2Bt2) ranges from 6 to 30 inches thick.

    2.1 Clay content by pipette method is 29.4 percent in the A2, 27.1 percent in the 2BA, 28.2 percent in the 2Bt1 and 26.4 percent in the 2Bt2.

    2.2 The 2Bt1 and 2Bt2 have distinct clay films on faces of peds.

3. Contact

    3.1 Depth to a (fracto) lithic contact is 20 to 40 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is udic, based on data from Sturhan (in preparation). Pedon is her site IA. The moisture control section is zone from depths of 8 to 35 inches. It remained moist in all parts throughout 1984, and dried in part, near the upper boundary for a time less than 30 days, in October, 1985.

2. Ultisol order

    2.1 Base saturation is 34.1 percent, by sum of cations, just above the lithic contact.

3. Humult suborder

   3.1 Organic carbon is 13.35 Kilograms per square meter to 89 cm depth.

4. Loamy-sketetal particle-size class

   4.1 Control section is 9 to 29 inches.

   4.2 Control section averages 27.8 percent clay, by weight, and 52.9 percent fragments coarser than 2 mm, by volume.

5. Other series characteristics

   5.1 The Bt horizon has hue of 10YR or 7.5YR, with 25 to 35 percent clay.

LOCATION SLIDECREEK

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

SLIDECREEK SERIES

The Slidecreek series consists of deep to very deep, well drained soils formed in residuum and colluvium weathered from graywacke sandstone, shale and siltstone. Slidecreek soils are on mountains and have slopes of 30 to 75 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Loamy-skeletal, mixed, isomesic Typic Humitropepts.

TYPICAL PEDON: Slidecreek extremely gravelly loam - on a uniform west-facing slope of 36 percent under tanoak, madrone and Douglas-fir at 2400 feet elevation. (Colors are for dry soil unless otherwise stated. When described April 24, 1984, the soil was moist throughout).

O--2 to 0 inches; fresh and decomposing tanoak and madrone leaves, twigs and bark, with fungal mycelia at mineral soil interface.

A--0 to 3 inches; brown (10YR 5/3) extremely gravelly loam, dark brown (7.5YR 3/3) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and common fine roots; many very fine and fine interstitial and common medium and coarse tubular pores; 86 percent pebbles; medium acid (pH 6.0); abrupt smooth boundary. (3 to 10 inches thick)

AB--3 to 11 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (7.5YR 4/4 and 7.5YR 3/4) moist; weak fine and medium subangular blocky, and moderate fine and medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and fine interstitial and common medium and coarse tubular pores; 58 percent pebbles; medium acid (pH 6.0); gradual wavy boundary. (0 to 8 inches thick)

BA--11 to 18 inches; light yellowish brown (10YR 6/4) extremely gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak fine granular, and weak medium and coarse subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine, common medium and coarse roots; many very fine and fine interstitial, and common medium and coarse tubular pores; 67 percent pebbles medium acid (pH 6.0); clear smooth boundary. (0 to 14 inches thick)

Bw1--18 to 25 inches; very pale brown (10YR 7/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine, common fine and medium, and few coarse roots; common very fine, fine and medium, and few coarse tubular pores; 52 percent pebbles; medium acid (pH 6.0); clear smooth boundary. (0 to 13 inches thick)

Bw2--25 to 35 inches; very pale brown (10YR 7/4) very gravelly silty clay loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine, fine, and medium, and few coarse roots; common very fine, and medium, and few coarse tubular pores; 50 percent pebbles; medium acid (pH 6.0); clear smooth boundary. (7 to 11 inches thick)

BC--35 to 42 inches; very pale brown (10YR 7/3) very gravelly silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine fine, medium and coarse roots; many very fine and fine interstitial, common medium and few coarse tubular pores; 36 percent pebbles; medium acid (pH 6.0); gradual smooth boundary. (7 to 30 inches thick)

C--42 to 59 inches; very pale brown (10YR 7/3) extremely gravelly silty clay loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; many fine and common very fine interstitial, and common medium and few coarse tubular pores; 73 percent pebbles; medium acid (pH 6.0). (0 to 20 inches thick)

TYPE LOCATION: Humboldt County, California; drive 0.6 miles west on Lyons Ranch road from Bald Hills road, then walk approximately 1200 feet north down hill; southeast quarter, northwest quarter, section 25, T. 9 N., R. 2 E., HBLM, Bald Hills Quadrangle.

RANGE IN CHARACTERISTICS: Depth to a lithic contact is 40 to 60 inches or more. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soils are usually moist, but the soil moisture control section, between depths of 10 to 35 inches, becomes dry in the upper part for a time less than 30 days cumulative from about September 15 to October 15. There is 12 to 20 Kg organic carbon per square meter to a depth of one meter. The particle-size control section, between depths of 10 to 40 inches, is 25 to 35 percent clay and contains 35 to 75 percent gravel and cobbles. Reaction is medium or strongly acid and base saturation is less than 50 percent throughout.

The A horizon is 10YR 5/2, 5/3, 6/3, 6/4 or 7.5YR 5/4. Moist color is 10YR 3/2, 3/3, 3/4, 4/3 or 7.5YR 3/2, 3/3, 4/4. The value, chroma or both increase to 4 or more, moist, within 10 inches of the soil surface. Texture is very gravelly loam, gravelly loam, very gravelly

clay loam or gravelly clay loam. It has 20 to 30 percent clay, 15 to 90 percent gravel and 0 to 5 percent cobbles.

The Bw horizon is 2.5Y 7/2, 8/2 or 10YR 6/3, 6/4, 7/4. Moist color is 2.5Y or 10YR 4/3, 4/4, 4/6, 5/3, 5/4. Texture is very cobbly loam, very cobbly clay loam, very gravelly clay loam, very gravelly silty clay loam or extremely gravelly clay loam. It has 25 to 35 percent clay, 35 to 80 percent gravel, 0 to 40 percent cobbles and 0 to 20 percent stones. Clay films are present in some pedons but the clay increases less than 1.2 times in a vertical distance of 12 inches.

COMPETING SERIES: This is the Millicoma series. Millicoma soils have umbric epipedons and are 20 to 40 inches deep to a paralithic contact.

GEOGRAPHIC SETTING: Slidecreek soils are on mountain sideslopes in highly dissected terrain. Slopes are 30 to 75 percent. Elevations are 800 to 2,700 feet. The soils formed in colluvium and residuum weathered from sandstone, shale and siltstone. The climate is humid with cool, foggy summers and cool, rainy winters. Mean annual precipitation is 70 to 100 inches. Mean January temperature is about 47 degrees F; mean July temperature is about 57 degrees F; and the mean annual temperature is about 52 degrees F. Frost-free season is about 240 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Coppercreek and the Lackscreek soils. Both have argillic horizons. Coppercreek soils are fine-loamy. Lackscreek soils are 20 to 40 inches deep to a lithic contact. The Lackscreek soils are on narrow spur ridges and convex slopes above the Slidecreek soils. The Coppercreek soils are alongside the Slidecreek soils on colluvium of lower rock content.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: This soil has been used for commercial timber, wildlife and watershed. Natural vegetation consists of Douglas-fir, redwood, tanoak, madrone and huckleberry.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California 1984. Source of name is from Slide Creek, a tributary to Redwood Creek about 10 miles southeast of the town of Orick.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 18 inches (A, AB horizons).

Cambic horizon - the zone from 18 to 35 inches (BA, Bw1, Bw2 horizons).

This revision moves the type location to a pedon better representing the concept of the series.

ADDITIONAL DATA: University of California samples 60-CA-12-16X, 61-CA-12-20X and 62-CA-12-23X were collected from Slidecreek pedons in Humboldt County outside of Redwood National Park, and reported by Begg, et al (1984).

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD:JHP/DJE
4/87

SLIDECREEK SERIES

Taxonomic Class: Loamy-skeletal, mixed, isomesic Typic Humitropepts.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 11 inches (A, AB) ranges from 6 to 11 inches thick.

    1.1 The value, chroma, or both increase to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by field estimate is 22 percent in the A and 25 percent in the AB.

2. Cambic horizon - 11 to 35 inches (BA, Bw1, Bw2) ranges from 4 to 30 inches thick.

    2.1 Clay content by field estimate is 28 percent in BA, 30 percent in Bw1 and 30 percent in Bw2. Clay films are absent.

    2.2 Alteration is evident from subangular blocky pedogenic structure, absence of rock structure, and decreasing chroma and redness with depth.

3. Contact

    3.1 Depth to a lithic contact is greater than 40 inches, and greater than 60 inches in most pedons.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is udic, based on data from Sturhan (in preparation). Type location is her site IC. The control section is zone from depths of 10 to 35 inches. It remained moist in all parts throughout 1984, and dried in part, near the upper boundary, for a time less than 30 days, in October, 1985.

2. Humitropepts great group

   2.1 Base saturation assumed less than 50 percent, based on analysis of other soils in survey area.

   2.2 Organic carbon is assumed 12 to 20 Kilograms per square meter to 1 meter depth, based on analysis of other soils in survey area.

3. Loamy-skeletal particle-size class

   3.1 Control section is 10 to 40 inches.

   3.2 There is 30.6 percent clay (wt. average).

   3.3 There is 53.1 percent rock fragments, by volume.

4. Other series characteristics

   4.1 The Bw horizon is 2.5YR or 10YR in hue and has 25 to 35 percent clay.

LOCATION TECTAH

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

TECTAH SERIES

The Tectah series consists of very deep, well drained soils formed in material weathered from sandstone, siltstone and schist. Tectah soils are on mountains and have slopes of 9 to 50 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Clayey, mixed, isomesic Typic Palehumults.

TYPICAL PEDON: Tectah silty clay loam - on a south-facing, slightly convex slope of 35 percent under redwood, hemlock, Douglas-fir, tanoak, rhododendron, huckleberry and salal at 1200 feet elevation. (Colors are for dry soil unless otherwise stated. When described July 6, 1982, the soil was moist throughout.)

O--2 to 0 inches; fresh and partially decomposed leaves, twigs and cones from redwood, Douglas-fir, tanoak and hemlock.

A--0 to 10 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; strong medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; common very fine and fine interstitial pores; 7 percent pebbles; medium acid (pH 5.6); gradual smooth boundary. (3 to 13 inches thick.

BAt--10 to 19 inches; reddish yellow (7.5YR 7/6) silty clay loam, strong brown (7.5YR 4/6) moist; strong medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; common very fine tubular and interstitial pores; few distinct clay films in pores and on faces of peds; 4 percent pebbles; medium acid (pH 5.6); gradual smooth boundary. (0 to 15 inches thick)

Bt1--19 to 29 inches; reddish yellow (7.5YR 7/6) silty clay, yellowish brown (10YR 5/6) moist; strong coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine, medium and coarse roots; common very fine tubular and interstitial pores; many distinct clay films on faces of peds and in pores; 9 percent pebbles; strongly acid (pH 5.2); diffuse smooth boundary. (10 to 26 inches thick)

Bt2--29 to 43 inches; yellow (10YR 7/6) silty clay, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable, sticky, plastic, few very fine, fine and medium roots; common very fine tubular and interstitial pores; common distinct clay films on faces of peds and in pores; 7 percent pebbles; strongly acid (pH 5.1); diffuse smooth boundary. (9 to 24 inches thick)

BCt1--43 to 59 inches; yellow (10YR 7/6) silty clay loam, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine and medium roots; common very fine tubular and interstitial pores; common distinct clay films on faces of peds and in pores; 6 percent pebbles; strongly acid (pH 5.2); diffuse smooth boundary. (0 to 46 inches thick)

BCt2--59 to 71 inches; yellow (10YR 7/6) silty clay loam, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine and medium roots; common very fine tubular and interstitial pores; common faint clay films on faces of peds and in pores; 8 percent pebbles; strongly acid (pH 5.1). (0 to 20 inches thick)

TYPE LOCATION: Humboldt County, California; 500 feet SE of junction between C-20 and C-Line Roads, Redwood National Park; southwest quarter, southeast quarter, Section 19, T. 10 N., R. 2 E., HBLM; Bald Hills Quadrangle.

RANGE IN CHARACTERISTICS: Depth to the base of the argillic horizon and a paralithic contact is 60 inches or more. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section, between depths of 4 to 13 inches, is continuously moist in all parts in most years, but it becomes nearly dry in the upper part from about September 15 to October 15 in most years. There is 12 to 20 kg per square meter of organic carbon to a depth of one meter. The upper 20 inches of the argillic horizon is 35 to 45 percent clay. It contains 2 to 25 percent gravel and the sesquioxide to clay ratio is 0.10 to 0.19. CEC to clay ratio is 24 to 40 meq/100g in the argillic horizon. Reaction is medium or strongly acid throughout. Base saturation is 5 to 35 percent between depths of 10 to 80 inches.

The A horizon is 10YR 5/3, 5/4, 5/6, 6/4 or 7.5YR 5/6, 6/6, 7/6. Moist color is 10YR 3/4, 3/6, 4/4 or 7.5YR 3/4, 4/6. Texture is loam, gravelly loam, gravelly silt loam, clay loam, gravelly clay loam or silty clay loam. There is 25 to 30 percent and 3 to 30 percent gravel.

The Bt horizon is 10YR 5/6, 6/6, 7/4, 7/6 or 7.5YR 5/6, 6/6, 7/6. Moist color is 10YR 4/6, 5/6, 5/8 or 7.5YR 4/4, 4/6, 4/8, 5/6, 5/8. Texture is clay loam, gravelly clay loam, silty clay loam, silty clay or gravelly clay. There is 35 to 50 percent clay and 2 to 25 percent gravel.

In some pedons there are subhorizons of the Bt below 40 inches depth with 5YR hues. These soils are transitional to the Trailhead series.

COMPETING SERIES: These are the Vandamme (T), Rohnerville and Winchuck (T) series in another family. All are less than 60 inches deep to the base of the argillic horizon. Vandamme soils are 40 to 60 inches deep to a paralithic contact. Rohnerville and Winchuck soils have umbric epipedons.

GEOGRAPHIC SETTING: Tectah soils occur on broad ridges and upper sideslopes of mountains. Slopes are 9 to 50 percent. Elevations are 300 to 2,600 feet. The soils formed in material weathered from sandstone, siltstone, and schist. The climate is humid with cool, foggy summers and cool, moist winters. Coastal influence limits the annual and diurnal range in temperature. Mean annual precipitation ranges from 70 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 58 degrees F; and the mean annual temperature is about 52 degrees F. Frost-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ahpah (T), Coppercreek (T) and Trailhead (T) soils. Ahpah and Coppercreek soils are fine-loamy. Ahpah soils are 20 to 40 inches deep and lack an argillic horizon. Trailhead soils have oxidic mineralogy and hues redder than 7.5YR throughout the argillic horizon. The Ahpah soils are on convex slopes and on narrow ridge crests above the Tectah soils. The Coppercreek soils are on concave areas and on steeper slopes below the Tectah soils. The Trailhead soils are on broad, gentler slopes above the Tectah soils.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderately slow permeability.

USE AND VEGETATION: This soil has been used for commercial timber, wildlife and watershed. Natural vegetation consists of redwood, Douglas-fir, western hemlock, tanoak, huckleberry and rhododendron.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California 1984. Source of name is from Tectah Creek located about 6 miles east of the town of Orick.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 10 inches (A horizon).

Argillic horizon - the zone from 10 to 43 inches (BAt, Bt, BCt horizons).

Ultisol feature - base saturation of 11.6 percent at the critical depth, 50 inches below the upper boundary of the argillic horizon.

Humult feature - 15.7 kilograms per square meter of organic carbon to a depth of 1 meter.

Palehumults feature - Clay remains at least 89 percent of its maximum to a depth of 71 inches.

ADDITIONAL DATA: Soil profile sample 82-CA-12-04X was collected at the type location and analyzed at the University of California Soil Morphology Laboratory in Davis, California. Back-up sample 84-RNP-3 was collected at another Tectah profile in Redwood National Park. Sample 57-CA-08-02X was collected from a Tectah profile in Del Norte County and is described on pages 21-22 in Begg, et al (1984).

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD: JHP/DJE
4/87

TECTAH SERIES

Taxonomic Class: Clayey, mixed, isomesic Typic Palehumults.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 10 inches (A) ranges from 3 to 13 inches thick.

    1.1 Organic carbon is 3.14 percent but moist and dry value and chroma are too high for an umbric or mollic epipedon.

    1.2 Clay content by pipette is 27.9 percent in the type pedon.

2. Argillic horizon - 10 to 43 inches (BAt, Bt, BCt) ranges from 12 to 60 inches thick.

    2.1 Clay content by pipette is 34.5 percent in the BAt, 40.9 percent in the Bt, and 42.6 percent in the BCt. Weighted average clay is 37.9 percent in the control section.

    2.2 The Bt and BCt have distinct clay films on faces of peds and in pores.

3. Contact

    3.1 Depth to a paralithic contact is greater than 60 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is udic, based on data from Sturhan (in preparation). Type location is her site IIIB.

        a. Control section is zone from depths of 4 to 13 inches.

        b. Psychrometers recorded maximum tensions of 10 bars in September 1984, and 12 bars in October 1985, at upper boundary of control section.

2. Ultisol order

   2.1 Base saturation is 11.6 percent at the critical depth, 50 inches below the upper boundary of the argillic horizon.

3. Humults suborder

   3.1 Organic carbon is 15.7 Kilograms per square meter to 1 meter depth.

4. Palehumults great group

   4.1 Clay remains at least 89 percent of its maximum to a depth of 71 inches.

5. Clayey particle-size class

   5.1 Control section is 10 to 30 inches.

   5.2 Control section averages 39.3 percent clay, by weight, and 6.1 percent fragments coarser than 2 mm, by volume.

6. Other series characteristics

   6.1 Hue is 10YR or 7.5YR in the Bt horizon to a depth of at least 40 inches. Some pedons redden further below 40 inches.

LOCATION TRAILHEAD

Tentative Series
RD:JHP/DJE
4/87
MLRA:4

TRAILHEAD SERIES

The Trailhead series consists of very deep, well drained soils formed in material weathered from schist and from stream terrace remnants of mixed lithology. Trailhead soils are on mountains and have slopes of 9 to 50 percent. The mean annual precipitation is about 85 inches and the mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Clayey, oxidic, isomesic Orthoxic Palehumults.

TYPICAL PEDON: Trailhead clay loam - on a south-facing convex slope of 25 percent under redwood, Douglas-fir, tanoak, hemlock, huckleberry, rhododendron and Oregon grape at 900 feet elevation. (Colors are for dry soil unless otherwise stated. When described June 20, 1983, the soil was moist throughout.)

O--1 to 0 inches; fresh and decomposing conifer needles, tanoak leaves and twigs; about 25 percent cover of surface pebbles.

A--0 to 4 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/3) moist; common, fine, rounded, yellowish red (5YR 5/6) ferrans; moderate medium, subangular blocky, parting to moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, many fine, and common medium roots; common very fine interstitial and common very fine and fine tubular pores; about 3 percent rounded to subangular pebbles; medium acid (pH 6.0); clear wavy boundary. (3 to 18 inches thick)

AB--4 to 11 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist, common, fine, rounded yellowish red (5YR 5/6) ferrans; moderate medium subangular blocky, parting to moderate fine subangular blocky structure; hard, friable, slightly sticky, plastic; common fine and medium, and few coarse roots; common very fine interstitial and common very fine and fine tubular pores; about 2 percent pebbles; medium acid (pH 5.8); gradual wavy boundary. (0 to 15 inches thick)

BAt--11 to 26 inches; reddish brown (5YR 5/6) clay loam, reddish brown (5YR 4/6) moist; weak coarse subangular blocky, parting to weak medium subangular blocky structure; slightly hard, slightly firm, sticky and plastic; common fine, medium and coarse roots; few very fine, fine and medium tubular pores; few faint to distinct clay films in pores and on faces of peds; less than 2 percent pebbles; medium acid (pH 5.6); diffuse smooth boundary. (0 to 21 inches thick)

Bt1--26 to 35 inches; reddish brown (5YR 5/6) clay, reddish brown (5YR 4/6) moist; weak very coarse subangular blocky, parting to weak medium subangular blocky structure; hard, firm, sticky, very plastic; common fine, medium and coarse roots; few very fine and fine tubular pores; few distinct clay films in pores and on faces of peds; less than 2 percent pebbles; medium acid (pH 5.7); diffuse smooth boundary. (0 to 19 inches thick)

Bt2--35 to 64 inches; reddish brown (5YR 5/6) clay, red (2.5YR 4/6) moist; weak very coarse subangular blocky structure; hard, firm, sticky, very plastic; common fine and medium and few coarse roots; few very fine and fine tubular pores; common distinct clay films in pores and few distinct clay films on faces of peds; less than 2 percent pebbles; medium acid (pH 5.7); diffuse smooth boundary. (7 to 30 inches thick)

Bt3--64 to 78 inches; reddish brown (5YR 5/6) clay, red (2.5YR 4/6) moist; weak very coarse subangular blocky structure; hard, firm, sticky, very plastic; few fine and medium roots; few very fine and fine tubular pores; common distinct clay films in pores and on faces of peds; about 10 percent pebbles; medium acid (pH 5.6). (0 to 43 inches thick)

TYPE LOCATION: Humboldt County, California; 500 feet WNW of trailhead to Tall Trees Grove from C-Line Road, Redwood National Park; southeast quarter, southwest quarter, Section 31, T. 10 N., R. 2 E., HBLM; Bald Hills Quadrangle.

RANGE IN CHARACTERISTICS: Depth the base of the argillic horizon and to a paralithic contact is 60 inches or more. The mean annual soil temperature is 50 to 56 degrees F. The difference between mean summer and mean winter temperature is 5 to 8 degrees F. The soil moisture control section, between depths of 8 to 28 inches, is continuously moist in all parts in most years, but it becomes nearly dry in the upper part from about September 15 to October 15 in most years. There is 12 to 25 kg per square meter of organic carbon to a depth of one meter. The upper 20 inches of the argillic horizon is 35 to 50 percent clay. It contains 1 to 15 percent gravel, 7 to 9 percent weatherable minerals and the sesquioxide to clay ratio is 0.20 to 0.30. CEC to clay ratio is 16 to 24 meq/100g in the major part of the argillic horizon. Reaction is medium or strongly acid throughout. Base saturation is 5 to 35 percent between depths of 10 to 80 inches.

The A horizon is 7.5YR 4/4, 5/3, 5/4, 5/6, 6/4, 6/6. Moist color is 7.5YR 3/2, 3/3, 3/4, 4/4 or 5YR 3/4, 4/4 and the value, chroma or both increase to 4 or more within 10 inches of the soil surface. Texture is clay loam, gravelly clay loam or silty clay loam. There is 27 to 35 percent clay and 1 to 25 percent gravel.

The Bt horizon is 5YR 4/8, 5/6, 5/8, 6/6 or 2.5YR 5/6, 5/8. Moist color is 5YR 4/6, 4/8, 5/8 or 2.5YR 3/6, 4/6, 4/8, 5/8. It is clay or silty clay. There is 40 to 60 percent clay and 1 to 15 percent gravel.

COMPETING SERIES: This is the Fortyfour (T) series in the clayey, oxidic, isomesic Typic Tropudults. Fortyfour soils are 20 to 40 inches deep to a paralithic contact and have CEC to clay ratios of 24 to 40 meq/100g in the argillic horizon.

GOEGRAPHIC SETTING: Trailhead soils occur on broad ridges and upper sideslopes of mountains. Slopes are 9 to 50 percent. Elevations are 300 to 2,600 feet. The soils formed in material weathered primarily from schist, but the upper profile often includes remnants of river terrace sediments having a mixture of pebbles of schist and sedimentary lithology. The climate is humid with cool foggy summers and cool moist winters. Coastal influence limits the annual and diurnal range in temperature. Mean annual precipitation ranges from 70 to 100 inches. Mean January temperature is about 48 degrees F; mean July temperature is about 58 degrees F; and the mean annual temperature is about 52 degrees F. Frost-free season is 250 to 300 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Fortyfour (T) soils and the Coppercreek (T) soils. Coppercreek soils are 10YR to 7.5YR throughout and are fine-loamy. The Fortyfour soils are on convex areas below, and spur ridges above the Trailhead soils. The Coppercreek soils are in broad hollows and on steeper slopes below the Trailhead soils.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderately slow permeability.

USE AND VEGETATION: This soil has been used for commercial timber and is used for wildlife and watershed. Natural vegetation consists of redwood, Douglas- fir, western hemlock, tanoak, huckleberry and rhododendron.

DISTRIBUTION AND EXTENT: Northern coastal California. The series is inextensive.

SERIES PROPOSED: Humboldt County, California 1983. Source of name is from the Tall Trees trailhead in Redwood National Park south of the town of Orick.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from 0 to 7 inches (A, upper AB horizons).

Argillic horizon - the zone from 7 to 78 inches (lower AB, BAt, Bt1, Bt2, Bt3)

Ultisol feature - base saturation of 20 percent at the critical depth, 50 inches below the upper boundary of the argillic horizon.
Humult feature - 22.7 kilograms per square meter of organic carbon to a depth of 1 meter.

Palehumult features - Clay remains at least 92 percent of its maximum to a depth of 78 inches, and there is 91 percent resistant minerals in the very fine sand fraction. The very fine sand and silt fractions are mostly quartz, although coarser sand and gravel fractions are predominantly schist fragments, according to Marron (1982).

Orthoxic feature - CEC is less than 24 meq/100g clay in most of the argillic horizon. Vermiculite, kaolinite, and chlorite are identifiable by x-ray analysis. Although vermiculite is a major clay mineral, the CEC is kept low by the combined influence of ferric iron, gibbsite and kaolinite, according to the NSSL report by Dr. W.D. Nettleton.

Oxidic mineralogy - There is 24 percent dithionite-extractable sesquioxides in the clay fraction of the particle-size control section.

ADDITIONAL DATA: The Trailhead type pedon is field sample number S83-CA-12-01, analyzed at Oregon State University and at NSSL. Backup samples S83-CA-12-02 and S83-CA-12-03 were analyzed for mineralogy class at NSSL. University of California samples 60-CA-12-17X and 60-CA-12-18X were collected for the Soil-Vegetation Survey in Redwood National Park. Durgin and Tackett (1981) present results of pipette and x-ray analyses on samples of Trailhead soils (which they called Sites). Marron (1982) has field descriptions, pipette analyses and microscopic analysis of Trailhead and associated soils (termed "well developed" or "very well developed" in thesis).

National Cooperative Soil Survey
U.S.A.

Tentative Series
RD: JHP/DJE
4/87

TRAILHEAD SERIES

Taxonomic Class: Clayey, oxidic, isomesic Orthoxic Palehumults.

Major Diagnostic Horizons:

1. Ochric epipedon - 0 to 7 inches (A, upper AB) ranges from 6 to 20 inches thick.

    1.1 Organic carbon is 5.57 percent in the A and 3.25 percent in the AB of the type pedon. However, the value and chroma both increase to 4 or more, moist, within 10 inches of the soil surface.

    1.2 Clay content by pipette method is 27.7 percent in the A.

2. Argillic horizon - 7 to 64 inches (lower AB, BAt, Bt1, Bt2, Bt3) ranges from 40 to 94 inches thick.

    2.1 Clay content by pipette method is 34.4 percent in AB, 41.3 percent in BAt, 48.4 percent Bt1, 54.6 percent in Bt2 and 50.3 percent in Bt3.

    2.2 The BAt, Bt1, Bt2 and Bt3 have distinct clay films on faces of peds.

3. Contact

    3.1 Depth to a paralithic contact is greater than 60 inches.

Other Diagnostic Horizons or Soil Characteristics:

1. Climate

    1.1 Long-term soil temperature regime is probably isomesic, based on average of data from Hauxwell et al (1981) and Sturhan (in preparation) in western Humboldt County.

    1.2 Soil moisture regime is udic, based on data from Sturhan (in preparation). Pedon is her site IIIC. The moisture control section, fron depths of 8 to 28 inches, remained moist in all parts throughout 1984 and 1985.

2. Ultisol order

   2.1 Base saturation is 20 percent, by sum of cations, at a depth of 57 inches, 50 inches below the upper boundary of the argillic horizon.

3. Humult suborder

   3.1 Organic carbon is 22.7 Kilograms per square meter to 1 meter depth.

4. Palehumult great group

   4.1 Clay remains at least 92 percent of its maximum to a depth of 78 inches.

   4.2 The upper 20 inches of the argillic horizon in the type pedon has 91 percent resistant minerals in the very fine sand fraction. Backup pedon (S83-CA-12-03) has 92 percent resistant minerals.

5. Orthoxic subgroup

   5.1 The ratio of CEC (by NH_4OAC) to clay, is 27 meq/100g in the BAt, 20 me/100g in the Bt1, 21 me/100g in the Bt2 and 23 meq/100g in the Bt3.

6. Clayey particle-size class

   6.1 Control section is 7 to 27 inches.

   6.2 Control section averages 40.2 percent clay, by weight, and 1.2 percent fragments coarser than 2 mm, by volume.

7. Oxidic mineralogy class

   7.1 Ratio of sesquioxides to clay is 0.24 in the control section.

8. Other series characteristics

   8.1 The Bt horizon has hue of 5YR or 2.5YR.

APPENDIX B. SOIL LABORATORY DATA

INDEX OF PEDONS DESCRIBED WITH SOIL LABORATORY DATA

Pedon 1. AHPAH COBBLY LOAM (taxadjunct)
83-RNP-13

Classification: Typic Humitropept, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 0.1 miles north on Bald Hills road from C-Line gate, then 225 feet south, downhill from road; southwest quarter, northeast quarter, Section 18, T. 10 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JL Sampled by: JL File number: JL-36 Photo number: 1:12000 RNP-78 7-50

Parent material: Graywacke sandstone. Physiographic position: Upper mountain slope near headwaters draw at 524 m (1720 ft.) elevation.

Relief: Convex vertical, uniform horizontal, south-facing slope of 46 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*) and tanoak (*Lithocarpus densiflorus*); shrub layer includes salal (*Gaultheria shallon*), rhododendron (*Rhododendron macrophyllum*), Oregon grape (*Mahonia nervosa*), evergreen huckleberry (*Vaccinium ovatum*) and red huckleberry (*Vaccinium parvifolium*); herb layer includes sword fern (*Polystichum munitum*), star flower (*Trientalis latifolia*), trillium (*Trillium ovatum*), inside-out flower (*Vancouveria hexandra*) and goodyera (*Goodyera oblongifolia*).

Colors are for the dry soil unless otherwise stated. When described (August 25, 1983) the soil was slightly moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 5 to 0 cm (2-0 in.); fresh and decomposing leaves and twigs from redwood, Douglas-fir and hemlock.

A -- 0 to 31 cm (0-12 in.); brown (10YR 5/3) cobbly loam, dark brown (7.5YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine, fine and coarse, and common medium roots; common very fine interstitial pores; 15 percent cobbles, 10 percent pebbles; very strongly acid (pH 5.0); clear wavy boundary.

Bw -- 31 to 51 cm (12-20 in.); brown (7.5 YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate coarse subangular blocky, parting to strong medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine, fine, medium and coarse roots; few very fine interstitial pores; 4 percent cobbles, 12 percent pebbles; very strongly acid (pH 5.0); clear wavy boundary.

BC -- 51 to 65 cm (20-26 in.); light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine, fine and medium roots; common very fine interstitial pores; 10 percent cobbles, 30 percent pebbles; very strongly acid (pH 5.0); clear wavy boundary.

Cr -- 65 to 95 cm (29-37 in.); soft, weathered graywacke sandstone, easily dug with a spade.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Ahpah (taxadjunct)

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Humitropept

Sample Number: 83-RNP-13

Location: Bald Hills Road, 0.1 mile north C-Line gate; SW 1/4, NE 1/4, S. 18, T.10.N, R.2.E

Pedon Number: 1

Lab Numbers: 72262-72264

Date Sampled: 25 Aug 83

Analyst: CZ, PG, RM

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	31	25	2.8	2.9	4.8	16.0	13.2	39.7	34.4	25.9	gl		32.6	13.7	18.9
Bw	31	51	16	2.2	3.8	5.9	18.4	14.3	44.6	30.0	25.4	gl		23.9	12.5	11.4
BC	51	65	40	4.7	5.6	7.3	20.8	14.3	52.7	25.5	21.8	vgscl				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/ 100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	15 bar H_2O / clay
A	0	31	5.5	4.7	1.90	0.24	0.83	21.3	36.0	3.42	0.08	42.8			19	0.82	0.53
Bw	31	51	5.5	1.8	0.81	0.12	0.38	12.5	24.9	1.28	0.06	21.3			5	0.49	0.49
BC	51	65	5.5	1.3	0.61	0.12	0.31	10.5	22.3	0.70	0.05	14.0			7	0.48	

REMARKS: This pedon is outside series limits of the Ahpah series because it has an umbric epipedon. Soils in the Ahpah series have ochric epipedons.

Pedon 2. ATWELL SILT LOAM (taxadjunct)
82-CA-12-03X

Classification: Mollic Hapludalf, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 200 feet north of Miller Creek, 160 feet west of C-40 road; southeast quarter, northwest quarter, Section 30, T. 10 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP Sampled by: JHP, JL, NKS File number: JHP-68 Photo number: 1:12000 RNP-78 7-48

Parent material: Sheared graywacke sandstone and mudstone. Physiographic position: Lower mountain slope near drainage at 213 m (700 ft.) elevation.

Relief: Southwest-facing slope with 30 percent gradient, uniform macrorelief and hummocky microrelief.

Hydrology: Somewhat poorly drained; medium runoff; moderate permeability between surface and depth of 76 cm, slow to very slow permeability below 76 cm; capillary fringe was at 76 cm, and groundwater was at 98 cm on date soil was described.

Vegetation: Redwood forest; tree layer includes redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga menziesii*), tanoak (*Lithocarpus densiflorus*), western hemlock (*Tsuga heterophylla*) and grand fir (*Abies grandis*); shrub layer includes rhododendron (*Rhododendron macrophyllum*), red huckleberry (*Vaccinium parvifolium*), evergreen huckleberry (*Vaccinium ovatum*), Oregon grape (*Mahonia nervosa*) and salal (*Gaultheria shallon*); herb layer includes sword fern (*Polystichum munitum*), redwood sorrel (*Oxalis oregona*), deer fern (*Blechnum spicant*), redwood violet (*Viola sempervirens*) and trillium (*Trillium ovatum*).

Colors are for the dry soil unless otherwise stated. When described (April 13, 1981) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 5 to 0 cm (2-0 in.); fresh and decomposing conifer needles, very fine roots and fungal mycelia.

A -- 0 to 12 cm (0-5 in.); grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; moderate medium granular and moderate very fine subangular blocky structure; hard, slightly firm, slightly sticky, slightly plastic; many very fine and fine, and common medium roots; many fine interstitial pores; about 10 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

AB -- 12 to 24 cm (5-9 in.); brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; common very fine tubular, and common fine interstitial pores; about 10 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

BAt--24 to 54 cm (9-21 in.); yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse subangular blocky, parting to moderate medium subangular blocky structure; hard, firm, sticky, plastic; common very fine, fine and coarse, and many medium roots; few fine interstitial, and common very fine, fine and medium tubular pores; common faint clay films on faces of peds; about 10 percent pebbles; medium acid (pH 6.0); clear irregular boundary.

Bt -- 54 to 76 cm (21-30 in.); pale yellow (2.5Y 7/4) very gravelly clay, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure; hard, firm, sticky, very plastic; common very fine and fine roots; few very fine and fine tubular pores; few distinct clay films on faces of peds; about 35 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

2Cg1 -- 76 to 98 cm (30-39 in.); light gray (N 7/) clay, greenish gray (5GY 5/1) moist; many medium distinct reddish yellow (7.5YR 6/6) mottles, strong brown (7.5YR 5/6) moist; massive; very hard, very firm, sticky, very plastic; few very fine and fine roots; few very fine and fine tubular pores; about 10 percent pebbles; medium acid (pH 6.0); clear smooth boundary.

2Cg2 -- 98 to 150 cm (39-59 in.); gray (N 6/) clay, dark bluish gray (5B 4/1) moist; common fine distinct brownish yellow (10YR 6/6) mottles, brown (10YR 5/4) moist; massive; very hard, very firm, sticky, very plastic; few very fine and fine roots; few very fine and fine tubular pores; about 10 percent pebbles; slightly acid (pH 6.5); diffuse smooth boundary.

2Cg3 -- 150 to 170 cm (59-79 in.); gray (N 5/) clay, black (5Y 2.5/1) moist; common distinct brownish yellow (10YR 6/6) mottles, brown (10YR 5/4) moist; massive; very hard, very firm, sticky, very plastic; few very fine and fine roots; few very fine and fine tubular pores; about 10 percent pebbles; many slickensides; slightly acid (pH 6.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Atwell (taxadjunct)
Location: 200 feet north of Miller Creek 160 feet west of C-40 road; SE 1/4, NW 1/4, S. 30, T.10N., R.2E.
Date Sampled: 13 Sep 82

Taxonomic Class: Fine-loamy, mixed, isomesic Mollic Hapludalf
Pedon Number: 2
Analyst: WRA, BK, NKS

Sample Number: 82-CA-12-03X
Lab Numbers: UCD 1571, OSU 75994-76000
Analytical Lab: UCD, HSU, OSU

HORIZON	DEPTH (cm) From	To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm 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 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	15 bars	% Available Moisture 1/3 to 15 bars
A	0	12	12.5	9.7	2.8	1.5	3.1	4.1	21.2	56.5	22.3	sil	1.36	37.0	22.5	14.5
AB	12	24	10.7	11.7	2.9	1.0	2.8	4.5	22.9	53.6	23.5	sil	1.30	33.3	18.5	14.8
BAt	24	54	13.5	9.7	4.1	1.7	3.0	4.0	22.5	48.0	29.5	cl	1.68	24.5	14.4	10.1
Bt	54	76	37.4	14.5	5.4	2.7	4.9	4.7	32.2	39.5	28.3	vgcl	1.71	20.0	12.4	7.6
2Cg1	76	98	10.6	7.8	4.4	2.0	2.9	3.1	20.2	43.6	36.2	cl	1.83	20.2	12.8	7.4
2Cg2	98	150	13.7	9.1	4.3	2.2	3.2	2.4	21.2	42.8	36.0	cl	1.72	22.0	13.1	8.9
2Cg3	150	170	10.0	7.4	4.2	2.5	3.6	4.0	21.7	40.6	37.7	cl	2.00	20.5	15.2	5.3

HORIZON	DEPTH (cm) From	To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	15 bar H_2O / clay
A	0	12	5.6	14.0	2.7	0.4	0.9	27.0	66.7	4.48	0.23	19.5	7.31	0.38	6	1.21	1.01
AB	12	24	5.1	8.5	1.8	0.3	0.6	18.5	60.5	3.09	0.18	17.2	4.82	0.28	4	0.79	0.79
BAt	24	54	4.7	3.4	1.3	0.3	0.7	12.2	46.7	1.18	0.09	13.1	5.95	0.45	11	0.41	0.49
Bt	54	76	4.9	2.2	1.6	0.2	0.4	11.6	37.9	0.68	0.09	7.6	2.56	0.34	9	0.41	0.44
2Cg1	76	98	4.9	4.5	3.7	0.3	0.3	12.1	72.7	0.47	0.11	4.3	1.89	0.44	13	0.33	0.35
2Cg2	98	150	5.0	9.8	5.0	0.3	0.3	12.8	120.3	0.65	0.10	6.5	5.81	0.89	8	0.36	0.36
2Cg3	150	170	6.0	12.7	7.6	0.3	0.2	13.7	151.8	0.64	0.09	7.1	2.56	0.36	2	0.36	0.40

REMARKS: This pedon is outside series limits of the Atwell series because it has a weighted average of 29 percent clay in the upper 50 cm of the argillic horizon (24-74 cm depth). Soils in the Atwell series have 35 to 50 percent clay.

Pedon 3. COPPERCREEK VERY GRAVELLY LOAM
83-RNP-12, S83-CA-12-06

Classification: Typic Haplohumult, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 900 ft NNW of junction between 2005 Road and K&K Road, Redwood National Park; southeast quarter, southwest quarter, section 15, T. 9 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP, JL Sampled by: JHP, JL, NKS File number: JHP-102 Photo number: 1:12000 RNP-78 8-44

Parent material: Graywacke sandstone and shale. Physiographic position: Middle mountain slope at 287 m (940 ft.) elevation.

Relief: Uniform, northwest-facing slope of 39 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), tanoak (*Lithocarpus densiflorus*) and madrone (*Arbutus menziesii*); shrub layer includes tanoak and black huckleberry (*Vaccinium ovatum*).

Colors are for the dry soil unless otherwise stated. When described (June 13, 1983) the soil was moist throughout. Field reaction was determined by chlorphenol red and bromcresol green indicators.

O -- 3 to 0 cm (1-0 in.); fresh and decomposing tanoak leaves, redwood needles and twigs.

A -- 0 to 9 cm (0-4 in.); pale brown (10YR 6/3) very gravelly loam, dark yellowish brown (10YR 3/4) moist; weak fine granular and subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine, and many medium roots; many very fine interstitial and common very fine and fine tubular pores; 36 percent pebbles; strongly acid (pH 5.3); clear smooth boundary.

AB -- 9 to 26 cm (4-10 in.); light yellowish brown (10YR 6/4) gravelly clay loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine, fine and coarse, many medium roots; common very fine and fine tubular pores; 20 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2); gradual smooth boundary.

BAt -- 26 to 41 (10-16 in.); very pale brown (10YR 7/4) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, sticky, slightly plastic; few very fine and fine, common medium and coarse roots; common very fine and fine tubular pores; 14 percent pebbles and 10 percent cobbles; strongly acid (pH 5.2); gradual wavy boundary.

Bt1 -- 41 to 75 cm (16-30 in.); pale yellow (2.5Y 7/3) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky, plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; 38 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2); gradual wavy boundary.

Bt2 -- 75 to 100 cm (30-39 in.); white (2.5Y 8/2) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky, plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; few faint clay films on ped faces; 38 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2); gradual smooth boundary.

BCt -- 100 to 170 cm (39-67 in.); light gray (2.5Y 7/2) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky, plastic; few very fine fine, medium and coarse roots; few very fine tubular pores; common faint clay films on ped faces; 43 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Coppercreek

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Haplohumult

Sample Number: 83-RNP-12, S83-CA-12-06

Location: 900 ft. NNW of junction between 2005 Rd. and K&K Rd.; SE 1/4, SW 1/4, S. 15, T.9N., R.2E.

Pedon Number: 3

Lab Numbers: 74021-74026 (OSU), 85P2208-2210 (NSSL)

Date Sampled: 03 Aug 83

Analyst: CZ, MKA, NKS

Analytical Lab: OSU, HSU, NSSL

HORIZON	DEPTH (cm) From	DEPTH (cm) To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	9	36.5	10.9	5.7	0.0	0.1	0.0	16.7	61.2	22.1	vgsil	1.00	33.2	16.5	16.7
AB	9	26	28.3	5.4	4.4	0.0	0.0	8.8	18.6	54.4	27.0	gsicl	1.13	31.6	14.8	16.8
BAt	26	41	22.0	4.8	5.3	3.9	2.8	2.6	20.2	50.6	29.2	gsicl	1.26	30.8	13.9	16.9
Bt1	41	75	37.3	8.1	7.8	5.4	4.6	3.7	29.6	43.0	27.4	vgcl	1.34	23.5	12.1	11.4
Bt2	75	100	38.9	7.1	8.1	5.1	3.1	3.0	26.4	45.7	27.9	vgcl	1.40	22.5	10.9	11.6
BCt	100	170	45.6	9.8	8.7	3.6	0.0	11.6	33.7	42.1	24.2	vgl	1.50	22.0	15.5	6.5

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	9	5.3	2.9	1.30	0.18	0.64	22.6	22.2	5.68	0.11	51.6	3.25	0.06	12	1.02	0.75
AB	9	26	5.0	1.5	0.76	0.83	0.40	13.5	25.9	2.84	0.08	35.5	3.91	0.11	13	0.50	0.55
BAt	26	41	5.0	0.7	0.45	0.27	0.21	11.5	14.2	1.22	0.06	20.3	1.80	0.09	22	0.39	0.48
Bt1	41	75	5.2	0.4	0.40	0.11	0.33	8.3	14.9	0.70	0.04	17.5	2.00	0.11	19	0.30	0.44
Bt2	75	100	4.8	0.9	1.40	0.28	0.57	8.1	38.9	0.37	0.05	7.4	0.79	0.11	19	0.29	0.39
BCt	100	170	5.3	0.8	1.50	0.13	0.21	6.6	40.0	0.34	0.05	6.8	1.94	0.29	38	0.27	0.64

REMARKS: Particle-size distributions of horizons from 26 to 100 cm depths are from NSSL, and the rest from OSU. 15-bar moisture of horizons from 0 to 26 cm depths are from OSU, 26 to 100 cm depths are from NSSL, and 100 to 170 cm from HSU. Exchangeable hydrogen from 100 to 170 cm depths is 10.5 meq/100g, giving 20.1 percent base saturation, by sum of cations. This is the typifying pedon for the Coppercreek series.

Soil series: Coppercreek

Classification: Fine-loamy, mixed, isomesic Typic Haplohumult

Sample Number: S83-CA-12-06

General Methods: 1B1A, 2A1, 2B

Location: 900 ft. NNW of junction between 2005 Rd. and K&K Rd.; SE 1/4, SW 1/4, S. 15, T.9N., R.2E. Redwood National Park Humboldt County, California

Lab No. 85P2208-2210
Pedon No. 85P 454
Project No. 85P 84
Sampled: 03 Aug 83
Reported: 24 Dec 85

U.S. Department of Agriculture
Soil Conservation Service
National Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Sample No.	Hzn No.	Depth (cm)	Horizon	Percent wt. in < 2 mm: Clay 3A1	Dith.-cit. extractable Fe 6C2B	Dith.-cit. extractable Al 6G7A	Ratio/clay Fe_2O_3 + GI	Clay Mineralogy < 2 micron fraction: X-ray 7A2I Relative Amounts	DTA 7A3 Percent
852208	1	26-41	AB	29.2	1.5	0.5	0.073	VR 3 KK 3 MI 2 CL 2	---
852209	2	41-75	BA	27.4	1.3	0.4	0.068	KK 4 VR 4 MI 3	---
852210	3	75-100	Bt1	27.9	1.0	0.2	0.051	KK 5 MI 4 VR 2 CL 2	---

KIND OF MINERAL: VR Vermiculite KK Kaolinite MI Mica CL Chlorite

RELATIVE AMOUNT: 5 Dominant 4 Abundant 3 Moderate 2 Small 1 Trace

Pedon 4. COPPERCREEK GRAVELLY CLAY LOAM
81-RNP-68 through -73

Classification: Typic Haplohumult, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; in forest below former W-Line road; southwest quarter, northwest quarter, section 5, T. 9N., R. 2E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP, DC Sampled by: JHP File number: JHP-65 Photo number: 1:12000 RNP-78 7-44

Parent material: Graywacke sandstone and shale. Physiographic position: Mountain sideslope at 299 m (980 ft.) elevation.

Relief: Uniform, north-facing slope of 54 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), tanoak (*Lithocarpus densiflorus*) and western hemlock (*Tsuga heterophylla*); shrub layer includes Oregon grape (*Mahonia nervosa*), rhododendron (*Rhododendron macrophyllum*) and salal (*Gaultheria shallon*); herb layer includes sword fern (*Polystichum munitum*), false Solomon's seal (*Smilacina racemosa*) and redwood violet (*Viola sempervirens*).

Colors are for the dry soil unless otherwise stated. When described (October 9, 1980) the soil was dry from the surface to a depth of 20 cm and moist below 20 cm. Field reaction was determined by Truog (Triplex indicator) method.

O1-- 5 to 1.5 cm (2-1/2 in.); fresh and decomposing needles, leaves and twigs from redwood, Douglas-fir and tanoak.

O2-- 1.5 to 0 cm (1/2-0 in.); humus, fungal mycelia and fine redwood roots.

A -- 0 to 12 cm (0-5 in.); dark yellowish brown (10YR 4/4) gravelly loam, very dark brown (10YR 2/2) moist; weak very fine subangular blocky and medium granular structure; soft, friable, slightly sticky, slightly plastic; many very fine and fine, common medium roots; many very fine and fine interstitial and tubular pores; 30 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

AB -- 12 to 38 cm (5-15 in.); yellowish brown (10YR 5/6) gravelly loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky, parting to weak fine subangular blocky structure; slightly firm, slightly sticky, slightly plastic; many very fine, fine and medium roots; common very fine and fine interstitial, and many fine and medium tubular pores; 20 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

BAt -- 38 to 59 cm (15-23 in.); yellowish brown (10YR 5/8) clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly firm, sticky, slightly plastic; common fine, and many medium and coarse roots; common very fine interstitial, fine, medium and coarse tubular pores; few thin clay films in pores; 12 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

Bt -- 59 to 87 cm (23-34 in.); yellowish brown (10YR 5/8) gravelly clay loam, strong brown (7.5YR 4/6) moist; weak coarse subangular blocky structure; firm, sticky, slightly plastic; common fine, medium and coarse roots; common fine and medium, and few coarse tubular pores; few faint clay films in pores and on faces of peds; 15 percent pebbles; pH indicator fades; gradual wavy boundary.

BC -- 87 to 158 cm (34-62 in.); yellowish brown (10YR 5/6) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; few medium prominent red (2.5YR 4/6) weathered pebbles; massive; slightly firm, sticky, slightly plastic; few fine, medium and coarse roots; few fine, medium and coarse tubular pores; 20 percent pebbles; pH indicator fades; diffuse wavy boundary.

C -- 158 to 214 cm (62-84 in.); brownish yellow (10YR 6/6) gravelly clay loam, yellowish brown (10YR 5/4) moist; massive; slightly firm, sticky, slightly plastic; few fine, medium and coarse roots; few fine and medium tubular pores; 10 percent pebbles; medium acid (pH 6.0).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Coppercreek

Location: In forest off W-Line road; SW 1/4, NW 1/4, S 5, T.9N., R.2E.

Date Sampled: 16 Sep 81

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Haplohumult

Analyst: CZ

Pedon Number: 4

Sample Number: 81-RNP-68 through 81-RNP-73

Lab Numbers: 63916-63921

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	15 bar H_2O / clay
A	0	12	6.0	9.4	1.80	0.14	0.77	29.9	40.5	8.00	0.28	28.6			22		
AB	12	38	5.8	2.1	0.67	0.19	0.29	18.4	17.7	3.48	0.15	23.2			12		
BAt	38	59	5.7	0.5	0.39	0.10	0.16	11.8	9.7	0.93	0.07	13.3			21		
Bt	59	87	5.8	0.7	0.78	0.11	0.16	10.3	17.0	0.53	0.05	10.6			12		
BC	87	158	5.7	1.7	1.60	0.11	0.23	11.9	30.6	0.38	0.05	7.6			<1		
C	158	214	5.7	2.4	2.10	0.12	0.18	10.2	47.1	0.19	0.04	4.8			<1		

REMARKS:

Pedon 5. COPPERCREEK VERY GRAVELLY LOAM (taxadjunct)
S83-CA-12-04

Classification: Typic Haplohumult, clayey, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 0.2 mile east of Tom McDonald Creek along G-6 road, then 125 feet south, uphill; southeast quarter, northeast quarter, Section 11, T. 9 N., R. 1 E., Humboldt base line and meridian; Rodgers Peak Quadrangle.

Description by: JHP, JL Sampled by: JHP, JL, NKS File number: JHP-110 Photo number: 1:12000 RNP-78 5-16

Parent material: Schist. Physiographic position: Middle mountain slope at 198 m (650 ft.) elevation.

Relief: Uniform, north-facing slope of 31 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*), tanoak (*Lithocarpus densiflorus*) and Douglas-fir (*Pseudotsuga menziesii*); shrub layer includes rhododendron (*Rhododendron macrophyllum*), Oregon grape (*Mahonia nervosa*), salal (*Gaultheria shallon*), black huckleberry (*Vaccinium ovatum*) and red huckleberry (*Vaccinium parvifolium*); herb layer includes sword fern (*Polystichum munitum*), deer fern (*Blechnum spicant*), redwood sorrel (*Oxalis oregona*) and inside-out flower (*Vancouveria hexandra*).

Colors are for the dry soil unless otherwise stated. When described (September 6, 1983) the soil was moist throughout. Field reaction was determined by chlorphenol red indicator.

O -- 3 to 0 cm (1-0 in.); fresh and decomposing tanoak leaves and redwood needles.

A -- 0 to 7 cm (0-3 in.); brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; weak fine granular and fine subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; 50 percent angular pebbles; medium acid (pH 5.8); clear wavy boundary.

AB -- 7 to 31 cm (3-12 in.); light yellowish brown (10YR 6/4) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium roots; common very fine interatitial, very fine and fine tubular pores; 25 percent angular pebbles, 2 percent cobbles; medium acid (pH 5.8); gradual wavy boundary.

Bt1 -- 31 to 59 cm (12-23 in.); reddish yellow (7.5YR 6/6) gravelly clay loam, strong brown (7.5YR 4/6) moist; weak coarse and medium, parting to fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium and few coarse roots; common very fine and fine tubular pores; few faint clay films bridging mineral grains and on ped faces; 17 percent pebbles and 3 percent cobbles; medium acid (pH 5.8); gradual wavy boundary.

Bt2 -- 59 to 79 cm (23-31 in.); yellow (10YR 7/6) gravelly clay loam, yellowish brown (10YR 5/8) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine, common medium and few coarse roots; common very fine and few fine tubular pores; few faint clay films bridging mineral grains and on ped faces; 12 percent pebbles and 2 percent cobbles; medium acid (pH 5.8); gradual smooth boundary.

BC -- 79 to 128 cm (31-50 in.); yellow (10YR 7/6) gravelly clay loam, yellowish brown (10YR 5/8) moist; weak coarse subangular blocky structure; soft, friable, slightly sticky, slightly plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; 11 percent pebbles and 5 percent cobbles; medium acid (pH 6.0); gradual smooth boundary.

C -- 128 to 166 cm (50-65 in.); pale yellow (2.5Y 7/4) cobbly clay loam, light olive brown (2.5Y 5/6) moist; massive; soft, friable, slightly sticky, slightly plastic; few very fine, fine and medium roots; few very fine tubular pores; 10 percent pebbles and 10 percent cobbles; medium acid (pH 6.0).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Coppercreek (taxadjunct)

Location: 0.2 mile east of Tom McDonald Creek on G-6 road; SE 1/4, NE 1/4 S. 11, T.9N, R.1E

Date Sampled: 07 Sep 83

Taxonomic Class: Clayey, mixed, isomesic Typic Haplohumult

Analyst: CZ, MKA, NKS

Pedon Number: 5

Sample Number: S83-CA-12-04

Lab Numbers: 73303-73308

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm 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 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	15 bars	% Available Moisture 1/3 to 15 bars
A	0	7	50	3.2	5.5	2.4	4.5	6.7	22.3	53.0	24.7	vgsil	1.00	36.6	24.2	12.4
AB	7	31	27	4.0	5.2	2.1	4.2	5.9	21.4	49.3	29.3	gcl	1.21	39.2	23.2	16.0
Bt1	31	59	20	1.1	4.0	2.3	4.2	5.1	16.7	50.1	33.1	gsicl	1.20	32.0	20.6	11.4
Bt2	59	79	13	2.4	5.5	3.2	4.7	5.6	21.4	52.5	26.1	sil	1.24	30.1	24.0	6.1
BC	79	128	16	0.9	3.4	2.4	4.6	1.8	13.1	63.3	23.7	gsil	1.25	28.5	20.3	8.2
C	128	166	20	1.5	5.3	3.0	7.3	2.2	19.3	59.6	21.1	gsil	1.25	24.9	16.7	8.2

HORIZON	DEPTH (cm) From	To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	15 bar H_2O / clay
A	0	7	6.1	15.0	2.20	0.20	0.71	33.6	53.9	7.25	0.36	20.1	2.54	0.13	5	1.36	0.98
AB	7	31	5.9	11.0	1.70	0.17	0.82	28.6	47.9	4.81	0.30	16.0	10.20	0.64	7	0.98	0.79
Bt1	31	59	6.0	3.7	0.80	0.15	0.27	15.7	31.3	2.26	0.15	15.1	6.07	0.40	3	0.47	0.62
Bt2	59	79	6.1	2.0	0.40	0.12	0.17	11.6	23.2	1.57	0.10	15.7	3.39	0.22	7	0.44	0.92
BC	79	128	6.3	1.9	0.45	0.17	0.25	9.5	29.2	0.87	0.07	12.4	4.48	0.36	4	0.40	0.86
C	128	166	6.2	1.8	0.36	0.14	0.18	8.4	29.5	0.58	0.07	8.3	2.20	0.27	7	0.40	0.79

REMARKS: Since the 15 bar H_2O/clay ratio is so high, 2.5 x 15 bar H_2O was used, rather than pipette clay, to estimate the percentage of clay in the 31-59 cm particle-size control section. This pedon is outside the taxonomic limits of the Coppercreek family because it is estimated to have 51.5 percent clay. Coppercreek soils have 25 to 35 percent clay in the particle-size control section.

Soil series: Coppercreek (taxadjunct)

Classification: Clayey, mixed, isomesic Typic Haplohumult

Location: 0.2 mile east of Tom McDonald Creek on G-6 Rd.; SE 1/4, NE 1/4, S. 11, T. 9N., R. 1E.

Redwood National Park
Humboldt County, California

Sample number: S83-CA-12-04

Lab No. 84T7003-7005
Pedon No. 84T 2
Project No. 84T 2
Sampled: 07 Sep 83
Reported: 15 Aug 84

U.S. Department of Argiculture
Soil Conservation Service
National Soil Survey Laboratory
Lincoln, Nebraska 68508

RT84CA015

Sample No.	Hzn No.	COARSE SILT FRACTION .02-.05 mm Optical mineralogy 7B1A Percentages										CLAY MINERALOGY <.002 mm X-ray 7A2I Relative amounts				TOTAL ANALYSIS <.002 mm clay Percent	
		RE 7B1A Percent														K_2O 6Q3A	Fe 6C7A
84T7003	1	53	QZ51	SR22	FK13	AM 8	BT 2	OP 2	AR 1	EP 1	ZR<1	VR 3	CL 2	MI 2	FD 2	1.0	10.2
84T7004	2	47	QZ44	SR25	FK14	BT 7	AM 7	OP 3	EP 1	ZR<1		VR 3	CL 2	MI 2	FD 1	0.9	9.5
84T7005	3	46	QZ44	SR23	FK14	AM13	BT 4	OP 2	ZR<1	EP<1		VR 3	CL 2	MI 2	FD 2	0.8	9.5

MINERALOGY: RE = Resistant

KIND OF MINERAL: OP = Opaques QZ = Quartz ZR = Zircon AM = Amphibole AR = Weathered Aggregates BT = Biotite CL = Chlorite
EP = Epidote FD = Feldspar FK = Potassium Feldspar MI = Mica SR = Sericite VR = Vermiculite

RELATIVE AMOUNT: 5 Dominant 4 Abundant 3 Moderate 2 Small 1 Trace

MINERALOGY BASED ON SAND/SILT: Mixed

MINERALOGY BASED ON CLAY: Mixed

FAMILY PLACEMENT: Mixed

Soil series: Coppercreek (taxadjunct)

Classification: Clayey, mixed, isomesic Typic Haplohumult

Sample number: S83-CA-12-04

General Methods: 1B1A, 2A1, 2B

Location: 0.2 mile east of Tom McDonald Creek on G-6 Rd.; SE 1/4, NE 1/4, S. 11, T. 9N., R. 2E.

Redwood National Park
Humboldt County, California

Lab No. 84T7003-7005
Pedon No. 84T 2
Project No. 84T 2
Sampled: 07 Sep 83
Reported: 15 Aug 84

U.S. Department of Argiculture
Soil Conservation Service
National Soil Survey Laboratory
Lincoln, Nebraska 68508

Sample No.	Hzn No.	Depth (cm)	Horizon	Particle size distribution (wt. <2mm)										Total Wt. >2mm Coarse fraction
				TOTAL			SILT		SAND					
				Clay < .002	Silt .002 -.05	Sand .05 -2	FSI .002 -.02	COSI .02 -.05	VFS .05 -.10	FS .10 -.25	MS .25 -.50	CS .5 -1	VCS 1 -2	
847003	1	31-59	Bt1	26.0	50.7	23.3	37.9	12.8	4.3	3.8	3.9	4.9	6.4	19
847004	2	59-79	Bt2	20.5	55.9	23.6	43.2	12.7	4.2	4.0	4.6	5.8	5.0	19
847005	3	79-128	BC	19.0	58.2	22.8	44.5	13.7	4.6	4.1	4.1	5.0	5.0	18

Sample No.	Hzn No.	Depth (cm)	Horizon	Percent wt in < 2mm				Ratio/clay		Ratio: $\frac{Fe_2O_3}{2.5x15\text{-bar water}}$	pH	
				15-bar Water 4B2A	Dith-cit. extractable Fe 6C2B	Al 6G7A	Mn 6D2A	CEC 8D1	15-bar Water 8D1		1:2 .01M $CaCl_2$ 8C1F2	1:1 H_2O 8C1F
847003	1	31-59	Bt1	19.7	3.5	0.8	0.1	0.81	0.76	0.102	5.0	5.7
847004	2	59-79	Bt2	17.1	3.5	0.9	TR	0.83	0.83	0.117	4.9	5.5
847005	3	79-128	BC	14.7	3.1	0.8		0.84	0.77	0.121	5.0	5.7

Sample No.	Hzn No.	Depth (cm)	Horizon	meq/100g in < 2 mm								Percent base saturation	
				NH4OAc extractable bases						CEC			
				Ca 5B5A 6N2E	Mg 5B5A 6O2D	Na 5B5A 6P2B	K 5B5A 6Q2B	Sum bases	Acidity 6H5A	Sum of cations 5A3A	NH_4-OAc 5A8B	Sum of cations 5C3	NH_4-OAc 5C1
847003	1	31-59	Bt1	3.8	0.7	0.2	0.1	4.8	18.0	22.8	21.1	21	23
847004	2	59-79	Bt2	1.5	0.3	0.2	0.1	2.1	15.2	17.3	17.1	12	12
847005	3	79-128	BC	1.3	0.3	0.1	0.1	1.8	13.1	14.9	15.9	12	11

Pedon 6. DEVILSCREEK GRAVELLY CLAY LOAM
82-RNP-8, 83-RNP-11

Classification: Typic Humitropept, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; approximately 250 feet due east of G-6 Road bridge over Tom MacDonald Creek in the northwest corner of the southeast quarter, northeast quarter, Section 11, T. 9 N., R. 1 E., Humboldt base line and meridian; Rodgers Peak Quadrangle.

Description by: JHP, JL, MM2 Sampled by: JHP, JL, MM File number: JL-14 Photo number: 1:12000 RNP-78 5-15

Parent material: Schist. Physiographic position: Lower mountain slope at 152 m (500 ft.) elevation.

Relief: Uniform, north-facing slope of 68 percent gradient.

Hydrology: Somewhat poorly drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*) and tanoak (*Lithocarpus densiflorus*); shrub layer includes dogwood (*Cornus sessilis*), rhododendron (*Rhododendron macrophyllum*), salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), black huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis*) and Oregon grape (*Mahonia nervosa*); herb layer includes sword fern (*Polystichum munitum*), deer fern (*Blechnum spicant*), five-finger fern (*Adiantum pedatum*), piggyback plant (*Tolmiea menziesii*), wild ginger (*Asarum caudatum*) and inside-out flower (*Vancouveria hexandra*).

Colors are for the dry soil unless otherwise stated. When described (July 22, 1982) the soil was moist throughout. Field reaction was determined in 2:1 H2O by glass electrode.

O -- 3 to 0 cm (1-0 in.); litter of fresh and decomposing redwood twigs, leaves and bark, tanoak leaves and fern fronds.

A -- 0 to 12 cm (0-5 in.); light yellowish brown (10YR 6/4) gravelly clay loam, dark yellowish brown (10YR 4/6) moist; weak medium granular and subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common fine interstitial and many very fine and fine tubular pores; 33 percent pebbles; strongly acid (pH 5.4); gradual wavy boundary.

BA -- 12 to 32 cm (5-13 in.); ligh yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine, fine and medium and few coarse roots; common very fine and fine tubular pores; 6 percent pebbles; strongly acid (pH 5.4); gradual wavy boundary.

Bw -- 32 to 51 cm (13-21 in.); brownish yellow (10YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine and medium and few coarse roots; common very fine, fine and medium tubular pores; 6 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

BC -- 51 to 72 cm (21-29 in.); yellowish brown (10YR 5/6) cobbly clay loam, yellowish brown (10YR 5/8) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; 12 percent pebbles and 10 percent cobbles; strongly acid (pH 5.2); gradual smooth boundary.

Cg1 -- 72 to 92 cm (29-37 in.); light gray (2.5Y 7/2) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; common medium faint pale brown (10YR 6/6) mottles, yellowish brown (10YR 5/8) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; 40 percent pebbles and 10 percent cobbles; strongly acid (pH 5.2); clear wavy boundary.

Cg2 -- 92 to 168 cm (37-67 in.); light gray (5Y 7/1) very gravelly loam, variegated olive (5Y 5/3) and gray (5Y 6/1) moist; common medium distinct strong brown (7.5YR 5/6) and common medium prominent strong brown (7.5YR 5/8) mottles moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium and coarse roots; few very fine tubular pores; 38 percent pebbles and 10 percent cobbles; strongly acid (pH 5.1).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Devilscreek

Location: 250 feet east of G-6 road bridge over Tom McDonald Creek; SE 1/4 NE 1/4, S.11, T.9N., R.1E.

Date Sampled: 22 Jul 82, 30 Jun 83

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Humitropept

Analyst: CZ, MKA, NKS

Pedon Number: 6

Sample Number: 82-RNP-8 (chem), 83-RNP-11 (physical)

Lab Numbers: 67438-67443

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	12	33	9.3	6.8	0.1	4.9	8.3	29.4	44.4	26.2	gl	1.05	42.3	18.8	23.5
BA	12	32	6	6.9	6.2	3.2	0.0	11.4	27.7	45.1	27.2	cl	1.10	43.8	19.7	24.1
Bw	32	51	6	4.1	5.2	0.0	0.0	13.6	22.9	48.5	28.6	cl	1.23	47.9	22.4	25.5
BC	51	72	22	7.0	7.3	0.0	0.0	17.4	31.7	50.0	18.3	gl	1.41	31.2	12.5	18.7
Cg1	72	92	50	23.0	13.7	0.0	0.0	22.6	59.3	36.2	4.5	vgsl	1.53	23.3	6.7	16.6
Cg2	92	168	48	13.8	11.5	5.7	0.0	2.5	33.5	61.7	4.8	vgsil	1.58	24.6	4.4	20.2

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	12	5.4	7.3	2.10	0.14	0.57	24.7	40.9	3.89	0.22	17.7	3.28	0.19	1	0.94	0.72
BA	12	32	5.4	4.6	1.40	0.17	0.21	19.8	32.2	1.62	0.13	12.5	3.35	0.27	1	0.73	0.72
Bw	32	51	5.5	2.1	0.72	0.17	0.09	14.5	21.2	1.45	0.13	11.2	3.19	0.29	<1	0.51	0.78
BC	51	72	5.2	0.8	0.25	0.12	0.07	9.0	13.8	1.62	0.11	14.7	3.74	0.25	<1	0.49	0.68
Cg1	72	92	5.2	0.4	0.14	0.05	0.05	5.1	12.5	0.75	0.08	9.4	1.15	0.12	30	1.13	1.49
Cg2	92	168	5.1	2.0	0.52	0.06	0.13	4.0	67.8	0.45	0.08	5.6	2.81	0.50	34	0.83	0.92

REMARKS: Since the 15 bar H_2O/clay ratio is so high, 2.5 x 15 bar H_2O was used, rather than pipette clay, to estimate the percentage of clay in the 25-100 cm particle-size control section. This is the typifying pedon for the Devilscreek series.

Pedon 7. ELFCREEK GRAVELLY LOAM
84-RNP-8

Classification: Typic Eutropept, loamy-skeletal, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; approximately 650 feet downslope from end of M-4 logging road, 100 feet above middle fork of Bridge Creek, Redwood National Park; center of north half, southeast quarter, Section 30, T. 9 N., R. 2 E., Humboldt base line and meridian; Rodger's Peak Quadrangle.

Description by: JL, JHP, NKS Sampled by: JHP, NKS File number: JL-19 Photo number: 1:12000 RNP-78 6-14

Parent material: Schist. Physiographic position: Lower mountain slope at 293 m (960 ft.) elevation.

Relief: Uneven, slightly convex, northeast-facing slope of 22 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*), tanoak (*Lithocarpus densiflorus*) and Douglas-fir (*Pseudotsuga menziesii*); shrub layer is sparse salal (*Gaultheria shallon*); herb layer includes sword fern (*Polystichum munitum*), deer fern (*Blechnum spicant*), redwood sorrel (*Oxalis oregona*), wild ginger (*Asarum caudatum*), five-finger fern (*Adiantum pedatum*), trillium (*Trillium ovatum*), redwood violet (*Viola sempervirens*) and inside-out flower (*Vancouveria hexandra*).

Colors are for the dry soil unless otherwise stated. When described (September 22, 1984) the soil was moist throughout. Field reaction was determined by chlorphenol red and bromthymol blue indicators.

O -- 6 to 0 cm (2-0 in.); fresh and decomposing redwood needles, tanoak leaves and twigs.

A -- 0 to 11 cm (0-4 in.); grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine, fine and few medium roots; many very fine and fine interstitial pores; 34 percent pebbles; medium acid (pH 5.8); clear wavy boundary.

Bw -- 11 to 35 cm (4-14 in.); pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine, and few fine, medium and coarse roots; many very fine and fine interstitial, and few very fine tubular pores; 17 percent pebbles and 7 percent cobbles; medium acid (pH 6.0); gradual wavy boundary.

C1 -- 35 to 80 cm (14-31 in.); gray (5Y 6/1) extremely gravelly loam, dark gray (5Y 4/1) moist; massive; soft, very friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; 62 percent pebbles; slightly acid (pH 6.2); diffuse wavy boundary.

C2 -- 80 to 120 cm (31-47 in.); gray (5Y 5/1) very gravelly loam, dark gray (5Y 4/1) moist; massive; hard, very friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; 43 percent pebbles; slightly acid (pH 6.1); diffuse wavy boundary.

C3 -- 120 to 165 cm (47-65 in.); gray (5Y 5/1) very gravelly loam, dark gray (5Y 4/1) moist; massive; hard, friable, nonsticky, slightly plastic; few very fine, fine, medium and coarse roots; many very fine interstitial pores; 40 percent pebbles; slightly acid (pH 6.1); gradual smooth boundary.

C4 -- 165 to 220 cm (65-87 in.); gray (N 5/) gravelly loam, dark gray (N 4/) moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine, fine and medium roots; common very fine interstitial pores; 33 percent pebbles; neutral (pH 6.6).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Elfcreek

Taxonomic Class: Loamy-skeletal, mixed, isomesic Typic Eutropept

Sample Number: 84-RNP-8

Location: 650 feet downslope from M-4 road, 100 feet above middle fork, Bridge Creek; SE 1/4, S.30, T.9N, R.2E.

Pedon Number: 7

Lab Numbers: 75894-75899

Date Sampled: 12 Jul 84

Analyst: BK, PG

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	11	34	19.3	7.8	3.6	5.4	5.6	41.7	42.0	16.3	gl				
Bw	11	35	24	10.9	8.0	4.2	5.9	5.9	34.9	46.5	18.6	gl				
C1	35	80	62	23.8	11.3	4.3	6.7	6.6	52.7	38.7	8.6	vgsl				
C2	80	120	43	22.5	13.5	6.1	9.4	7.9	59.4	31.1	9.5	vgsl				
C3	120	165	40	22.2	13.2	6.4	9.9	8.7	60.4	32.4	7.2	vgsl				
C4	165	220	33	16.4	10.8	5.6	7.5	6.2	46.5	41.1	12.3	gl				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	11	6.1	9.1	1.50	0.15	0.53	15.3	73.7	5.16	0.16	32.3			5	0.94	
Bw	11	35	6.4	6.4	0.83	0.12	0.54	11.1	71.1	2.32	0.08	29.0			4	0.60	
C1	35	80	6.4	2.1	0.31	0.08	0.16	3.0	88.3	0.64	0.08	8.0			7	0.35	
C2	80	120	6.3	2.4	0.51	0.10	0.15	3.2	98.7	0.56	0.07	8.0			9	0.34	
C3	120	165	6.3	2.2	0.53	0.08	0.12	3.4	86.2	0.47	0.07	6.7			9	0.47	
C4	165	220	6.4	3.0	0.30	0.08	0.07	3.0	115.0	0.70	0.03	23.3			3	0.24	

REMARKS: This is the typifying pedon for the Elfcreek series.

Pedon 8.
84-RNP-15

Classification: Typic Troporthent, coarse-loamy, mixed, non-acid, isomesic

Location: Humboldt County, California; Redwood National Park; about 1700 feet south on 1821 road from junction between 1820 and 1821 roads; southwest quarter, southeast quarter, section 27, T. 9N. R. 2E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP Sampled by: JHP File number: JHP-118 Photo number: 1:12000 RNP-78 8-41

Parent material: Colluvium derived from schist. Physiographic position: Large hollow in lower hillslope at 162 m (530 ft.) elevation.

Relief: Gently convex, northeast-facing slope of 68 percent gradient.

Hydrology: Moderately well drained; medium runoff; moderate permeability; groundwater observed at depth of 87 cm (34 in.).

Vegetation: Moist, early successional forest; tree layer includes big-leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), willow (*Salix sp.*), California bay (*Umbellularia californica*) and a few coast redwood saplings (*Sequoia sempervirens*); shrub layer includes dogwood (*Cornus sessilis*), elderberry (*Sambucus callicarpa*), thimbleberry (*Rubus parviflorus*), western raspberry (*Rubus leucodermis*) and yerba de selva (*Whipplea modesta*); herb layer includes sword fern (*Polystichum munitum*), redwood sorrel (*Oxalis oregona*), five-finger fern (*Adiantum pedatum*), piggy-back plant (*Tolmiela menziesii*), chain fern (*Woodwardia fimbriata*), western coltsfoot (*Petasites palmatus*) and iris (*Iris douglasiana*).

Colors are for the dry soil unless otherwise stated. When described (June 20, 1984) the soil was moist or wet throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 4 to 0 cm (2-0 in.); fresh and decomposing maple and alder leaves and fern fronds.

A1 -- 0 to 14 cm (0-6 in.); gray (N 5/) gravelly silt loam, olive gray (5Y 4/2) moist; weak medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; 20 percent pebbles; neutral (pH 7.0); gradual smooth boundary.

A2 -- 14 to 30 cm (6-12 in.); gray (N 5/) gravelly loam, dark gray (5Y 4/1) moist;weak medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine, common medium and few coarse roots; common very fine and fine interstitial, and common fine and medium tubular pores; 20 percent pebbles; neutral (pH 7.0); gradual smooth boundary.

C -- 30 to 87 cm (12-34 in.); gray (N 5/) gravelly loam, dark gray (N 4/) moist; massive; hard, friable, slightly sticky, slightly plastic; many very fine and fine, common medium and coarse roots; common fine and medium tubular, and few very fine interstitial pores; 20 percent pebbles; slightly acid (pH 6.5); gradual smooth boundary.

Cg1 -- 87 to 122 cm (34-48 in.); gray (N 5/) gravelly loam, dark gray (N 4/) moist; common medium prominent pale yellow (2.5Y 8/4) mottles, yellowish brown (10YR 5/6) moist; massive, very hard, slightly firm, slightly sticky, slightly plastic; few very fine and fine roots; common very fine interstitial pores; 25 percent pebbles; mildly alkaline (pH 7.5); clear smooth boundary.

Cg2 -- 122 to 145 cm (48-57 in.); gray (N 5/) gravelly silt loam, dark gray (5Y 4/1) moist; common coarse prominent reddish yellow (10YR 6/8) and pale yellow (2.5Y 8/4) mottles, strong brown (7.5YR 5/6) and very pale brown (10YR 7/4) moist; massive; very hard, slightly firm, slightly sticky, slightly plastic; few very fine roots; no pores; 20 percent pebbles; mildly alkaline (pH 7.5); abrupt smooth boundary.

Cg3 -- 145 to 167 cm (57-66 in.); gray (N 5/) gravelly loam, dark gray (N 4/) moist; massive; very hard, slightly firm, slightly sticky, slightly plastic; no roots; no pores; 20 percent pebbles; mildly alkaline (pH 7.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Coarse-loamy, mixed, non-acid, isomesic Typic Troporthent

Sample Number: 84-RNP-15

Location: 0.3 mi. south on 1821 road from junction with 1821 road; SW 1/4, SE 1/4, S.27, T.9N., R.2E.

Pedon Number: 8

Lab Numbers: 81546-81551

Date Sampled: 20 June 84

Analyst: BK, LF

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm 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 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	15 bars	% Available Moisture 1/3 to 15 bars
A1	0	14	20	27.1	14.4	5.1	8.4	6.5	61.5	31.3	7.2	gsl				
A2	14	30	20	21.1	11.3	4.7	8.2	7.1	52.4	38.1	9.5	gsl				
C	30	87	20	17.4	13.1	6.1	11.9	9.3	57.8	24.4	17.8	gsl				
Cg1	87	122	25	21.6	13.7	5.7	10.3	7.6	58.9	33.9	7.2	gsl				
Cg2	122	145	20	18.3	11.8	5.1	8.7	6.7	50.6	39.4	10.0	gl				
Cg3	145	167	16	23.1	12.5	4.9	8.8	7.7	57	31.4	11.6	gsl				

HORIZON	DEPTH (cm) From	To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/ 100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	15 bar H_2O / clay
A1	0	14	6.2	8.0	1.01	0.07	0.26	10.8	86.5	3.68	0.17	21.6			12	1.50	
A2	14	30	6.2	6.9	0.75	0.07	0.26	9.5	84.0	2.75	0.13	21.2			6	1.00	
C	30	87	6.2	6.7	0.50	0.07	0.20	6.7	111.5	1.55	0.10	15.5			3	0.38	
Cg1	87	122	6.5	3.4	0.30	0.08	0.07	3.1	124.2	0.86	0.07	12.3			<1	0.43	
Cg2	122	145	6.4	3.7	0.37	0.09	0.13	3.4	126.2	0.90	0.08	11.3			3	0.34	
Cg3	145	167	6.0	2.7	0.37	0.08	0.08	2.5	129.2	1.04	0.07	14.9			1	0.22	

REMARKS:

Pedon 9. FORTYFOUR CLAY LOAM
83-RNP-7, S82-CA-12-05X

Classification: Typic Hapludult, clayey, oxidic, isomesic

Location: Humboldt County, California; Redwood National Park; roadcut on M-11-1-1 logging road, 750 feet south of junction of L-1 and M-11-1-1 roads in Redwood National Park; southwest quarter, southeast quarter, Section 22, T. 10 N., R. 1 E., Humboldt base line and meridian; Rodger's Peak Quadrangle.

Description by: JHP, JL Sampled by: JHP, JL File number: JHP-91 Photo number: 1:12000 RNP-78 5-22

Parent material: Schist. Physiographic position: Upper mountain slope at 375 m (1230 ft.) elevation.

Relief: Convex, southeast-facing slope of 20 percent gradient.

Hydrology: Well drained; medium runoff; moderately slow permeability; no groundwater observed.

Vegetation: Second growth redwood forest; trees include Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), coast redwood (*Sequoia sempervirens*), tanoak (*Lithocarpus densiflorus*) and red alder (*Alnus rubra*); shrubs include rhododendron (*Rhododendron macrophyllum*), black huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), coyote bush (*Baccharis pilularis* ssp. *consanguinea*) and yerba de selva (*Whipplea modesta*).

Colors are for the dry soil unless otherwise stated. When described (June 30, 1982) the soil was moist throughout. Reaction is in 2:1 H2O by glass electrode.

O -- 1 to 0 cm (1/2-0 in.); fresh and decomposing Douglas-fir needles and twigs.

A -- 0 to 30 cm (0-12 in.); strong brown (7.5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky, parting to moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, common medium roots; many very fine and fine interstitial, and common fine and medium tubular pores; 14 percent pebbles; very strongly acid (pH 5.0); gradual wavy boundary.

BAt -- 30 to 45 cm (12-18 in.); yellowish red (5YR 5/8) clay loam, yellowish red (5YR 4/8) moist; moderate coarse subangular blocky, parting to moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine, medium and few coarse roots; few very fine and fine interstitial, and common fine and medium tubular pores; 14 percent pebbles; very strongly acid (pH 5.0); gradual wavy boundary.

Bt -- 45 to 76 cm (18-30 in.); yellowish red (5YR 5/8) gravelly clay, yellowish red (5YR 4/8) moist; moderate coarse subangular blocky structure; hard, firm, sticky, slightly plastic; common fine and medium, and few coarse roots; common fine, medium and coarse tubular pores; common distinct red (2.5YR 4/6) moist, clay films on faces of peds; 20 percent pebbles; strongly acid (pH 5.2); gradual wavy boundary.

BCt -- 76 to 99 cm (30-39 in.); variegated reddish yellow (5YR 6/6) and yellow (10YR 7/8) clay loam, yellowish red (5YR 5/8) moist; moderate medium subangular blocky, parting to moderate fine subangular blocky structure; hard, firm, sticky, slightly plastic; few fine, medium and coarse roots; few fine, medium and coarse tubular pores; few distinct clay films on faces of peds; 10 percent pebbles; very strongly acid (pH 4.9); abrupt wavy boundary.

Cr -- 99 to 125 cm (39-49 in.); strongly reddened, fractured, weathered schist with a few narrow seams of red clay.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Fortyfour

Taxonomic Class: Clayey, oxidic, isomesic Typic Hapludult

Sample Number: 82-RNP-7, S82-CA-12-05X

Location: M-11-1-1 road, 750 feet south of L-1 junction; SW 1/4, SE 1/4, S.22, T.10N, R.1E.

Pedon Number: 9

Lab Numbers: OSU 67434-67437, UCD 1565

Date Sampled: 30 Jun 82

Analyst: CZ, PG, MAM, SSM

Analytical Lab: OSU, UCD

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	30	14	3.6	2.7	1.4	3.6	6.4	17.7	48.3	34.0	sicl				
BAt	30	45	14	2.7	2.9	1.5	3.8	7.0	17.9	40.6	41.5	sic				
Bt	45	76	20	1.2	2.3	0.3	0.1	16.2	20.1	35.9	44.0	c		34.5	21.8	12.7
BCt	76	99	10	2.5	3.7	2.3	5.3	8.7	22.5	34.5	43.0	c				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	30	5.0	1.0	0.47	0.11	0.33	14.0	13.6	2.09	0.09	23.2			2	0.41	
BAt	30	45	5.0	0.6	0.45	0.09	0.19	13.7	9.7	0.50	0.05	10.0			1	0.33	
Bt	45	76	5.2	0.5	0.52	0.06	0.21	17.5	7.4	0.21	0.06	3.5			<1	0.40	0.64
BCt	76	99	4.9	0.5	0.46	0.07	0.15	11.9	9.9	0.12	0.08	1.5			<1	0.28	

REMARKS: This is the typifying pedon for the Fortyfour series.

Pedon 10. LACKSCREEK GRAVELLY LOAM
82-RNP-10, 83-CA-12-05

Classification: Typic Haplohumult, loamy-skeletal, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 0.5 mile on W-Line Road from Bald Hills Road and 1,000 feet west along the ridge from W-Line Road; in the southwest quarter, southwest quarter, Section 29, T. 10 N., R. 2 E., Humboldt base line and meridian; Coyote Peak Quadrangle.

Description by: JHP **Sampled by**: JHP, NKS **File number**: JHP-87 **Photo number**: 1:12000 RNP-78 7-46

Parent material: Colluvium from graywacke sandstone and shale overlying residuum weathered from shale. **Physiographic position**: Slope just below narrow ridge at 610 m (2000 ft.) elevation.

Relief: Uniform, south-facing slope of 56 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Mixed evergreen forest; tree layer includes tanoak (*Lithocarpus densiflorus*), Douglas-fir (*Pseudotsuga menziesii*), and madrone (*Arbutus menziesii*); shrub layer includes tanoak and black huckleberry (*Vaccinium ovatum*).

Colors are for the dry soil unless otherwise stated. When described (May 4, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O1 -- 5 to 1 cm (2-1/2 in.); fresh Douglas-fir needles, twigs, cones, and tanoak leaves.

O2 -- 1 to 0 cm (1/2-0 in.); decomposing leaves, humus and fungal mycelia.

A1 -- 0 to 24 cm (0-9 in.); brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium and few coarse roots; common very fine And fine interstitial and common very fine and fine tubular pores; about 15 percent fine and 5 percent coarse pebbles; very strongly acid (pH 5.0); clear wavy boundary.

A2 -- 24 to 40 cm (9-16 in.); yellowish brown (10YR 5/4) gravelly clay loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine, medium and coarse roots; common very fine interstitial and common very fine , fine and medium tubular pores; 15 percent fine and 8 percent coarse pebbles; strongly acid (pH 5.5); abrupt wavy boundary.

2BA -- 40 to 56 cm (16-22 in.); light brown (7.5YR 6/4) very cobbly clay loam, brown (7.5YR 4/4) moist; weak fine subangular bloc[y structure; hard, slightly firm, sticky, slightly plastic; few very fine and fine, common medium and few coarse roots; few very fine interstitial and few very fine and fine tubular pores; 20 percent cobbles, 25 percent fine and 10 percent coarse pebbles; strongly acid (pH 5.5); clear wavy boundary.

2Bt1 -- 56 to 78 cm (22-31 in.); very pale brown (10YR 7/4) extremely cobbly clay loam, yellowish brown (10YR 5/6) moist; weak fine subangular blocky structure; slightly hard, firm, sticky, plastic; common medium, and few very fine, fine and coarse roots; few very fine tubular pores; common distinct clay films on ped faces; 50 percent cobbles, 20 percent coarse and 15 percent fine pebbles; strongly acid (pH 5.5); clear broken boundary.

2Bt2 -- 78 to 89 cm (31-35 in.); light yellowish brown (10YR 6/4) extremely gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky, plastic; few fine and medium roots; few very fine tubular pores; common distinct clay films on ped faces; 50 percent fine and 25 percent coarse pebbles; strongly acid (pH 5.5); abrupt irregular boundary.

2R -- 89 to 110 cm (35-43 in.); fractured shale, fractures mostly less than 1 mm across and 1 to 10 cm apart. About 1 percent soil material in fractures and pockets; few medium and fine roots; few very fine interstitial pores; common prominent clay films on fracture faces; strongly acid (pH 5.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Lackscreek

Taxonomic Class: Loamy-skeletal, mixed, isomesic Typic Haplohumult

Sample Number: 82-RNP-10 (chem), 83-RNP-14 (physical)

Location: 0.5 mile on W-Line road from Bald Hills Road, then west 1000 feet; SW 1/4, SW 1/4, S.29, T.10N., R.2E.

Pedon Number: 10

Lab Numbers: 68117-68121

Date Sampled: 12 Aug 82, 20 Oct 83

Analyst: CZ, MKA, NKS

Analytical Lab: OSU, HSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A1	0	24	23.0	17.5	9.3	4.4	8.1	6.3	45.6	33.7	20.7	gl	0.98	32.0	16.4	15.6
A2	24	40	35.3	7.9	8.2	4.7	8.6	6.1	35.5	35.1	29.4	gcl	1.01	31.4	16.0	15.4
2BA	40	56	61.1	7.8	8.1	4.3	9.5	6.5	36.2	36.7	27.1	vgcl	1.25	27.2	15.4	11.8
2Bt1	56	78	80.2	3.7	5.4	3.5	6.9	6.2	25.7	46.1	28.2	vcobcl	1.33	27.8	14.6	13.2
2Bt2	78	89	77.8	6.0	5.8	2.5	7.3	6.2	27.8	45.8	26.4	exgl	1.35	28.5	14.0	14.5

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A1	0	24	5.1	2.3	1.2	0.13	0.69	19.9	21.7	4.29	0.15	28.6	7.77	0.27	19	0.96	0.79
A2	24	40	5.4	2.6	1.4	0.12	0.62	16.8	28.2	2.84	0.13	21.8	2.97	0.14	25	0.57	0.54
2BA	40	56	5.4	2.8	1.7	0.13	0.53	14.5	35.6	1.80	0.11	16.4	1.40	0.09	25	0.54	0.57
2Bt1	56	78	5.4	2.8	2.2	0.11	0.47	13.5	41.3	1.51	0.09	16.8	0.87	0.05	15	0.48	0.52
2Bt2	78	89	5.5	2.8	2.7	0.11	0.45	13.5	44.9	1.04	0.09	11.6	0.34	0.03	19	0.51	0.53

REMARKS: Exchangeable hydrogen from 78 to 89 cm depths is 11.7 meq/100g, giving 34.1 percent base saturation, by sum of cations. This is the typifying pedon for the Lackscreek series.

Soil series: Lackscreek

Classification: Loamy-skeletal, mixed, isomesic Typic Haplohumult

Sample Number: S83-CA-12-05

General Methods: 1B1A, 2A1, 2B

Location: 0.5 mile on W-Line road from Bald Hills road, then east 1000 feet; S.29, T.10N., R.2E. Redwood National Park Humboldt County, California

Lab No. 85P2206-2207
Pedon No. 85P 453
Project No. 85P 84
Sampled: 20 Aug 83
Reported: 24 Dec 85

U.S. Department of Agriculture
Soil Conservation Service
National Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Sample No.	Hzn No.	Depth (cm)	Horizon	Percent wt. in < 2 mm: Clay 3A1	Dith.-cit. extractable Fe 6C2B	Dith.-cit. extractable Al 6G7A	Ratio/clay Fe_2O_3 + GI	Clay Mineralogy < 2 micron fraction: X-ray 7A2I Relative Amounts	DTA 7A3 Percent
852206	1	24-40	A2	29.8	2.4	0.5	0.115	VR 2 KK 2 MI 2 CL 1	KK 2
852207	2	40-56	2BA	30.0	2.5	0.5	0.119	VR 3 KK 3 MI 2 CL 1	KK 4

KIND OF MINERAL: VR Vermiculite KK Kaolinite MI Mica CL Chlorite

RELATIVE AMOUNT: 5 Dominant 4 Abundant 3 Moderate 2 Small 1 Trace

Pedon 11. SLIDECREEK EXTREMELY GRAVELLY LOAM (taxadjunct)
80-RNP-52 through -57

Classification: Typic Dystropept, loamy-skeletal, mixed, isomesic.

Location: Humboldt County, California; Redwood National Park; 1.9 miles on C-Line road from Bald Hills Road, then east, up hill 200 feet; northeast quarter, southwest quarter, Section 19, T. 10 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: DC, JHP Sampled by: DC File number: DC-7 Photo number: 1:12000 RNP-78 7-48

Parent material: Colluvium from fractured sandstone. Physiographic position: Slope just below narrow ridge at 427 m (1400 ft.) elevation.

Relief: Convex, irregular northwest-facing slope of 53 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Second-growth redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), tanoak (*Lithocarpus densiflorus*) and madrone (*Arbutus menziesii*); shrub layer includes tanoak, black huckleberry (*Vaccinium ovatum*), yerba de selva (*Whipplea modesta*), blueblossom (*Ceanothus thyrsiflorus*), rhododendron (*Rhododendron macrophyllum*) and coyote bush (*Baccharis pilularis* ssp. *consanguinea*); a sparse herb layer consists of a few sword fern (*Polystichum munitum*) and fireweed (*Erechtites arguta*).

Colors are for the dry soil unless otherwise stated. When described (October 30, 1980) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 10 to 0 cm (4-0 in.); tanoak leaves, redwood needles and small amount of duff.

A -- 0 to 18 cm (0-7 in.); grayish brown (10YR 5/2) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; weak very fine subangular blocky, parting to weak very fine and fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine, and common medium roots; many very fine and fine interstitial pores; 75 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

Bw -- 18 to 34 cm (7-13 in.); light yellowish brown (10YR 6/4) very gravelly clay loam, dark yellowish brown (10YR 3/4) moist; weak very fine subangular blocky, parting to weak very fine and fine granular structure; slightly hard, friable, sticky, slightly plastic; many very fine and fine, and common medium roots; many very fine and fine tubular and common very fine interstitial pores; 50 percent pebbles; strongly acid (pH 5.5); abrupt irregular boundary.

BC -- 34 to 50 cm (13-20 in.); very pale brown (10YR 7/4) very gravelly sandy clay loam, yellowish brown (10YR 5/4) moist; moderate very fine and fine subangular blocky structure; hard, friable, sticky, slightly plastic; common very fine, and few fine and medium roots; many very fine, fine and medium tubular and common very fine and fine interstitial pores; 55 percent pebbles; very strongly acid (pH 4.5); clear wavy boundary.

2Bw -- 50 to 71 cm (20-28 in.); light yellowish brown (10YR 6/4) very gravelly clay loam, dark yellowish brown (10YR 4/6) moist; moderate very fine and fine subangular blocky structure; hard, firm, sticky, plastic; common very fine, few fine and medium roots; many very fine, fine and medium, and common very fine and fine interstitial pores; 35 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

2BC -- 71 to 109 cm (28-43 in.); light yellowish brown (10YR 6/4) extremely gravelly clay loam, yellowish brown (10YR 5/6) moist; weak very fine and fine subangular blocky structure; hard, firm, sticky, plastic; common very fine and fine roots; common very fine and fine tubular pores; 95 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

2C -- 109 to 170 cm (43-67 in.); very pale brown (10YR 7/3) extremely gravelly loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, slightly sticky, slightly plastic; common very fine and few fine roots; many very fine and fine tubular pores; 95 percent pebbles; strongly acid (pH 5.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Slidecreek (taxadjunct)

Taxonomic Class: Loamy-skeletal, mixed, isomesic Typic Dystropept

Sample Number: 80-RNP-52 through 80-RNP-57

Location: 1.9 miles on C-Line road from Bald Hills Road, then 200 feet east; NE 1/4, SW 1/4, T. 10N, R. 2E.

Pedon Number: 11

Lab Numbers: 63279-63284

Date Sampled: 30 Oct 80

Analyst: CZ

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	18	5.2	2.7	1.8	0.17	0.64	27.4	19.4	6.03	0.19	31.7			5		
Bw	18	34	5.0	1.0	1.1	0.17	0.40	21.4	12.5	2.85	0.09	31.7			2		
BC	34	50	5.2	0.8	1.5	0.13	0.21	12.3	21.5	0.85	0.06	14.2			7		
2Bw	50	71	5.2	0.5	0.72	0.21	0.33	14.0	12.6	0.95	0.07	13.6			9		
2BC	71	109	5.3	0.6	1.1	0.15	0.57	12.2	19.8	1.18	0.09	13.1			32		
2C	109	170	5.3	0.4	1.4	0.18	0.21	8.7	25.2	0.46	0.07	6.6			18		

REMARKS: This pedon is outside of taxonomic limits of the Slidecreek family because it is estimated to have approximately 8 Kg/m^2 of organic carbon to a depth of 1 meter. Soils in the Slidecreek family have at least 12 Kg/m^2 O.C. to a depth of 1 meter.

Pedon 12. TECTAH SILTY CLAY LOAM
82-CA-12-04X

Classification: Typic Palehumult, clayey, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 500 feet southeast of junction between C-20 and C-Line roads; southwest quarter, southeast quarter, section 19, T. 10N., R. 2E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JL Sampled by: JL, JHP, NKS File number: JL-12 Photo number: 1:12000 RNP-78 7-48

Parent material: Graywacke sandstone and siltstone. Physiographic position: Midslope bench at 366 m (1200 ft.) elevation.

Relief: Slightly convex, south-facing slope of 35 percent gradient.

Hydrology: Well drained; medium runoff; moderately slow permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii*) and tanoak (*Lithocarpus densiflorus*); shrub layer includes rhododendron (*Rhododendron macrophyllum*), black huckleberry (*Vaccinium ovatum*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*) and Oregon grape (*Mahonia nervosa*); herb layer includes a few sword fern (*Polystichum munitum*) and deer fern (*Blechnum spicant*).

Colors are for the dry soil unless otherwise stated. When described (July 6, 1982) the soil was moist throughout. Reaction was determined in 2:1 H2O by glass electrode.

O -- 5 to 0 cm (2-0 in.); fresh and partially decomposed leaves, twigs and cones from redwood, Douglas-fir, tanoak and hemlock.

A -- 0 to 25 cm (0-10 in.); light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; strong medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; common very fine and fine interstitial pores; 7 percent pebbles; medium acid (pH 5.6); gradual smooth boundary.

BAt -- 25 to 49 cm (10-19 in.); reddish yellow (7.5YR 7/6) silty clay loam, strong brown (7.5YR 4/6) moist; strong medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; common very fine tubular and interstitial pores; few distinct clay films in pores and on faces of peds; 4 percent pebbles; medium acid (pH 5.6); gradual smooth boundary.

Bt1 -- 49 to 74 cm (19-29 in.); reddish yellow (7.5YR 7/6) silty clay, yellowish brown (10YR 5/6) moist; strong coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine, medium and coarse roots; common very fine tubular and interstitial pores; many distinct clay films on faces of peds and in pores; 9 percent pebbles; strongly acid (pH 5.2); diffuse smooth boundary.

Bt2 -- 74 to 110 cm (29-43 in.); yellow (10YR 7/6) silty clay, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine and medium roots; common very fine tubular and interstitial pores; common distinct clay films on faces of peds and in pores; 7 percent pebbles; strongly acid (pH 5.1); diffuse smooth boundary.

BCt1 -- 110 to 150 cm (43-59 in.); yellow (10YR 7/6) silty clay loam, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine and medium roots; common very fine tubular and interstitial pores; common distinct clay films on faces of peds and in pores; 6 percent pebbles; strongly acid (pH 5.2); diffuse smooth boundary.

BCt2 -- 150 to 180 cm (59-71 in.); yellow (10YR 7/6) silty clay loam, yellowish brown (10YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable, sticky, plastic; few very fine, fine and medium roots; common very fine tubular and interstitial pores; common faint clay films on faces of peds and in pores; 8 percent pebbles; strongly acid (pH 5.1).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Tectah

Taxonomic Class: Clayey, mixed, isomesic Typic Palehumult

Sample Number: 82-CA-12-04X

Location: 500 ft. SE of junction between C-Line and C-20 roads; SW 1/4, SE 1/4, S.19, T.10N, R.2E.

Pedon Number: 12

Lab Numbers: UCD 1572, OSU 76001-76006

Date Sampled: 12 Aug 82

Analyst: WRA, BK. NKS

Analytical Lab: UCD, HSU, OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	25	4.9	4.6	2.3	1.5	3.9	5.9	18.2	53.9	27.9	sicl	1.23	38.4	17.1	21.3
BAt	25	49	2.9	2.2	1.9	1.5	3.5	6.0	15.1	50.4	34.5	sicl	1.35	30.2	16.5	13.7
Bt1	49	74	7.9	3.5	2.2	1.7	3.4	5.0	15.8	43.3	40.9	sic	1.33	28.9	17.5	11.4
Bt2	74	110	5.8	5.2	1.2	0.7	2.6	4.2	13.9	43.5	42.6	sic	1.41	26.3	16.5	9.8
BCt1	110	150	4.9	2.6	1.6	1.3	3.4	5.2	14.1	47.4	38.5	sicl	1.41	27.6	18.2	9.4
BCt2	150	180	7.1	3.4	1.5	1.0	3.0	4.8	13.7	48.3	38.0	sicl	1.41	25.1	16.1	9.0

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	25	5.0	4.4	1.9	0.3	0.50	15.4	46.1	3.14	0.114	27.5	9.18	0.33	<1	0.55	0.61
BAt	25	49	4.7	0.7	0.8	0.3	0.30	12.5	16.8	1.36	0.072	18.9	4.28	0.23	<1	0.36	0.48
Bt1	49	74	4.7	0.2	0.7	0.2	0.20	11.2	11.6	0.55	0.063	8.7	1.68	0.19	<1	0.27	0.43
Bt2	74	110	4.7	0.3	0.6	0.2	0.20	11.2	11.6	0.31	0.053	5.8	1.48	0.25	<1	0.26	0.39
BCt1	110	150	4.6	0.3	0.7	0.3	0.20	10.0	15.0	0.17	0.057	3.0	0.91	0.31	<1	0.26	0.47
BCt2	150	180	4.7	0.4	0.6	0.3	0.20	11.6	12.9	0.21	0.056	3.8	0.83	0.22	<1	0.31	0.42

REMARKS: This is the typifying pedon for the Tectah series.

Pedon 13. TECTAH GRAVELLY SILTY CLAY LOAM
84-RNP-3

Classification: Typic Palehumult, clayey, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; bankcut on skid trail 75 feet west of C-13 road, 3000 feet south of A-9-9 deck; northeast quarter, northwest quarter, section 34, T. 10N., R. 1E., Humboldt base line and meridian; Rodgers Peak Quadrangle.

Description by: JHP, RWM Sampled by: JHP, RWM File number: RWM-1 Photo number: 1:12000 RNP-78 4-18

Parent material: Schist Physiographic position: Middle mountain slope at 299 m (980 ft.) elevation.

Relief: Gently convex, north-facing slope of 27 percent gradient.

Hydrology: Well drained; medium runoff; moderately slow permeability; no groundwater observed.

Vegetation: Second-growth redwood forest; tree layer includes red alder (*Alnus rubra*), western hemlock (*Tsuga heterophylla*), Douglas-fir (*Pseudotsuga menziesii*), coast redwood (*Sequoia sempervirens*) and tanoak (*Lithocarpus densiflorus*); shrub layer includes salal (*Gaultheria shallon*), rhododendron (*Rhododendron macrophyllum*), black huckleberry (*Vaccinium ovatum*) and yerba de selva (*Whipplea modesta*); herb layer includes a few sword fern (*Polystichum munitum*) and redwood violet (*Viola sempervirens*).

Colors are for the dry soil unless otherwise stated. When described (March 22, 1984) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 6 to 0 cm (2-0 in.); fresh and decomposing rhododendron, alder and tanoak leaves, with some moss growing on most of it.

A -- 0 to 17 cm (0-7 in.); brown (7.5YR 5/4) gravelly silt loam, dark brown (7.5YR 3/4) moist; weak fine granular and weak coarse subangular blocky, parting to weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine, common fine and few medium roots; many very fine and fine interstitial, and many medium and few coarse tubular pores; 16 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

AB -- 17 to 34 cm (7-13 in.); strong brown (7.5YR 5/6) silty clay loam, dark brown (7.5YR 3/4) moist; weak coarse subangular blocky, parting to weak medium subangular blocky structure; hard, friable, sticky, slightly plastic; many very fine and fine, common medium and few coarse roots; many very fine and fine interstitial, and many medium and few coarse tubular pores; 3 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

BAt -- 34 to 61 cm (13-24 in.); brownish yellow (10YR 6/6) silty clay loam, strong brown (7.5YR 4/6) moist; weak coarse subangular blocky structure; vey hard, friable, sticky, slightly plastic; common very fine, fine and medium, and few coarse roots; many very fine and fine interstitial, common medium and few coarse tubular pores; 11 percent pebbles; pH indicator fades; clear wavy boundary.

Bt1 -- 61 to 94 cm (24-37 in.); brownish yellow (10YR 6/6) silty clay loam, yellowish brown (10YR 5/8) moist; weak very coarse, parting to weak coarse subangular blocky structure; hard, slightly firm, sticky, slightly plastic; common medium, and few very fine, fine and coarse roots; common very fine and fine interstitial, and common very fine, few fine and medium tubular pores; 14 percent pebbles; pH indicator fades; gradual wavy boundary.

Bt2 -- 94 to 169 cm (37-67 in.); brownish yellow (10YR 6/6) gravelly silty clay loam, strong brown (7.5YR 5/8) moist; weak very coarse subangular blocky structure; hard, firm, sticky, plastic; few very fine, fine and medium roots; common very fine and fine interstitial, and common very fine, and few fine and medium tubular pores; common faint clay films on faces of peds; 18 percent pebbles; pH indicator fades; gradual smooth boundary.

Bt3 -- 169 to 192 cm (67-76 in.); reddish yellow (7.5YR 6/6) gravelly silty clay, yellowish red (5YR 5/8) moist; weak very coarse subangular blocky structure; very hard, firm, sticky, plastic; few very fine, fine and medium roots; common very fine and fine interstitial, and few very fine and fine tubular pores; common faint clay films in pores, few faint clay films on faces of peds; 27 percent pebbles; pH indicator fades.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Tectah

Taxonomic Class: Clayey, mixed, isomesic Typic Palehumult

Sample Number: 84-RNP-3

Location: 3000 feet south of A-9 Deck; NE 1/4, NW 1/4, S 34, T.10N, R.1E.

Pedon Number: 13

Lab Numbers: 75918-75923

Date Sampled: 23 Apr 84

Analyst: BK, PG

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	17	16	2.7	2.2	0.8	1.9	1.1	8.7	56.2	35.1	gsicl				
AB	17	34	3	1.9	1.6	0.5	2.0	2.2	8.2	52.3	39.5	sicl				
BAt	34	61	11	2.0	1.6	0.5	1.6	2.6	8.3	52.7	39.0	sicl				
Bt1	61	94	14	1.0	1.4	0.6	2.1	3.3	8.4	49.6	42.0	sic				
Bt2	94	169	18	3.5	2.0	1.0	2.2	3.2	11.9	49.4	38.7	gsicl				
Bt3	169	192	27	4.0	3.0	0.8	3.5	4.4	15.7	33.6	50.7	gc				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	17	5.4	2.3	1.3	0.19	0.59	21.2	20.7	4.18	0.16	26.1			2	0.60	
AB	17	34	5.4	0.9	0.86	0.18	0.37	12.7	18.2	1.74	0.06	29.0			<1	0.32	
BAt	34	61	5.4	0.9	1.1	0.20	0.38	13.8	18.7	0.81	0.06	13.5			<1	0.35	
Bt1	61	94	5.5	0.6	1.3	0.24	0.15	15.2	15.1	0.32	0.03	10.7			<1	0.36	
Bt2	94	169	5.6	0.5	1.3	0.35	0.10	14.6	15.4	0.17	0.02	8.5			<1	0.38	
Bt3	169	192	5.6	0.8	1.4	0.26	0.07	11.7	21.6	0.21	0.03	7.0			<1	0.23	

REMARKS:

Pedon 14. TRAILHEAD CLAY LOAM
S-83-CA-12-01

Classification: Orthoxic Palehumult, clayey, oxidic, isomesic

Location: Humboldt County, California; Redwood National Park; 500 feet WNW of trailhead to Tall Trees Grove from C-Line Road, Redwood National Park; southeast quarter, southwest quarter, Section 31, T. 10 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP Sampled by: JHP, JL File number: JHP-80 Photo number: 1:12000 RNP-78 6-20

Parent material: Schist residuum and terrace remnants derived from sandstone, schist and quartzite. Physiographic position: Midslope bench on divide in mountains at 274 m (900 ft.) elevation.

Relief: Convex, south-facing slope of 25 percent gradient with hummocky micro-relief.

Hydrology: Well drained; medium runoff; moderately slow permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), tanoak (*Lithocarpus densiflorus*) and western hemlock (*Tsuga heterophylla*); shrub layer includes black huckleberry (*Vaccinium ovatum*), rhododendron (*Rhododendron macrophyllum*) and Oregon grape (*Mahonia nervosa*).

Colors are for the dry soil unless otherwise stated. When described (January 14, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 2 to 0 cm (1-0 in.); fresh and decomposing conifer needles, tanoak leaves and twigs; about 25 percent cover of surface pebbles.

A -- 0 to 11 cm (0-4 in.); brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/3) moist; common, fine, rounded, yellowish red (5YR 5/6) ferrans; moderate medium, subangular blocky, parting to moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, many fine, and common medium roots; common very fine interstitial and common very fine and fine tubular pores; about 3 percent rounded to subangular pebbles; slightly acid (pH 6.5); clear wavy boundary.

AB -- 11 to 28 cm (4-11 in.); reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist, common, fine, rounded yellowish red (5YR 5/6) ferrans; moderate medium subangular blocky, parting to moderate fine subangular blocky structure; slightly hard, friable, sticky, plastic; common fine and medium, and few coarse roots; common very fine interstitial and common very fine and fine tubular pores; about 2 percent pebbles; slightly acid (pH 6.5); gradual wavy boundary.

BAt1 -- 28 to 66 cm (11-26 in.); reddish brown (5YR 5/6) clay loam, reddish brown (5YR 4/6) moist; weak coarse subangular blocky, parting to weak medium subangular blocky structure; slightly hard, slightly firm, sticky and plastic; common fine, medium and coarse roots; few very fine, fine and medium tubular pores; few faint to distinct clay films in pores and on ped faces; less than 2 percent pebbles; medium acid (pH 6.0); diffuse smooth boundary.

Bt1 -- 66 to 90 cm (26-35 in.); reddish brown (5YR 5/6) clay, reddish brown (5YR 4/6) moist; weak very coarse subangular blocky, parting to weak medium subangular blocky structure; hard, firm, sticky, very plastic; common fine, medium and coarse roots; few very fine and fine tubular pores; few distinct clay films in pores and on ped faces; less than 2 percent pebbles; medium acid (pH 6.0); diffuse smooth boundary.

Bt2 -- 90 to 165 cm (35-64 in.); reddish brown (5YR 5/6) clay, red (2.5YR 4/6) moist; weak very coarse subangular blocky structure; hard, firm, sticky, very plastic; common fine and medium and few coarse roots; few very fine and fine tubular pores; common distinct clay films in pores and few distinct clay films on ped faces; less than 2 percent pebbles; pH indicator fades; diffuse smooth boundary.

Bt3 -- 165 to 200 cm (64-78 in.); reddish brown (5YR 5/6) clay, red (2.5YR 4/6) moist; weak very coarse subangular blocky structure; hard, firm, sticky, very plastic; few fine and medium roots; few very fine and fine tubular pores; common distinct clay films in pores and on ped faces; about 10 percent pebbles; pH indicator fades.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Trailhead

Taxonomic Class: Clayey, oxidic, isomesic Orthoxic Palehumult

Sample Number: S83-CA-12-01

Location: 500 ft. WNW of trailhead to Tall Trees Grove; SE 1/4, SW 1/4, S.31, T.10N., R.2E.

Pedon Number: 14

Lab Numbers: 71231-71236

Date Sampled: 22 Jun 83

Analyst: CZ, MKA, PG, NKS

Analytical Lab: OSU, HSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A	0	11	1.5	8.7	3.7	0.7	3.1	6.1	22.3	50.0	27.7	sicl	1.22	30.0	19.7	10.3
AB	11	28	1.3	4.8	2.7	0.8	2.6	5.5	16.4	49.2	34.4	sicl	1.27	29.9	19.5	10.4
BAt	28	66	0.9	2.5	2.3	0.5	3.1	6.5	14.9	43.8	41.3	sic	1.45	27.1	21.2	5.9
Bt1	66	90	0.7	2.4	1.6	0.0	3.1	4.2	11.3	40.3	48.4	sic	1.60	27.4	18.5	8.9
Bt2	90	165	0.8	0.9	1.1	0.0	2.6	4.0	8.6	36.8	54.6	c	1.60	27.5	18.0	9.5
Bt3	165	200	10.0	3.2	1.5	0.1	0.2	6.3	11.3	38.4	50.3	c				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/ 100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	11	6.0	6.1	1.00	0.08	0.61	12.0	64.9	5.57	0.16	34.8	7.36	0.21	5	0.43	0.71
AB	11	28	5.8	2.1	0.54	0.08	0.40	14.7	21.2	3.25	0.08	40.6	6.93	0.17	3	0.43	0.57
BAt	28	66	5.6	1.3	0.52	0.09	0.18	11.3	18.5	1.16	0.04	29.0	6.33	0.22	3	0.27	0.51
Bt1	66	90	5.7	2.2	0.91	0.06	0.16	9.9	33.6	0.44	0.03	14.7	1.68	0.11	1	0.20	0.38
Bt2	90	165	5.7	2.8	1.20	0.10	0.16	11.4	37.4	0.27	0.03	9.0	3.21	0.36	1	0.21	0.33
Bt3	165	200	5.6	2.2	0.86	0.11	0.09	11.8	27.6	0.30	0.02	15.0			1	0.23	

REMARKS: This is the typifying pedon for the Trailhead series.

Soil series: Trailhead

Classification: Clayey, oxidic, isomesic Orthoxic Palehumult

Sample number: S83-CA-12-01

General Methods: 1B1A, 2A1, 2B

Location: 500 ft. WNW of trailhead to Tall Trees Grove; SE 1/4, SW 1/4, S. 31, T. 10., R. 2E.

Redwood National Park
Humboldt County, California

Lab No. 83T7731-7733
Pedon No. 83T 102
Project No. 83T 102
Sampled: 22 Jun 83
Reported: 27 Dec 83

U.S. Department of Argiculture
Soil Conservation Service
National Soil Survey Laboratory
Lincoln, Nebraska 68508

Sample No.	Hzn No.	Depth (cm)	Horizon	Particle size distribution (wt. <2mm)										Total Wt. >2mm Coarse fraction
				TOTAL			SILT		SAND					
				Clay < .002	Silt .002 -.05	Sand .05 -2	FSI .002 -.02	COSI .02 -.05	VFS .05 -.10	FS .10 -.25	MS .25 -.50	CS .5 -1	VCS 1 -2	
837731	1	28-66	BAt1	39.0	44.4	16.6	28.5	15.9	4.8	3.2	2.5	3.0	3.1	8
837732	2	66-90	BAt2	45.5	41.1	13.4	26.9	14.2	3.8	2.3	1.9	2.2	3.2	7
837733	3	90-165	Bt1	50.5	38.3	11.2	25.6	12.7	3.8	1.9	1.5	1.8	2.2	5

Sample No.	Hzn No.	Depth (cm)	Horizon	Percent wt. in <2mm				Ratio/clay			pH	
				Organic Carbon 6A1C	15-bar Water 4B2A	Dith-cit. extractable Fe 6C2B	Dith-cit. extractable Al 6G7A	CEC 8D1	15-bar Water 8D1	Fe_2O_3 + GI	1:2 .01M $CaCl_2$ 8C1F	1:1 H_2O 8C1F
837731	1	28-66	BAt1	0.89	19.1	4.7	0.9	0.35	0.40	0.272	4.7	5.4
837732	2	66-90	BAt2	0.41	21.4	6.0	1.0	0.19	0.47	0.249	5.1	5.5
837733	3	90-165	Bt1	0.26	23.9	6.4	1.0	0.19	0.47	0.252	5.0	5.6

Sample No.	Hzn No.	Depth (cm)	Horizon	meq/100g in < 2 mm								Percent base saturation	
				NH4OAc extractable bases						CEC			
				Ca 5B5A 6N2E	Mg 5B5A 6O2D	Na 5B5A 6P2B	K 5B5A 6Q2B	Sum bases	Acidity 6H5A	Sum of cations 5A3A	NH_4-OAc 5A8B	Sum of cations 5C3	NH_4-OAc 5C1
837731	1	28-66	BAt1	1.1	0.5	0.1	0.3	2.0	13.9	15.9	13.5	13	15
837732	2	66-90	BAt2	1.6	0.7	0.1	0.2	2.6	12.1	14.7	8.5	18	31
837733	3	90-165	Bt1	2.0	1.0	0.1	0.2	3.3	12.9	16.2	9.7	20	34

Soil series: Trailhead

Classification: Clayey, oxidic, isomesic Orthoxic Palehumult

Sample number: S83-CA-12-01

Location: 500 ft. WNW of trailhead to Tall Trees Grove; SE 1/4, NE 1/4, S. 31, T. 10N., R. 2E.

Redwood National Park
Humboldt County, California

Lab No. 83T7731-7733
Pedon No. 83T 102
Project No. 83T 102
Sampled: 22 Jun 83
Reported: 27 Dec 83

U.S. Department of Argiculture
Soil Conservation Service
National Soil Survey Laboratory
Lincoln, Nebraska 68508

RT84CA015

Sample No.	Hzn No.	COARSE SILT FRACTION .02-.05 mm Optical mineralogy 7B1A Percentages										CLAY MINERALOGY <.002 mm X-ray 7A2I Relative amounts				DTA 7A3 Percent		TOTAL ANALYSIS <.002 mm clay Percent	
		RE 7B1A Percent																K_2O 6Q3A	Fe 6C7A
83T7731	1	90	QZ77	RA12	FP 6	GS 1	MS 1	OP 1	BT 1	FK<1	PR<1	VR 3	GI 2	KK 1	CL 1	GI10	KK 7	0.4	10.9
83T7732	2	91	QZ81	RA 7	FP 6	OP 3	PR 1	MS 1	BT 1	GA<1	GS<1	VR 3	GI 2	KK 1	CL 1	GI16	KK 6	0.2	11.6
83T7733	3	93	QZ83	RA 8	FK 4	OP 2	FP 2	BT 1	TM<1	HN<1	GS<1	VR 3	GI 2	KK 1	CL 1	GI17	KK11	0.3	11.9

MINERALOGY: RE = Resistant

KIND OF MINERAL: GI = Gibbsite OP = Opaques QZ = Quartz RA = Resistant Aggregates BT = Biotite CL = Chlorite FK = Potassium feldspar FP = Plagioclase feldspar GS = Glass MS = Muscovite PR = Pyroxene VR = Vermiculite KK = Kaolinite GA = Glass Aggregates TM = Tourmaline HN = Horneblende

RELATIVE AMOUNT: 5 Dominant 4 Abundant 3 Moderate 2 Small 1 Trace

MINERALOGY BASED ON SAND/SILT: Siliceous

MINERALOGY BASED ON CLAY: Mixed

FAMILY PLACEMENT: Oxidic

Pedon 15.
81-RNP-74 through -79

Classification: Ultic Hapludalf, fine-loamy, mixed, mesic

Location: Humboldt County, California; Redwood National Park; Cutbank near headwaters of north fork, Slide Creek, 20 feet south of Counts Hill prairie; southwest quarter, northeast quarter, section 10, T. 9 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP Sampled by: JHP File number: JHP-71 Photo number: 1:12000 RNP-78 8-46

Parent material: Sheared sandstone and shale. Physiographic position: Upper mountain slope at 886 m (2250 ft.) elevation.

Relief: Convex west-facing slope of 45 percent gradient.

Hydrology: Well drained; medium runoff; moderately slow permeability; groundwater observed seeping from cutbank at depth of 172 cm.

Vegetation: Oak woodland; Oregon white oak (*Quercus garryana*), dogtail (*Cynosurus echinatus*), western wildrye (*Elymus glaucus*), western buttercup (*Ranunculus occidentalis*) and California fescue (*Festuca californica*).

Colors are for the dry soil unless otherwise stated. When described (May 5, 1981) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 10 cm (0-4 in.); grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; friable, sticky, slightly plastic; many very fine, common fine roots; many fine interstitial and common fine and medium tubular pores; about 8 percent small pebbles; slightly acid (pH 6.5); abrupt irregular boundary.

AB -- 10 to 18 cm (4-7 in.); grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; firm, sticky, plastic; common very fine, fine and medium roots; common fine interstitial, and common fine and medium tubular pores; about 5 percent small pebbles; slightly acid (pH 6.5); clear wavy boundary.

Bt1 -- 18 to 40 cm (7-16 in.); grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular block structure; firm, sticky, plastic; many fine and medium, and common very fine and coarse roots; common fine and medium, and few coarse tubular pores; few faint clay films in pores and on faces of peds; about 8 percent pebbles; medium acid (pH 6.0); gradual wavy boundary.

2Bt2 -- 40 to 88 cm (16-35 in.); light brownish gray (10YR 6/2) very gravelly clay loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; firm, sticky, plastic; common fine, medium and coarse roots; few fine and medium tubular pores; 20 percent pebbles, 15 percent cobbles; medium acid (pH 6.0); clear wavy boundary.

2C1 -- 88 to 120 cm (35-47 in.); pale brown (10YR 6/3) gravelly clay loam, brown (10YR 5/3) moist; massive; firm, sticky, plastic; few fine, medium and coarse roots; few fine tubular pores; 25 percent pebbles; strongly acid (pH 5.5); diffuse smooth boundary.

2C2 -- 120 to 172 cm (47-68 in.); pale brown (10YR 6/3) extremely gravelly sandy clay loam, brown (10YR 5/3) moist; massive; firm, sticky, very plastic; few fine, medium and coarse roots; few fine tubular pores; about 75 percent pebbles; strongly acid (pH 5.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine-loamy, mixed, mesic Ultic Hapludalf

Location: Near headwaters, N. fork of Slide Creek; SW 1/4, NE 1/4, S.10, T.9N., R.2E.

Date Sampled: 5 Nov 81

Analyst: CZ

Pedon Number: 15

Sample Number: 81-RNP-74 through 81-RNP-79

Lab Numbers: 64709-64714

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	10	6.3	9.9	1.9	0.10	0.76	18.7	67.7	4.12	0.24	17.2	59	5.21	0.40
AB	10	18	5.9	5.9	1.7	0.10	0.72	14.7	57.3	2.61	0.18	14.5	53	3.47	0.42
Bt	18	40	5.7	4.1	1.5	0.15	0.58	13.2	48.0	1.80	0.15	12.0	44	2.73	0.39
2Bt	40	88	5.7	3.7	1.9	0.39	0.34	12.2	51.9	1.16	0.11	10.5	10	1.95	0.18
2C1	88	120	5.7	3.4	2.7	0.10	0.24	13.0	49.5	0.64	0.08	8.0	15	1.26	0.09
2C2	120	172	5.6	3.5	2.6	0.10	0.26	15.2	42.5	0.57	0.08	7.1	20	1.35	0.10

REMARKS:

Pedon 16.
83-RNP-10, 84-RNP-9

Classification: Ultic Hapludalf, fine, mixed, mesic

Location: Humboldt County, California; Redwood National Park; Upper Copper Creek sub-basin; northeast quarter, southeast quarter, section 24, T. 9 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JL, KAP Sampled by: JL, KAP, JHP File number: KAP-2 Photo number: 1:12000 RNP-78 10-50

Parent material: Graywacke sandstone and metagraywacke. Physiographic position: Middle mountain slope at 747 m (2450 ft.) elevation.

Relief: Uniform west-facing slope of 40 percent gradient.

Hydrology: Somewhat poorly drained; medium runoff; moderately slow permeability; groundwater observed at depth of 116 cm. Bottom of soil pit filled with water after July 1 rain and remained full 11 days. It was bailed out on July 12 and had not re-filled again on July 22.

Vegetation: Oak woodland with dense, small-diameter trees; trees are Oregon white oak (*Quercus garryana*) and a few California bay (*Umbellularia californica*); shrubs include poison oak (*Toxicodendron diversilobum*), snowberry (*Symphoricarpos mollis*) and Sierra gooseberry (*Ribes roezlii*); forbs include yerba buena (*Satureja douglasii*), strawberry (*Fragaria vesca*), vetch (*Vicia sp.*), firecracker plant (*Brodiaea ida-maia*), bedstraw (*Galium aparine*), soap plant (*Chlorogalum pomeridianum*), snakeroot (*Sanicula crassicaulis*), celery-leaved lovage (*Ligusticum apiifolium*), common yarrow (*Achillea millefolium*), mountain sweet-cicely (*Osmorhiza chilensis*), hairy cat's ear (*Hypochoeris radicata*), westen columbine (*Aquilegia formosa*), gumweed (*Madia gracilis*) and rein orchid (*Habenaria elegans*); grasses include dogtail (*Cynosurus echinatus*), large mountain brome (*Bromus marginatus*), redtop (*Agrostis alba*), tall oatgrass (*Arrhenatherum elatius*) and orchardgrass (*Dactylis glomerata*).

Colors are for the dry soil unless otherwise stated. When described (July 12, 1983) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 1 to 0 cm (1/2-0 in.); fresh and partially decomposed oak leaves, forbes and grass stems; abrupt wavy boundary.

A1 -- 0 to 20 cm (0-8 in.); grayish brown (2.5Y 5/2) gravelly clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic; many very fine, and few fine and medium roots; many very fine and fine interstitial pores; 8 percent pebbles, 8 percent cobbles; medium acid (pH 6.0); gradual smooth boundary.

A2 -- 20 to 40 cm (8-16 in.); light brownish gray (2.5Y 6/2) gravelly clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate coarse and very coarse subangular blocky structure; friable, slightly sticky, slightly plastic; common very fine, and few fine and medium roots; common very fine interstitial pores; 15 percent pebbles; medium acid (pH 6.0); abrupt irregular boundary.

BAt -- 40 to 72 cm (16-28 in.); pale yellow (2.5Y 7/4) gravelly clay loam, light olive brown (2.5Y 5/4) moist; moderate coarse and very coarse subangular block structure; sticky, plastic; few very fine, fine and medium roots; few very fine interstitial pores; many faint clay films on faces of peds and in pores; 15 percent pebbles, 3 percent cobbles; strongly acid (pH 5.5); gradual smooth boundary.

Bt -- 72 to 98 cm (28-39 in.); pale yellow (2.5Y 7/4) gravelly clay, light olive brown (2.5Y 5/4) moist; common fine prominent yellowish brown (10YR 5/8) mottles, strong brown (7.5YR 5/8) moist; weak coarse and very coarse subangular blocky structure; very sticky, plastic; common medium and coarse, and few very fine and fine roots; few very fine interstitial pores; common faint clay films on faces of peds and in pores; 15 percent pebbles; strongly acid (pH 5.5); clear smooth boundary.

Cg -- 98 to 138 cm (39-54 in.); light gray (10YR 7/1) gravelly silty clay, gray (10YR 5/1) moist; many fine prominent yellowish brown (10YR 5/6) mottles, strong brown (7.5YR 5/8) moist; massive; very sticky, very plastic; few very fine, fine, medium and coarse roots; few very fine intestitial pores; 20 percent pebbles, 2 percent cobbles, rock content increasing with depth; pH indicator fades.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine, mixed, mesic Ultic Hapludalf

Location: Upper Copper Creek basin; NE 1/4, SE 1/4, S 24, T.9N., R.2E.

Pedon Number: 16

Sample Number: 83-RNP-10 (chemical) 84-RNP-9 (physical)

Lab Numbers: 71706-71711

Date Sampled: 27 Jul 83, 11 Jul 84

Analyst: CZ, PG, RM

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A1	0	20	16	6.6	5.4	2.6	3.0	3.8	21.4	51.2	27.4	cobcl		24.1	13.1	11.0
A2	20	40	15	5.9	5.6	2.5	3.2	4.2	21.4	49.1	29.5	gcl		24.6	11.1	13.5
BAt	40	72	18	4.8	3.7	1.9	3.0	4.7	18.1	53.9	28.0	gsicl				
Bt	72	98	15	2.8	2.9	1.7	2.8	4.6	14.8	46.5	38.7	gsicl				
Cg	98	138	22	5.8	5.1	2.3	3.1	4.5	20.8	43.7	35.5	gcl				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A1	0	20	5.2	5.6	1.7	0.12	0.40	18.7	41.8	3.71	0.15	24.7			51	0.68	0.48
A2	20	40	5.4	3.4	1.5	0.11	0.31	15.0	35.5	2.90	0.13	22.3			41	0.51	0.38
BAt	40	72	5.2	1.8	1.4	0.09	0.15	12.5	27.5	0.87	0.06	14.5			3	0.45	
Bt	72	98	5.2	2.0	2.4	0.10	0.16	17.6	26.5	0.75	0.09	8.3			1	0.45	
Cg	98	138	5.2	2.5	4.8	0.12	0.15	20.5	36.9	0.81	0.08	10.1			1	0.58	
	160	165	6.2	5.3	10.5	0.16	0.15	14.0	115.1	0.58	0.06	9.7			4		

REMARKS:

Pedon 17.
83-RNP-9, 86-RNP-8

Classification: Typic Haplumbrept, loamy-skeletal, mixed, mesic

Location: Humboldt County, California; Redwood National Park; 600 feet northwest of gate between Lyons Ranch and Bald Hills road; southwest quarter, southeast quarter, section 24, T. 9 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JL, JHP, NKS Sampled by: JHP, NKS File number: JL-34 Photo number: 1:12000 RNP-78 10-50

Parent material: Sandstone and mudstone. Physiographic position: Upper mountain slope at 747 m (2450 ft.) elevation.

Relief: Convex northwest-facing slope of 27 percent gradient.

Hydrology: Moderately well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Oak woodland; Oregon white oak (*Quercus garryana*), dogtail (*Cynosurus echinatus*), western wildrye (*Elymus glaucus*), tall oatgrass (*Arrhenatherum elatius*), orchardgrass (*Dactylis glomerata*), velvet grass (*Holcus lanatus*), redtop (*Agrostis alba*), wild cucumber (*Marah oreganus*), celery-leaved lovage (*Ligusticum apiifolium*), bedstraw (*Galium aparine*), Andrew beadlily (*Clintonia andrewsiana*), sheep sorrel (*Rumex acetosella*), firecracker plant (*Brodiaea ida-maia*), mountain sweet-cicely (*Osmorhiza chilensis*), white brodiaea (*Brodiaea hyacinthina*), western swordfern (*Polystichum munitum*).

Colors are for the dry soil unless otherwise stated. When described (August 11,1986) the soil was dry to about 50 cm depth, and moist below 50 cm. Field reaction was determined by Truog (Triplex indicator) method.

O -- 1 to 0 cm (1/2-0 in.); decomposing oak leaves and twigs.

A1 -- 0 to 28 cm (0-11 in.); dark gray (10YR 4/1) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky, parting to weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine, common fine, medium and coarse roots; many very fine and fine interstitial and many very fine tubular pores; 8 percent pebbles; strongly acid (pH 5.5); gradual smooth boundary.

A2 -- 28 to 45 cm (11-18 in.); grayish brown (10YR 5/2) extremely cobbly loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine, and few medium roots; many very fine tubular, and common very fine interstitial pores; 20 percent pebbles, 60 percent cobbles; strongly acid (pH 5.5); abrupt wavy boundary.

Bw -- 45 to 72 cm (18-28 in.); light yellowish brown (2.5Y 6/4) extremely cobbly clay loam, olive brown (2.5Y 4/4) moist; weak coarse and very coarse subangular block structure; soft, very friable, slightly sticky, slightly plastic; few very fine, fine, medium and coarse roots; common very fine tubular and interstitial pores; 20 percent pebbles and 50 percent cobbles; strongly acid (pH 5.5); clear wavy boundary.

BC -- 72 to 112 cm (28-44 in.); light yellowish brown (2.5Y 6/4) extremely cobbly clay loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, sticky, slightly plastic; common very fine and fine, few medium and coarse roots; common and fine and few medium tubular, and common very fine interstitial pores; 22 percent pebbles, 50 percent cobbles; very strongly acid (pH 5.0); clear wavy boundary.

Cg -- 112 to 160 cm (44-63 in.); light gray (5Y 7/1) very gravelly silty clay loam, gray (N 6/) moist; many fine and medium distinct strong brown (7.5YR 5/8) mottles, strong brown (7.5YR 5/8) moist; massive; hard, firm, slightly sticky, plastic; common very fine and fine, few medium and coarse roots; common very fine and fine, few medium and coarse tubular pores; 50 percent pebbles; very strongly acid (pH 4.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Loamy-skeletal, mixed, mesic Typic Haplumbrept

Sample Number: 83-RNP-9, 86-RNP-8

Location: 600 ft. NW of Lyons Ranch/Bald Hills Road gate; SW 1/4, SE 1/4, S.24, T. 9 N., R. 2 E.

Pedon Number: 17

Lab Numbers: 71712-71714

Date Sampled: 5 Jul 83, 11 Aug 86

Analyst: CZ, NKS

Analytical Lab: OSU, HSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A1	0	28	9.2										1.00	37.3	22.5	14.8
A2	28	45	72.7										1.16	38.5	17.0	21.5
Bw	45	72	58.2										1.28	34.2	15.6	18.6
BC	72	112	85.4										1.35	22.5	13.4	9.1
Cg	112	160	55.5										1.50	25.5	12.0	13.5

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A1	0	28	5.4	3.5	1.30	0.08	0.45	22.8	23.4	5.34	0.36	14.8	13.58	0.92	6		
A2	28	45	5.3	0.6	0.33	0.07	0.26	14.7	8.6	3.71	0.25	14.8	2.00	0.13	3		
Bw	45	72	5.4	0.7	0.41	0.06	0.19	11.4	11.9	1.80	0.15	12.0	2.60	0.22	6		
BC	72	112	5.4	0.7	0.59	0.11	0.30	12.4	13.7	1.27	0.11	11.5	1.00	0.09	13		
Cg	112	160	5.2	1.3	3.60	0.21	0.12	17.8	29.4	0.72	0.07	10.3	2.31	0.22	11		

REMARKS:

Pedon 18.
82-RNP-2, 83-RNP-7, S-82-12-01X

Classification: Typic Xerumbrept, fine-loamy, mixed, mesic

Location: Humboldt County, California; Redwood National Park; Elk Camp prairie, 1690 feet southwest of junction between Bald Hills road and former W-Line, 2475 feet west of driveway to house; southeast quarter, northwest quarter, section 29, T. 10N., R. 2E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP, JL, RWM Sampled by: JHP, JL File number: JL-3 Photo number: 1:12000 RNP-78 8-50

Parent material: Earthflow colluvium from sedimentary and metasedimentary rocks.

Physiographic position: Foot of slump-earthflow on upper mountain slope at 610 m (2000 ft.) elevation.

Relief: Convex, southwest-facing slope of 20 percent gradient, with hummocky microrelief.

Hydrology: Somewhat poorly drained; medium runoff; moderately slow permeability; groundwater observed at depth of 175 cm (69 in.).

Vegetation: Prairie; species identified were tall oatgrass (*Arrhenatherum elatius*), soft chess (*Bromus mollis*), dogtail (*Cynosurus echinatus*), velvet grass (*Holcus lanatus*), Kentucky bluegrass (*Poa pratensis*), California oatgrass (*Danthonia californica*), sweet vernal grass (*Anthoxanthum odoratum*), six-weeks fescue (*Vulpia bromoides*), woodrush (*Luzula comosa*), plantain (*Plantago lanceolata*), western buttercup (*Ranunculus occidentalis*), hairy cat's ear (*Hypochoeris radicata*), thistle (*Cirsium* sp.), bracken fern (*Pteridium aquilinum*), sheep sorrel (*Rumex acetosella*), clover (*Trifolium* sp.), trefoil (*Lotus micranthus*), English daisy (*Bellis perennis*), blue dicks (*Brodiaea pulchella*), common yarrow (*Achillea millefolium*), narrow-leaved flax (*Linum bienne*) and mouse-ear chickweed (*Cerastium tomentosum*). Species list combines lists by JHP, JL on May 1, 1982 and by RWM on July 6, 1982.

Colors are for the dry soil unless otherwise stated. When described (May 1, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A1 -- 0 to 12 cm (0-5 in.); grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; friable, slightly sticky, slightly plastic; many very fine and few fine roots; many very fine interstitial, and common very fine and fine tubular pores; 3 percent pebbles; strongly acid (pH 5.5); clear wavy boundary.

A2 -- 12 to 42 cm (5-16 in.); grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; friable, sticky, plastic; common very fine roots; common very fine interstitial, and common very fine, fine and medium tubular pores; 10 percent pebbles, 3 percent cobbles; strongly acid (pH 5.5); clear wavy boundary.

Bt1 -- 42 to 58 cm (16-23 in.); mixed brown (10YR 5/3) and light yellowish brown (10YR 6/4) clay loam, dark brown (10YR 3/3) and dark yellowish brown (10YR 4/4) moist; moderate coarse subangular blocky structure; friable, sticky, plastic; few very fine roots; common very fine and fine tubular pores; 10 percent pebbles, 5 percent cobbles; strongly acid (pH 5.5); clear wavy boundary.

Bt2 -- 58 to 75 cm (23-29 in.); pale brown (10YR 6/3) clay, olive brown (2.5Y 3/3) moist; common fine prominent yellow (10YR 7/6) mottles, strong brown (7.5YR 5/6) moist; weak coarse and very coarse subangular blocky structure; firm, sticky, plastic; few very fine roots; few very fine and fine tubular pores; very few faint clay films lining pores; 10 percent pebbles; very strongly acid (pH 5.0); clear wavy boundary.

Cg1 -- 75 to 116 cm (29-45 in.); gray (N 5/) clay, gray (5Y 5/1) moist; many medium prominent brownish yellow (10YR 6/6) mottles, strong brown (7.5 YR 5/8) moist; massive; firm, sticky, plastic; few very fine roots; few very fine tubular pores; few faint clay films lining pores; 12 percent pebbles; very strongly acid (pH 5.0); gradual wavy boundary.

Cg2 -- 116 to 170 cm (45-66 in.); gray (N 5/) cobbly clay; gray (5YR 5/1) moist; many medium prominent brownish yellow (10YR 6/6) mottles, (10YR 5/8) moist; massive; firm, sticky, plastic; few very fine roots; few very fine tubular pores; common distinct gray (N 5/) clay films lining pores; 10 percent pebbles; 10 percent cobbles; strongly acid (pH 5.5).

Cg3 -- 170 to 190 cm (66-74 in.); gray (N 5/) clay loam, dark gray (5Y 4/1) moist; many medium prominent brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/8) moist; massive; firm, sticky, plastic; medium acid (pH 6.0).

Cg4 -- 190 to 216 cm (74-84 in.); gray (N 5/) clay loam; dark gray (5Y 4/1) moist; many medium prominent brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/8); massive; firm, sticky, plastic; neutral (pH 7.0).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Location: 1690 ft. SW of W-Line/Bald Hills Rd. junction; SE 1/4, NW 1/4, S.29, T.10N., R.2E.

Date Sampled: 10 May 82, 23 June 83

Taxonomic Class: Fine-loamy, mixed, mesic Typic Xerumbrept

Analyst: CZ, MKA, MAM, TC, WRA

Pedon Number: 18

Sample Number: 82-RNP-2, S-82-CA-12-01X, 83-RNP-7

Lab Numbers: 66522-66528 (OSU) 1552 (UCD)

Analytical Lab: OSU, UCD

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A1	0	12	3	4.6	3.7	0.1	4.7	9.2	22.3	48.8	28.9	cl				
A2	12	42	13	3.9	3.2	1.3	4.2	6.6	19.2	47.6	33.2	sicl				
Bt1	42	58	15	3.7	2.9	1.8	1.3	10.7	20.4	51.7	27.9	gcl				
Bt2	58	75	10	3.9	2.9	1.2	0.3	12.5	20.8	48.2	31.0	cl				
Cg1	75	116	12	9.2	6.5	3.0	0.0	12.1	30.8	42.1	27.1	cl				
Cg2	116	170	20	3.8	5.3	3.0	1.3	12.3	25.7	50.0	24.3	l				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A	0	42	5.6	4.4	2.4	0.09	0.25	18.3	39.0	3.19	0.24	13.3			1	0.57	
Bt1	42	58	5.7	3.2	2.2	0.13	0.11	13.7	41.2	0.50	0.08	6.3			1	0.41	
Bt2	58	75	5.7	3.8	2.9	0.31	0.13	16.6	43.0	0.38	0.09	4.2			1	0.59	
Cg1	75	116	5.7	4.2	3.5	0.27	0.12	18.5	43.7	0.26	0.09	2.9			1	0.60	
Cg2	116	170	5.9	7.3	5.4	0.28	0.12	18.9	69.3							0.70	
Cg3	170	190	6.3	10.4	6.5	0.24	0.10	14.4	119.7								
Cg4	190	216	6.8	12.6	6.8	0.22	0.08	12.7	155.1								

REMARKS: Minerals in clay fraction were analyzed for horizons from 58-116 cm at UCD. Minerals present by X-ray diffraction included mica, vermiculite, chlorite, mica-vermiculite, and vermiculite-chlorite intergrades.

Pedon 19.
83-RNP-17

Classification: Pachic Xerumbrept, fine-loamy, mixed, mesic

Location: Humboldt County, California; Redwood National Park; ridgetop in Counts Hill prairie; northeast quarter, northwest quarter, section 10, T. 9N., R. 2E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP Sampled by: JHP File number: JHP-113 Photo number: 1:12000 RNP-78 9-48

Parent material: Sandy siltstone. Physiographic position: Broadly rounded ridgetop at 731 m (2400 ft.) elevation.

Relief: Gently convex, southwest-facing slope of 13 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Prairie; species identified were dogtail (*Cynosurus echinatus*) and sheep sorrel (*Rumex acetosella*).

Colors are for the dry soil unless otherwise stated. When described (October 21, 1983) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A1 -- 0 to 19 cm (0 - 7 1/2 in.); dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular and weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, common medium roots; common very fine interstitial and common very fine and fine tubular pores; 3 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

A2 -- 19 to 52 cm (7 1/2 - 20 1/2 in.); dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common very fine and fine, few medium roots; common very fine, fine and medium tubular pores; 5 percent pebbles; strongly acid (pH 5.5); abrupt irregular boundary.

AC -- 52 to 72 cm (20 1/2 - 28 in.); brown (10YR 5/3) and light olive brown (2.5Y 5/4) variegated very gravelly loam, dark yellowish brown (10YR 3/4) olive brown moist; massive; soft, very friable, slightly sticky, slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; 35 percent pebbles, 15 percent cobbles; strongly acid (pH 5.5); abrupt, wavy boundary.

Cr -- 72 to 91 cm (28 - 36 in.); saprolitic sandy siltstone, easily dug and crushable in one hand; original rock macrostructure still intact throughout; becomes harder at about 90 cm (35 in.); depth to Cr ranges from 62 to 87 cm (24-34 in.) across pit face.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine-loamy, mixed, mesic Pachic Xerumbrept

Sample Number: 83-RNP-17

Location: Upper Counts Hill Prairie; NE 1/4, NW 1/4, S 10, T.9N, R.2E

Pedon Number: 19

Lab Numbers: 74310-74312

Date Sampled: 21 Oct 83

Analyst: CZ, PG, RM

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A1	0	19	3	12.7	9.8	5.9	6.7	4.4	39.5	39.3	21.2	l		37.4	13.5	23.9
A2	19	52	5	9.8	7.7	4.7	6.1	5.5	33.8	43.5	22.7	l		37.5	15.4	22.1
AC	52	72	50	10.3	9.1	3.9	3.8	3.4	30.5	44.5	25.0	vgl		33.3	11.8	21.5

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A1	0	19	5.2	2.7	0.88	0.14	0.39	30.0	13.7	8.41	0.54	15.6			111	1.42	0.64
A2	19	52	5.3	1.5	0.46	0.08	0.35	20.3	11.8	5.51	0.32	17.2			41	0.89	0.68
AC	52	72	5.4	1.1	0.37	0.09	0.34	16.6	11.4	3.83	0.25	15.3			23	0.66	0.47

REMARKS:

Pedon 20.
82-RNP-1

Classification: Pachic Xerumbrept, fine, mixed, mesic

Location: Humboldt County, California; Redwood National Park; Elk Camp prairie, 1750 feet southwest of junction between W-Line and Bald Hills roads, 3000 feet northwest of driveway to house; southeast quarter, southwest quarter, section 29, T. 10 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JL, JHP, RWM Sampled by: JL, JHP File number: JL-2 Photo number: 1:12000 RNP-78 8-50

Parent material: Sandstone, siltstone and shale. Physiographic position: Small swale in upper mountain slope at 607 m (2000 ft.) elevation.

Relief: Concave, southeast-facing slope of 21 percent gradient; hummocky microrelief.

Hydrology: Well drained; medium runoff; moderately slow permeability; groundwater observed at depth of 259 cm.

Vegetation: Prairie; species identified include dogtail (*Cynosurus echinatus*), orchardgrass (*Dactylis glomerata*), tall oatgrass (*Arrhenatherum elatius*), soft chess (*Bromus mollis*), sweet vernal grass (*Anthoxanthum odoratum*), six-weeks fescue (*Vulpia bromoides*), California oatgrass (*Danthonia californica*), plantain (*Plantago lanceolata*), western buttercup (*Ranunculus occidentalis*), bracken fern (*Pteridium aquilinum*), common yarrow (*Achillea millefolium*), California harebell (*Campanula prenanthoides*), mouse-ear chickweed (*Cerastium viscosum*), sheep sorrel (*Rumex acetocella*), hairy cat's ear (*Hypochoeris radicata*), thistle (*Cirsium* sp.), narrow-leaved flax (*Linum bienne*), blue-eyed grass (*Sysyrinchium bellum*) and shamrock (*Trifolium dubium*). Species list combines lists by JHP, JL on May 10, 1982 with list by RWM on July 6, 1982.

Colors are for the dry soil unless otherwise stated. When described (May 10, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 22 cm (0-9 in.); dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular and coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine roots; common very fine and fine interstitial pores; less than 5 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

ABt -- 22 to 73 cm (9-29 in.); dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; friable, sticky, slightly plastic; common very fine roots; common very fine interstitial and tubular pores; few faint clay films on faces of peds; less than 5 percent pebbles; medium acid (pH 6.0); diffuse wavy boundary.

BAt -- 73 to 108 cm (29-43 in.); grayish brown (2.5Y 5/2) clay, dark brown (10YR 3/3) moist; moderate very coarse subangular blocky structure; friable, sticky, plastic; few very fine roots; common very fine tubular and few very fine interstitial pores; few distinct clay films on faces of peds; less than 5 percent pebbles; medium acid (pH 6.0); diffuse wavy boundary.

Bt -- 108 to 175 cm (43-69 in.); light grayish brown (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; moderate very coarse subangular blocky structure; firm, sticky, plastic; few very fine roots; common very fine tubular pores; few faint clay films on faces of peds; less than 5 percent pebbles; medium acid (pH 6.0).

C1 -- 175 to 210 cm (69-83 in.); light grayish brown (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; common fine prominent reddish yellow (7.5YR 6/8) mottles, strong brown (7.5YR 4/8) moist; massive; firm, sticky, plastic; few very fine tubular pores; less than 5 percent pebbles; medium acid (pH 6.0).

C2 -- 210 to 243 cm (83-96 in.); light gray (2.5Y 7/3) clay, light olive brown (2.5Y 5/4) moist; many coarse prominent reddish yellow (7.5YR 7/8) mottles, strong brown (7.5YR 5/8) moist; massive; firm, sticky, plastic; few very fine tubular pores; less than 5 percent pebbles; medium acid (pH 6.0).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine, mixed, mesic Pachic Xerumbrept

Sample Number: 82-RNP-1

Location: 1750 ft. SW of W-Line/Bald Hills Rd. junction; SE 1/4, SW 1/4, S.29, T.10N., R.2E.

Pedon Number: 20

Lab Numbers: 66516-66521

Date Sampled: 10 May 82

Analyst: CZ

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	22	5.4	5.0	1.6	0.09	0.19	20.1	34.2	4.23	0.30	14.1	4	3.13	0.12
ABt	22	73	5.7	6.6	2.0	0.12	0.10	19.2	45.9	4.23	0.20	21.2	4	3.30	0.05
BAt	73	108	5.9	5.4	1.6	0.13	0.10	15.5	46.6	1.39	0.12	11.6	1	3.38	0.06
Bt	108	175	6.0	5.0	1.6	0.12	0.08	11.8	57.6	0.93				3.13	0.05
C1	175	210	6.1	5.0	1.7	0.13	0.09	11.4	60.7	0.56				2.94	0.05
C2	210	243	6.1	5.7	2.0	0.13	0.10	12.8	62.0					2.85	0.05

REMARKS: Clay increase was judged too gradual to meet requirements of an argillic horizon.

Pedon 21.
P-11, 83-RNP-6

Classification: Xeric Palehumult, fine-loamy, mixed, mesic

Location: Humboldt County, California; Redwood National Park; Dolason prairie; 300 feet southwest of K&K road, 1.7 miles south of junction between K&K and Bald Hills roads; southwest quarter, northeast quarter, section 4, T. 9N., R. 2E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: BRG Sampled by: BRG, JL, JHP File number: P-11 Photo number: 1:12000 RNP-78 8-48

Parent material: Graywacke sandstone and siltstone. Physiographic position: Mountain midslope bench at 689 m (2260 ft.) elevation.

Relief: Gently convex, west-facing slope of 25 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Prairie; species identified were vernal grass (*Anthoxanthum aristatum*), hairy cat's ear (*Hypochoeris radicata*), narrow-leaved flax (*Linum bienne*), sheep sorrel (*Rumex acetosella*) and trefoil (*Lotus micranthus*).

Colors are for the dry soil unless otherwise stated. When described (November 14, 1978) the soil was moist throughout. Field reaction was determined by bromcresol green and chlorphenol red indicators.

A1 -- 0 to 13 cm (0-5 in.); grayish brown (10YR 5/2) loam, dark grayish brown (10YR 3/2) moist; strong very fine and fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and few fine roots; common very fine, fine and medium interstitial, and few coarse tubular pores; intensive gopher activity; very stongly acid (4.7); clear wavy boundary.

A2 -- 13 to 62 cm (5-24 in.); grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and few fine roots; few very fine and fine interstitial, and few fine, medium, and coarse tubular pores; intensive gopher activity; very strongly acid (pH 4.7); diffuse wavy boundary.

BAt -- 62 to 87 cm (24-34 in.); brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; common very fine interstitial, and few very fine, fine, medium and coarse tubular pores; common faint clay films in pores; intensive gopher activity; very strongly acid (pH 4.7); clear irregular boundary.

Bt1 -- 87 to 106 cm (34-42 in.); light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky, and moderate very fine and fine granular structure; slightly hard, friable, sticky, plastic; few very fine roots; common very fine interstitial and medium tubular, and few fine interstitial and tubular pores; many prominent clay films in pores, common distinct to prominent clay films on faces of peds; many krotovinas of A horizon material; very strongly acid (pH 5.0); clear irregular boundary.

2Bt2 -- 106 to 154 cm (42-61 in.); reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate very fine and fine subangular blocky structure; hard, firm, sticky, plastic; few very fine roots; common very fine and few fine interstitial, and few fine and medium tubular pores; many prominent clay films on faces of peds and in pores; several krotovinas of A horizon material; strongly acid (pH 5.2); diffuse wavy boundary.

2Bt3 -- 154 to 222 cm (61-87 in.); reddish yellow (7.5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; massive; hard, firm, sticky, plastic; few very fine roots; common very fine, and few fine interstitial pores; many prominent red (2.5YR 5/6), red (2.5YR 4/6) moist, clay films on faces of peds and in pores; mangans common in parts of horizon; strongly acid (pH 5.2).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine-loamy, mixed, mesic Xeric Palehumult

Location: 300 ft. SW of K&K Road, 1.7 mi. S. of K&K/Bald Hills Rd. junction; SW 1/4, NE 1/4, S.4, T.9N., R.2E.

Date Sampled: 14 NOV 78, 21 Jun 83

Analyst: CZ, MKA, BRG

Pedon Number: 21

Sample Number: P-11 (chemical), 83-RNP-6 (physical)

Lab Numbers: 52835-52840

Analytical Lab: OSU, HSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	% >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	% Moisture Retained 15 bars	% Available Moisture 1/3 to 15 bars
A1	0	13	7	11.1	10.4	4.8	0.6	15.8	42.7	37.4	19.9	l	0.95			
A2	13	62	6	6.0	8.7	5.8	10.1	8.6	39.2	39.5	21.3	l	0.99			
BAt	62	87	5	5.0	5.9	3.6	6.0	5.4	25.9	43.0	31.1	cl	1.04			
Bt1	87	106	18	5.5	5.3	3.3	0.0	11.1	25.2	41.5	33.3	gcl	1.32			
2Bt2	106	154	14	4.6	3.6	2.2	0.0	7.4	17.8	35.7	46.5	c	1.29			
2Bt3	154	222	13										1.22			

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H_2O / clay
A1	0	13	4.9	1.00	0.50	0.30	0.23	30.09	6.7	7.48	0.56	13.4	8.59	0.64	13	1.51	
A2	13	62	4.9	0.33	0.12	0.22	0.08	24.17	3.1	5.09	0.30	17.0	23.21	1.37	8	1.13	
BAt	62	87	5.1	0.28	0.08	0.20	0.05	20.44	3.0	3.51	0.20	17.6	8.67	0.49	6	0.66	
Bt1	87	106	5.1	0.25	0.08	0.17	0.08	14.47	4.0	1.99	0.13	15.3	4.09	0.27	4	0.43	
2Bt2	106	154	5.3	0.48	0.21	0.22	0.07	12.77	7.7	0.21	0.08	2.6	1.12	0.43	2	0.27	
2Bt3	154	222	5.4	0.68	0.33	0.22	0.09	12.11	10.9	0.21	0.06	3.5	1.52	0.43	2		

REMARKS:

Pedon 22. COPPERCREEK VERY GRAVELLY LOAM (taxadjunct)
81-RNP-80 through -84, -129, -130

Classification: Typic Humitropept, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; 375 feet northwest of Maneze barn; southeast quarter, northeast quarter, section 22, T. 9 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: DC, JHP Sampled by: JHP File number: DC-2 Photo number: 1:12000 RNP-78 9-47

Parent material: Graywacke sandstone and siltstone. Physiographic position: Middle mountain slope at 390 m (1280 ft.) elevation.

Relief: Uniform, south-facing slope of 60 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Second-growth redwood forest; tree layer includes Douglas-fir (*Pseudotsuga menziesii*), tanoak (*Lithocarpus densiflorus*), coast redwood (*Sequoia sempervirens*) and big-leaf maple (*Acer macrophyllum*); shrub layer includes tanoak, blueblossom (*Ceanothus thyrsiflorus*) and coyote bush (*Baccharis pilularis* ssp. *consanguinea*).

Colors are for the dry soil unless otherwise stated. When described (November 5, 1981) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A1 -- 0 to 16 cm (0-6 in.); grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine interstitial and common very fine tubular pores; 40 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

A2 -- 16 to 27 cm (6-11 in.); grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine, parting to moderate very fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine interstitial and common very fine tubular pores; 40 percent pebbles; medium acid (pH 6.0); clear wavy boundary.

Bw1 -- 27 to 38 (11-15 in.); light yellowish brown (2.5Y 6/3) gravelly clay loam, brown (10YR 4/3) moist; weak medium, parting to weak fine subangular blocky structure; slightly hard, friable, sticky, plastic; common fine and medium roots; common very fine tubular, and few very fine interstitial pores; 25 percent pebbles; medium acid (pH 6.0); gradual wavy boundary.

Bw2 -- 38 to 69 cm (15-27 in.); light yellowish brown (2.5Y 6/3) gravelly clay loam, olive brown (2.5Y 4/3) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, sticky, plastic; common fine, medium and coarse roots; common fine tubular, and few very fine interstitial pores; 25 percent pebbles; strongly acid (pH 5.5); gradual smooth boundary.

BC -- 69 to 120 cm (27-47 in.); light brownish gray (2.5Y 6/2) gravelly clay loam, olive brown (2.5Y 4/3) moist; massive; slightly hard, friable, sticky, plastic; common fine, medium and coarse roots; few fine tubular and very fine interstitial pores; 30 percent pebbles; strongly acid (pH 5.5); gradual smooth boundary.

C1 -- 120 to 160 cm (47-63 in.); light brownish gray (2.5Y 6/2) very gravelly clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky, plastic; few fine and medium roots; few very fine tubular pores; 30 percent pebbles, 15 percent cobbles; very strongly acid (pH 5.0); gradual smooth boundary.

C2 -- 160 to 182 cm (63-72 in.); light brownish gray (2.5Y 6/2) very gravelly clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky, plastic; few fine roots; few very fine tubular pores; 35 percent pebbles, 15 percent cobbles; very strongly acid (pH 5.0).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Coppercreek (taxadjunct)

Location: 375 ft. NW of Maneze barn; SE 1/4, NE 1/4, S.22, T.9N., R.2E.

Date Sampled: 5 Nov 81

Taxonomic Class: Fine-loamy, mixed, isomesic Typic Humitropept

Analyst: CZ

Pedon Number: 22

Sample Number: 81-RNP-80 through -84, -129, -130

Lab Numbers: 64715-64719, 65424,5

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A1	0	16	6.1	15.2	2.10	0.09	0.37	24.5	72.5	5.10	0.26	19.6	30	7.24	0.18
A2	16	27	6.1	10.3	1.60	0.07	0.26	18.3	66.8	2.96	0.18	16.4	41	6.44	0.16
Bw1	27	38	5.8	4.5	0.89	0.05	0.25	12.0	47.4	1.39	0.10	13.9	140	5.06	0.28
Bw2	38	69	5.8	3.5	1.10	0.06	0.28	9.5	52.0	1.10	0.08	13.8	145	3.18	0.25
BC	69	120	5.5	1.8	0.76	0.05	0.18	8.1	34.4	0.57	0.07	8.1	51	2.37	0.24
C1	120	160	5.8	2.6	0.92	0.08	0.24	8.3	46.3	0.45	0.06	7.5	32	2.83	0.26
C2	160	182	5.7	2.6	0.99	0.08	0.16	7.6	50.4	0.42	0.07	6.0	29	2.63	0.16

REMARKS: This pedon is outside the series limits of the Coppercreek series because it has a mollic epipedon and cambic horizon. Soils in the Coppercreek series have ochric epipedons and argillic horizons.

Pedon 23.
82-RNP-7A, S-82-12-02X

Classification: Typic Hapludoll, fine, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; forest below Elk Camp prairie, 3150 feet south of junction between W-Line and Bald Hills roads, 2600 feet southwest of driveway to house; southeast quarter, southwest quarter, section 29, T. 10 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: JHP, JL Sampled by: JHP, JL File number: JHP-88 Photo number: 1:12000 RNP-78 8-50

Parent material: Sandstone, siltstone and shale. Physiographic position: Mountain drainage headwaters at 536 m (1760 ft.) elevation.

Relief: Uniform, southwest-facing slope of 29 percent gradient.

Hydrology: Moderately well drained; medium runoff; moderately slow permeability; groundwater observed at depth of 100 cm.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*) and tanoak (*Lithocarpus densiflorus*); shrub layer is sparse tanoak and wood rose (*Rosa gymnocarpa*); herb layer includes sword fern (*Polystichum munitum*), inside-out flower (*Vancouveria hexandra*), candy flower (*Montia siberica*), wild ginger (*Asarum caudatum*), vanilla grass (*Hierochloe occidentalis*), vanilla leaf (*Achlys triphylla*), toothwort (*Dentaria californica*), fairy bells (*Disporum smithii*), bedstraw (*Galium triflorum*), common rush (*Juncus effusus*), hound's tongue (*Cynoglossum grande*), yerba buena (*Satureja douglasii*) and hedge nettle (*Stachys sp.*).

Colors are for the dry soil unless otherwise stated. When described (May 18, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 2 to 0 cm (1-0 in.); fresh and decomposing redwood twigs and needles.

A -- 0 to 28 cm (0-11 in.); grayish brown (10YR 5/2) clay loam, black (10YR 2/1) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common medium and few very fine and fine roots; common fine and few medium and coarse tubular pores; about 5 percent pebbles; slightly acid (pH 6.5); diffuse smooth boundary.

AB -- 28 to 50 cm (11-20 in.); grayish brown (10YR 5/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky, slightly plastic; common medium and few very fine, fine and coarse roots; common fine, and few medium and coarse tubular pores; about 5 percent pebbles; slightly acid (pH 6.5); gradual wavy boundary.

BAt -- 50 to 78 cm (20-31 in.); grayish brown (10YR 5/2) clay loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure; hard, slightly firm, sticky, plastic; few very fine, fine, medium and coarse roots; common very fine and few fine tubular pores; few faint clay films on faces of peds; about 10 percent pebbles; medium acid (pH 6.0); gradual wavy boundary.

Bt -- 78 to 102 cm (31-40 in.); light brownish gray (10YR 6/2) cobbly clay, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; hard, firm, sticky, plastic; few very fine, fine, medium and coarse roots; common very fine, and few fine and coarse tubular pores; common distinct clay films on faces of peds and in pores; about 10 percent pebbles, 15 percent cobbles; medium acid (pH 6.0); gradual wavy boundary.

BCt -- 102 to 120 cm (40-47 in.); light brownish gray (2.5Y 6/2) very cobbly clay, dark brown (10YR 3/3) moist; common medium prominent brownish yellow (10YR 6/6) mottles, strong brown (7.5YR 5/8) moist; massive; very hard, firm, sticky, plastic; few very fine, fine, medium and coarse roots; common very fine and few fine tubular pores; many prominent clay films in pores; about 15 percent pebbles, 25 percent cobbles; medium acid (pH 6.0); clear smooth boundary.

Cg -- 120 to 150 cm (47-59 in.); light brownish gray (2.5Y 6/2) gravelly clay, dark grayish brown (2.5Y 4/2) moist; many coarse faint gray (N 6/) and medium distinct brownish yellow (10YR 6/8) mottles, gray (N 5/) and strong brown (7.5YR 5/8) moist; massive; very hard, firm, sticky, plastic; few very fine, fine, medium and coarse roots; few very fine tubular pores; about 18 percent pebbles; strongly acid (pH 5.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine, mixed, isomesic Typic Hapludoll

Sample Number: 82-RNP-7A, S82-CA-12-02X

Location: 3150 ft. S. of W-Line/Bald Hills Rd. junction; SE 1/4, SW 1/4, S.29, T.10N., R.2E.

Pedon Number: 23

Lab Numbers: 66543-66548 (OSU), 1553 (UCD)

Date Sampled: 18 May 82

Analyst: CZ, MAM, TC, WRA

Analytical Lab: OSU, UCD

HORIZON	DEPTH (cm) From	DEPTH (cm) To	Field est. % >2mm (vol.)	PARTICLE SIZE DISTRIBUTION (wt. <2mm) % Sand VCS 2.00mm to 1.0mm	% Sand CS 1.0mm to 0.5mm	% Sand MS 0.5mm to 0.25mm	% Sand FS 0.25mm to 0.10mm	% Sand VFS 0.10mm to 0.05mm	% Sand TOTAL 2.0mm to 0.05mm	% Silt 50 -2 microns	% Clay <2 microns	Textural Class	Bulk Density g/cc (moist) (clod)	MOISTURE RETENTION DATA % Moisture Retained 1/3 bars	15 bars	% Available Moisture 1/3 to 15 bars
Cg	120	150	18	1.5	1.3	0.5	1.1	4.0	8.4	62.6	29.0	gsicl				

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	Wt.OC Kg/m^2	Wt. N Kg/m^2	P (ppm) Bray	RATIOS CEC / clay	RATIOS 15 bar H20 / clay
A	0	28	5.7	12.4	2.9	0.12	0.18	21.9	71.2	3.94	0.22	17.9			3		
AB	28	50	5.8	9.3	2.6	0.13	0.13	18.1	67.2	2.78	0.19	14.6			2		
BAt	50	78	5.6	6.8	2.2	0.14	0.12	16.3	56.8	2.32	0.15	15.5			1		
Bt	78	102	5.4	6.1	2.2	0.19	0.17	16.8	51.5	1.97	0.15	13.1			4		
BCt	102	120	5.4	5.8	2.2	0.18	0.16	14.3	58.3								
Cg	120	150	5.4	5.1	2.5	0.16	0.10	13.0	60.5								

REMARKS: Minerals in clay fraction were analyzed from 120-150 cm at UCD. Minerals identified by x-ray diffraction included chlorite, vermiculite-chlorite intergrade, mica-vermiculite intergrade, mica, and a trace of smectite. Clay increase was judged too gradual to meet requirements of an argillic horizon.

Pedon 24.
81-RNP-59 through -63

Classification: Aquic Argiudoll, fine-loamy, mixed, isomesic

Location: Humboldt County, California; Redwood National Park; forest below end of former W-Line Road; center of north half, southeast quarter, section 5, T. 9 N., R. 2 E., Humboldt base line and meridian; Bald Hills Quadrangle.

Description by: DC, JHP Sampled by: DC, JHP File number: DC-6 Photo number: 1:12000 RNP-78 7-43

Parent material: Graywacke sandstone. Physiographic position: Mountain drainage headwaters at 280 m (920 ft.) elevation.

Relief: Gently concave, south-facing slope of 26 percent gradient; slightly hummocky microrelief.

Hydrology: Moderately well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Redwood forest; tree layer includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*) and tanoak (*Lithocarpus densiflorus*); shrub layer includes tanoak, black huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), yerba de selva (*Whipplea modesta*), red huckleberry (*Vaccinium parvifolium*) and Oregon grape (*Berberis nervosa*); herb layer includes sword fern (*Polystichum munitum*), redwood sorrel (*Oxalis oregona*), star flower (*Trientalis latifolia*), bedstraw (*Galium triflorum*), trillium (*Trillium ovatum*) and false Solomon's seal (*Smilacina racemosa*).

Colors are for the dry soil unless otherwise stated. When described (October 28, 1980) the soil was thoroughly moist from the surface to a depth of 50 cm, and nearly dry below 50 cm. Field reaction was determined by Truog (Triplex indicator) method.

O1 -- 5 to 1 cm (2-1/2 in.) ; fresh and decomposing needles and twigs.

O2 -- 1 to 0 cm (1/2-0 in.); humus, fungal mycelia and a few roots.

A -- 0 to 18 cm (0-7 in.); grayish brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine, medium and coarse roots; common very fine interstitial, and common very fine and fine tubular pores; 15 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

BAt -- 18 to 28 cm (7-11 in.); brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; slightly firm, sticky, slightly plastic; common fine and medium, many coarse roots; common very fine interstitial, and common very fine and fine tubular pores; few faint clay films in pores; 15 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.

Btg -- 28 to 51 cm (11-20 in.); gray (N 6/) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; few fine distinct strong brown (7.5YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; strong coarse and very coarse subangular blocky structure; firm, sticky, plastic; common fine and medium, and few very fine roots; common very fine interstitial, and common very fine, fine and medium tubular pores; many faint clay films on faces of peds, few distinct clay films in pores; 20 percent pebbles; slightly acid (pH 6.5); gradual smooth boundary.

BCtg -- 51 to 67 cm (20-26 in.); gray (N 6/) gravelly clay loam, dark gray (5Y 4/1) moist; few fine distinct strong brown (7.5YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; very firm, sticky, plastic; few very fine, fine and medium roots; common very fine tubular pores; 20 percent pebbles; slightly acid (pH 6.5); gradual smooth boundary.

Cg -- 67 to 103 cm (26-41 in.); gray (N 6/) very gravelly clay loam, gray (5Y 5/1) moist; many fine prominent brownish yellow (10YR 6/8) mottles, yellowish brown (10YR 5/8) moist; massive; firm, sticky, plastic; few very fine, fine and medium roots; few very fine tubular pores; 35 percent pebbles; slightly acid (pH 6.5).

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine-loamy, mixed, isomesic Aquic Argiudoll

Location: Below end of W-Line road; N 1/2, SE 1/4, S.5, T.9N., R.2E.

Date Sampled: 16 Sep 81

Analyst: CZ

Sample Number: 81-RNP-59 through 81-RNP-63

Pedon Number: 24

Lab Numbers: 63922-63926

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	18	6.1	17.6	2.8	0.14	0.95	29.8	72.1	6.84	0.32	21.4	3	6.3	0.34
BAt	18	28	6.3	13.6	2.4	0.12	0.37	19.8	83.3	2.73	0.18	15.2	6	5.7	0.15
Btg	28	51	6.5	13.9	2.5	0.12	0.31	17.0	99.0	1.74	0.15	11.6	6	5.6	0.12
BCtg	51	67	6.7	11.7	2.2	0.11	0.24	14.1	101.1	0.81	0.10	8.1	3	5.3	0.11
Cg	67	103	6.7	12.9	3.1	0.13	0.14	12.7	128.1	0.44	0.09	4.9	3	4.2	0.05

REMARKS:

Pedon 25.
82-RNP-5

Classification: Lithic Xerorthent, loamy-skeletal, serpentinitic, non-acid, mesic

Location: Del Norte County, California; Redwood National Park; SW 1/4, SE 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JHP Sampled by: JHP, JL File number: LBH-1 Photo number: RNP-75 1:10000 9-26 74

Parent material: Serpentinite. Physiographic position: Mountain ridgetop at 564 m (1850 ft.) elevation.

Relief: Very gently convex, south-facing slope of 6 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Pine savannah; Jeffrey pine (*Pinus jeffreyi*) and Idaho fescue (*Festuca idahoensis*).

Colors are for the dry soil unless otherwise stated. When described (May 13, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 9 cm (0-4 in.); brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; 23 percent pebbles; mildly alkaline (pH 7.5); abrupt wavy boundary.

Bw -- 9 to 23 cm (4-9 in.); yellowish brown (10YR 5/4) very gravelly clay loam; weak coarse subangular blocky structure; 41 percent pebbles; mildly alkaline (pH 7.5); abrupt irregular boundary.

R -- 23 cm (9 in.); hard serpentine rock; depth ranges from 21 to 25 cm within excavation.

Ground surface has a coarse gravel pavement, with about 40 percent of the surface covered; slope has approximately 5 percent low bedrock outcrops.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Loamy-skeletal, serpentinitic, non-acid, mesic Lithic Xerorthent

Location: Little Bald Hills; SW 1/4, SE 1/4, Section 23, T.16N., R.1E.

Date Sampled: 13 May 82

Analyst: CZ

Pedon Number: 25

Sample Number: 82-RNP-5

Lab Numbers: 66679-66680

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	9	7.0	1.5	11.1	0.06	0.10	14.4	88.6	2.73	0.18	15.2	<1	0.14	0.01
Bw	9	23	7.0	1.4	13.6	0.05	0.08	17.7	85.5	2.90	0.19	15.3	2	0.10	0.01

REMARKS:

Pedon 26. WEITCHPEC STONY CLAY LOAM (taxadjunct)
82-RNP-6

Classification: Dystric Eutrochrept, loamy, serpentinitic, mesic, shallow

Location: Del Norte County, California; Redwood National Park; NW 1/4, NW 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JL Sampled by: JL, JHP File number: LBH-2 Photo number: RNP-75 1:10000 9-26 74

Parent material: Serpentinite. Physiographic position: Broad mountain ridgetop at 564 m (1850 ft.) elevation.

Relief: Uniform, southwest-facing slope of 17 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Douglas-fir woodland; Douglas-fir (*Pseudotsuga menziesii*), Jeffrey pine (*Pinus jeffreyi*), dwarf ceanothus (*Ceanothus pumilus*), coffee berry (*Rhamnus californica ssp. occidentalis*), buttercup (*Ranunculus uncinatus*) and viola (*Viola adunca*).

Colors are for the moist soil. When described (May 13, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 30 cm (0-12 in.); dark reddish brown (2.5YR 3/4) stony clay loam; less than 5 percent pebbles, 20 percent cobbles and stones; slightly acid (pH 6.5); diffuse wavy boundary.

Bw -- 30 to 45 cm (12-18 in.); yellowish red (5YR 4/6) stony clay loam; 10 percent pebbles, 20 percent cobbles and stones; neutral (pH 7.0).

Cr -- 45 cm (18 in.); weathered serpentinite.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Weitchpec (taxadjunct)
Location: Little Bald Hills; NW 1/4, NW 1/4, Section 23, T.16N, R.1E.
Date Sampled: 13 May 82

Taxonomic Class: Loamy, serpentinitic, mesic, shallow Dystric Eutrochrept
Analyst: CZ

Pedon Number: 26
Sample Number: 82-RNP-6
Lab Numbers: 66681-66682
Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	30	6.5	1.8	10.5	0.08	0.28	19.5	64.9	2.55	0.15	17.0	<1	0.17	0.03
Bw	30	45	6.7	0.9	10.0	0.05	0.12	15.5	71.4	1.39	0.08	17.4	<1	0.09	0.01

REMARKS: This pedon is outside the series limits of the Weitchpec series because it is less than 50 cm deep. Weitchpec soils are 50 to 75 cm deep.

Pedon 27.
82-RNP-3

Classification: Typic Hapludalf, fine-loamy, serpentinitic, mesic

Location: Del Norte County, California; Redwood National Park; NW 1/4, NW 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JHP, JL Sampled by: JHP, JL File number: LBH-3 Photo number: RNP-75 1:10000 9-26 74

Parent material: Serpentinite and peridotite. Physiographic position: Upper mountain slope at 488 m (1600 ft.) elevation.

Relief: Uniform, north-facing slope of 43 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Douglas-fir woodland; Douglas-fir (*Pseudotsuga menziesii*), western azalea (*Rhododendron occidentale*), black huckleberry (*Vaccinium ovatum*), coffee berry (*Rhamnus californica ssp. occidentalis*), wood rose (*Rosa gymnocarpa*), ocean spray (*Holodiscus discolor*) and sword fern (*Polystichum munitum*).

Colors are for the moist soil. When described (May 13, 1982) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 19 cm (0-7 in.); dark reddish brown (2.5YR 3/4) loam; weak medium granular and weak medium subangular blocky structure; less than 5 percent pebbles; neutral (pH 7.0).

BAt -- 19 to 53 cm (7-21 in.); dark reddish brown (2.5YR 3/4) cobbly clay loam; weak coarse subangular blocky, parting to weak fine subangular blocky structure; 5 percent pebbles, 10 percent cobbles; mildly alkaline (pH 7.5).

Bt -- 53 to 68 cm (21-27 in.); dark red (2.5YR 3/6) gravelly clay loam; weak coarse subangular blocky structure; many distinct clay films on ped faces; 25 percent pebbles; mildly alkaline (pH 7.5).

Cr -- 68 to 135 cm (27-53 in.); decomposed serpentinite, easily dug with hand tools.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Fine-loamy, serpentinitic, mesic Typic Hapludalf

Sample Number: 82-RNP-3

Location: Little Bald Hills, NW 1/4, NW 1/4, Section 23 T.16N., R.1E.

Pedon Number: 27

Lab Numbers: 66675-66677

Date Sampled: 13 May 82

Analyst: CZ

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	19	6.8	2.3	18.7	0.06	0.12	26.1	81.1	3.60	0.19	18.9	4	0.12	0.01
BA	19	53	6.9	1.9	18.8	0.05	0.09	23.5	88.7	2.55	0.15	17.0	1	0.10	<0.01
Bt	53	68	7.1	1.0	11.3	0.03	0.04	13.5	91.6	1.28	0.07	18.3	1	0.09	<0.01

REMARKS:

Pedon 28.
84-RNP-4

Classification: Typic Xerorthent, loamy, serpentinitic, non-acid, mesic, shallow

Location: Del Norte County, California; Redwood National Park; 130 ft. southwest (bearing 230 degrees) from meteorological tower; SW 1/4, SE 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JHP, MJA Sampled by: JHP, MJA File number: LBH-4 Photo number: RNP-75 1:10000 9-26 74

Parent material: Serpentinite. Physiographic position: Ridge shoulder at 610 m (2000 ft.) elevation.

Relief: Convex vertical, uniform horizontal, southwest-facing slope of 26 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Pine savannah; Jeffrey pine (*Pinus jeffreyi*) and Idaho fescue (*Festuca idahoensis*).

Colors are for the dry soil unless otherwise stated. When described (May 21, 1984) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 11 cm (0-4 in.); brown (7.5YR 5/3) gravelly loam, dark brown (7.5YR 3/3) moist; moderate medium granular and weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, and common medium roots; many very fine and fine interstitial, and common medium tubular pores; neutral (pH 7.0); 25 percent pebbles; clear wavy boundary.

Bw -- 11 to 21 cm (4-8 in.); brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/4) moist; moderate coarse subangular blocky, parting to moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, medium and coarse roots; common very fine, fine and medium, few coarse tubular pores; neutral (pH 7.0); 57 percent pebbles; abrupt wavy boundary.

Cr -- 21 to 31 cm (8-12 in.); slightly weathered serpentinite, can be dug with knife or pick; irregularly weak and fractured, fractures averaging 10 to 15 cm apart and containing very fine and fine roots.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Location: Little Bald Hills; SW 1/4, SE 1/4, Section 23, T.16N., R.1E.

Date Sampled: 21 May 84

Taxonomic Class: Loamy, serpentinitic, non-acid mesic, shallow Typic Xerorthent

Analyst: CZ

Pedon Number: 28

Sample Number: 84-RNP-4

Lab Numbers: 75870-75871

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	11	6.6	1.8	15.0	0.17	0.12	18.2	93.9	3.89	0.19	20.5	<1	0.12	0.01
Bw	11	21	6.8	1.5	15.0	0.13	0.10	17.5	95.6	3.36	0.21	16.0	<1	0.10	0.01

REMARKS:

Pedon 29.
84-RNP-5

Classification: Typic Xerochrept, loamy-skeletal, serpentinitic, mesic, shallow

Location: Del Norte County, California; Redwood National Park; 30 ft. southwest (bearing 225 degrees) from tree number 179; NE 1/4, SW 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JHP, MJA Sampled by: JHP, MJA File number: LBH-5 Photo number: RNP-75 1:10000 9-26 74

Parent material: Peridotite and serpentinite. Physiographic position: Broad ridge at 582 m (1910 ft.) elevation.

Relief: Nearly uniform north-facing slope of 6 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Pine savannah; Jeffrey pine (*Pinus jeffreyi*) and Idaho fescue (*Festuca idahoensis*), with some wood rose (*Rosa gymnocarpa*), pinemat manzanita (*Arctostaphylos nevadensis*) coffee berry (*Rhamnus californica ssp. occidentalis*) at base of trees.

Colors are for the dry soil unless otherwise stated. When described (May 22, 1984) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 15 cm (0-6 in.); red (2.5YR 5/6) gravelly loam, dark red (2.5YR 3/6) moist; weak medium granular and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, and few medium roots; many very fine and fine interstitial, and common fine tubular pores; neutral (pH 7.0); 22 percent pebbles; clear smooth boundary.

Bw -- 15 to 28 cm (6-11 in.); red (2.5 YR 5/6) very cobbly clay loam, dark red (2.5YR 3/6) moist; moderate coarse subangular blocky, parting to moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, medium and coarse roots; common fine interstitial and medium tubular pores; neutral (pH 7.0); 40 percent cobbles, 14 percent pebbles; clear wavy boundary.

Cr -- 28 to 50 cm (11-20 in.); slightly to strongly weathered serpentinite, easily dug with knife or spade; contains rounded, more resistant cobble- and stone-size chunks; irregularly fractured, fractures averaging 17 cm apart; tree roots enter fractures.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Loamy-skeletal, serpentinitic, mesic, shallow, Typic Xerochrept

Sample Number: 84-RNP-5

Location: Little Bald Hills; NE 1/4; SW 1/4, Section 23, T.16N., R.1E.

Pedon Number: 29

Lab Numbers: 75872-75873

Date Sampled: 22 May 84

Analyst: CZ

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	15	6.5	1.7	11.0	0.17	0.16	18.0	72.4	4.12	0.16	25.8	<1	0.15	0.01
Bw	15	28	6.8	0.5	12.0	0.14	0.05	16.0	79.3	2.09	0.08	26.1	<1	0.04	<0.01

REMARKS:

Pedon 30.
84-RNP-6

Classification: Typic Hapludalf, loamy-skeletal, serpentinitic, mesic

Location: Del Norte County, California; Redwood National Park; In Douglas-fir lichen plot number 6, 18 ft. west of big, wolfy Douglas-fir; NE 1/4, SW 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JHP, MJA Sampled by: JHP, MJA File number: LBH-6 Photo number: RNP-75 1:10000 9-26 74

Parent material: Peridotite. Physiographic position: Broad ridge at 579 m (1900 ft.) elevation.

Relief: Gently convex vertical, gently concave horizontal, east-facing slope of 9 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Douglas-fir woodland; Douglas-fir (*Pseudotsuga menziesii*), ocean spray (*Holodiscus discolor*), coffeeberry (*Rhamnus californica ssp. occidentalis*), tanoak (*Lithocarpus densiflorus*), Oregon grape (*Mahonia nervosa*), western azalea (*Rhododendron occidentale*), black huckleberry (*Vaccinium ovatum*), wood rose (*Rosa gymnocarpa*), sword fern (*Polystichum munitum*), yerba de selva (*Whipplea modesta*), and iris (*Iris innominata*).

Colors are for the dry soil unless otherwise stated. When described (May 22, 1984) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

O -- 5 to 0 (2-0 in.); fresh and decomposing Douglas-fir needles, fine roots and humus; moss and small herbaceous plants rooted in organic layer; fungal mycelia present at mineral soil boundary.

A -- 0 to 8 cm (0-3 in.); reddish brown (2.5YR 5/4) loam, dark red (2.5YR 3/6) moist; weak fine granular, parting to weak medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, and common medium roots; many very fine and fine interstitial pores; slightly acid (pH 6.5); 5 percent pebbles; clear smooth boundary.

AB -- 8 to 30 cm (3-12 in.); red (2.5YR 5/6) clay loam, dark red (2.5YR 3/6) moist; weak coarse subangular blocky, parting to moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium, common very fine and coarse roots; common fine interstitial and medium tubular pores; neutral (pH 7.0); 4 percent pebbles; pieces of charcoal up to 1 cm across; clear wavy boundary.

BA -- 30 to 53 cm (12-21 in.); yellowish red (5YR 5/6) stony clay loam, yellowish red (5YR 4/6) moist; weak coarse subangular blocky, parting to weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common medium and coarse, and few very fine roots; common fine interstitial, and medium and coarse tubular pores; neutral (pH 7.0); 3 percent pebbles, 31 percent stones; pieces of charcoal up to 1 cm across; clear wavy boundary.

Bt -- 53 to 120 cm (21-47 in.); yellowish red (5YR 5/8) very stony clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable, sticky, slightly plastic; few medium and coarse roots; common fine tubular pores; few faint clay films in pores; neutral (pH 7.0); 3 percent pebbles, 50 percent stones; pieces of charcoal up to 1 cm across; large number of stones make further digging impracticable.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series:

Taxonomic Class: Loamy-skeletal, serpentinitic, mesic Typic Hapludalf

Sample Number: 84-RNP-6

Location: Little Bald Hills; NE 1/4, SW 1/4, Section 23 T.16N., R.1E.

Pedon Number: 30

Lab Numbers: 75874-75877

Date Sampled: 22 May 84

Analyst: CZ

Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	8	6.0	3.4	6.0	0.21	0.21	21.3	46.1	3.02	0.16	18.9	<1	0.57	0.04
AB	8	30	6.1	1.0	4.1	0.16	0.08	11.4	46.8	2.44	0.09	27.1	<1	0.24	0.02
BA	30	53	6.2	0.4	4.5	0.14	0.05	8.5	59.9	1.28	0.05	25.6	<1	0.09	0.01
Bt	53	120	6.8	0.3	9.7	0.12	0.08	13.1	77.9	1.10	0.03	36.7	<1	0.03	0.01

REMARKS:

Pedon 31. SERPENTANO FAMILY GRAVELLY LOAM
84-RNP-7

Classification: Dystric Eutrochrept, loamy-skeletal, serpentinitic, mesic

Location: Del Norte County, California; Redwood National Park; In Douglas-fir lichen plot number 7, 15 ft. WNW of tree number 66; NE 1/4, SW 1/4, Section 23, T. 16 N., R. 1 E., Humboldt base line and meridian; Hiouchi Quadrangle.

Description by: JHP, MJA Sampled by: JHP, MJA File number: LBH-7 Photo number: RNP-75 1:10000 9-26 74

Parent material: Serpentinite and peridotite. Physiographic position: Edge of broad ridge at 588 m (1930 ft.) elevation.

Relief: Convex vertical, Uniform horizontal, south-facing slope of 7 percent gradient.

Hydrology: Well drained; medium runoff; moderate permeability; no groundwater observed.

Vegetation: Douglas-fir woodland; tree layer includes Douglas-fir (*Pseudotsuga menziesii*), Port Orford cedar (*Chamaecyparis lawsoniana*), Jeffrey pine (*Pinus jeffreyi*), tanoak (*Lithocarpus densiflorus*) and California bay (*Umbellularia californica*); shrub layer includes coffee berry (*Rhamnus californica ssp. occidentalis*), ocean spray (*Holodiscus discolor*), western azalea (*Rhododendron occidentale*), black huckleberry (*Vaccinium ovatum*), wood rose (*Rosa gymnocarpa*), red huckleberry (*Vaccinium parvifolium*), pine-mat manzanita (*Arctostaphylos nevadensis*), hairy manzanita (*A. columbiana*) and yerba de selva (*Whipplea modesta*); herb layer is sparse, with a few iris (*Iris innominata*) and sword fern (*Polystichum munitum*).

Colors are for the dry soil unless otherwise stated. When described (May 22, 1984) the soil was moist throughout. Field reaction was determined by Truog (Triplex indicator) method.

A -- 0 to 15 cm (0-6 in.); yellowish red (5YR 5/6) gravelly loam, yellowish red (5YR 4/6) moist; moderate medium granular, parting to moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine, fine and medium, and few coarse roots; many very fine and fine interstitial, and common fine and medium tubular pores; slightly acid (pH 6.5); 20 percent pebbles; gradual smooth boundary.

AB -- 15 to 29 cm (6-12 in.); yellowish red (5YR 5/6) gravelly clay loam, yellowish red (5YR 4/6) moist; weak fine granular, and weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium, and common very fine and coarse roots; common very fine and fine interstitial, fine and medium tubular pores; neutral (pH 7.0); 26 percent pebbles; gradual wavy boundary.

Bw -- 29 to 46 cm (12-18 in.); reddish yellow (7.5YR 6/6) very stony clay loam, strong brown (7.5YR 5/6) moist; moderate medium, parting to moderate fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine, fine and coarse, and few medium roots; common fine and medium, and few coarse tubular pores; neutral (pH 7.0); 11 percent pebbles, 33 percent stones; clear wavy boundary.

C -- 46 to 66 cm (18-26 in.); reddish yellow (7.5YR 6/6) very stony clay loam, strong brown (7.5YR 5/6) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common fine, few very fine, medium and coarse roots; common very fine and fine tubular pores; neutral (pH 7.0); 10 percent pebbles, 58 percent stones; abrupt irregular boundary.

Cr -- 66 to 83 cm (26-33 in.); slightly to strongly weathered pteridotite and serpentinite; can be dug with shovel and spade; fractures average 15 cm apart with common roots in fractures.

PHYSICAL AND CHEMICAL SOIL ANALYSES

Soil Series: Serpentano (OR) family
Location: Little Bald Hills; NE 1/4, SW 1/4, Section 23, T.16N., R.1E.
Date Sampled: 22 May 84

Taxonomic Class: Loamy-skeletal, serpentinitic, mesic Dystric Eutrochrept
Analyst: CZ

Pedon Number: 31
Sample Number: 84-RNP-7
Lab Numbers: 75878-75881
Analytical Lab: OSU

HORIZON	DEPTH (cm) From	DEPTH (cm) To	pH (2:1) H_2O	EXTRACTABLE CATIONS (meq/100g) Ca	Mg	Na	K	CEC (meq/100g) NH_4OAC	% Base Saturation	ORGANIC MATTER % Organic Carbon	% Organic Nitrogen	C/N	P (ppm) Bray	RATIOS Ca/Mg	RATIOS K/Mg
A	0	15	5.7	1.2	4.5	0.17	0.17	13.8	43.8	2.84	0.06	47.3	<1	0.27	0.04
AB	15	29	6.1	0.6	5.3	0.16	0.08	11.1	55.3	1.80	0.03	60.0	<1	0.11	0.02
Bw	29	46	6.4	0.5	7.6	0.13	0.05	10.7	77.4	1.39	0.03	46.3	<1	0.07	0.01
C	46	66	6.7	0.5	12.0	0.14	0.05	13.8	92.0	0.35	0.03	11.7	<1	0.04	<0.01

REMARKS:

Argillic horizon. A subsoil horizon that is characterized by the illuvial accumulation of layer-lattice silicate clays. The argillic horizon usually has films of oriented clay on the surface of pores or peds.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Cambic horizon. A subsoil horizon that has soil structure rather than rock structure, contains some weatherable minerals, and is characterized by the alteration or removal of mineral material as indicated by mottling or gray colors, stronger chromas or redder hues than in underlying horizons. The cambic horizon lacks cementation or induration and has too few evidences of illuviation to meet the requirements of the argillic horizon.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value.

Clast. A fragment of rock separate and detached from bedrock.

Clay. 1) Particle-size class: mineral soil particles (soil separates) less than 0.002 millimeter in diameter.
2) Soil textural class: soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay skin, argillan.

Cobble. Clast (rock fragment) 7.5 to 25 cm (3 to 10 inches) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, debris flow or debris torrent and deposited at the base of steep slopes.

Control section, particle size. The part of the subsoil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 25 to 100 cm.

Debris flow. A mass failure in which saturated soil rock and organic debris flows in a rapid slurry downslope along a narrow track. Debris flows occur over periods ranging from minutes to hours and tend to leave chaotically mixed, lobate deposits. The most rapid, narrow flows are called debris torrents.

Debris slide. A landslide in which soil and rock moves downslope along an approximately planar failure surface. Sliding occurs over periods ranging from hours to days, mainly during periods of exceptional precipitation. Material transported above slide planes may or may not be strongly disrupted, depending on depth of failure and slide tranjectory. Shallow slides may grade into debris flows.

Drainage class. Refers to depth, frequency and duration of periods of saturation or partial saturation of the soil. In this report, two classes are distinguished in statistical analyses:

Well drained. Water drains from the soil readily, but not rapidly, and is available to plants most of the year. The soil is free of mottling within 150 cm of the ground surface, and wetness does not inhibit plant growth.

Imperfected drained. Water does not drain from the soil readily during part of the year. Periodically, the soil is wet long enough to inhibit growth of deep-rooted plants. The subsoil or substratum has mottling within 150 cm of the ground surface. Within the imperfectly drained class, two subclasses are distinguished in the pedon and series descriptions:

Moderately well drained. Water-related mottles begin between depths of 75 to 150 cm.

Somewhat poorly drained. Water-related mottles begin between depths of 50 to 75 cm.

Earthflow. A complex landscape association of deep-seated sliding, slumping, flowing and creep, with characteristic and lobate microtopography, closed depressions, prominant scarps and benches. Some have open lateral or transverse cracks and discontinuous gully systems.

Exchangeable cation. A positively charged ion held by a negative surface charge on a soil colloid (clay or organic matter), that can be displaced by other cations from an extracting solution. Major exchangeable cations include Ca^{++}, Mg^{++}, K^{+}, Na^{+}, and NH_4^{+}. Synonym: exchangeable base.

Family, soil. In soil classification, the category immediately above soil series and below subgroup. Soil families are named according to the particle-size, mineralogy, temperature, reaction and depth classes of the series being classified (Soil Survey Staff 1975, Chapter 18).

Gravel. Rounded or angular clasts (rock fragments) 2 millimeters to 7.5 centimeters in diameter. Each individual clast is called a pebble.

Great group. In soil classification, the third highest category, beneath soil order and suborder. Differentiates in the great group category place soils together with close similarities in 1) kind, arrangement and degree of expression of soil horizons; 2) soil moisture and temperature regimes; 3) base status (Soil Survey Staff 1975, pp. 77-78).

Horizon, soil. A layer of soil, approximately parallel to the grounded surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the Soil Survey Manual. (Soil Survey Staff 1951) and National Soils Handbook (USDA 1983a). The major horizons of mineral soil are as follows:

O horizon. -An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon. -The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material.

B horizon. -The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, iron and aluminum; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A and C horizon; or (4) combinations of these.

C horizon. -The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon.

R layer. -Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Leaching. The removal of soluble material from soil or other material by percolating water.

Mass movement. The downslope displacement of soil, or soil and rocks by processes acting below the immediate soil surface. Mass movements include soil creep, slides and flows. Surficial processes, which include sheet, rill and gully erosion, are not mass movements.

Mineralogy class. Refers to the mineralogical composition of selected size fractions of the particle-size control section of a soil (Soil Survey Staff 1975, pp. 386-387).

Moisture control section. Subsurface zone used to classify soil moisture regimes. Upper boundary is the depth to which dry soil is moistened by 2.5 cm (1 inch) of water. Lower boundary is the depth moistened by 7.5 cm (3 inches) of water (Soil Survey Staff 1975, pp. 53-54).

Moisture regime, soil. Refers to the presence or absence of plant-available water (held at a tension of less than 15 bars in the soil moisture control section) throughout the year. Two soil moisture regimes are identified in Redwood National Park:

Xeric. Under this regime, the moisture control section becomes dry in all parts 45 or more consecutive days within the 4 months following the summer solstice in 6 or more years out of 10. This regime is hypothesized for the prairies.

Udic. Under this regime, the moisture control section does not become dry for the length of time specified in the xeric moisture regime. The regime has been recognized in the forests and oak woodlands (Sturhan 1987).

Mottling, soil. Irregular spots of brown and gray color, usually in a gray or olive-gray matrix. Mottling generally indicates poor aeration and impeded drainage.

Mudstone. Sedimentary rock containing dominantly silt and clay-size particles.

Munsell notation. A designation of color by degrees of the three simple variables: hue, value, and chroma. For example, a notation of 10YR 6/4 is a hue of 10YR, value of 6, and chroma of 4.

Parent material. The unconsolidated material in which soil forms.

Particle-size class. Refers to the grain-size distribution of the particle-size control section for Soil Taxonomy. Three of the classes are common in Redwood National Park:

Fine-loamy. Less than 35 percent rock fragments, by volume; in the fine earth fraction, 15 percent or more fine sand or coarser up to 7.5 cm, and 18 to 34 percent clay, by weight.

Loamy-skeletal. At least 35 percent rock fragments, by volume; in the fine earth fraction, texture is loamy fine sand, very fine sand or finer, with less than 35 percent clay, by weight.

Clayey. Less than 35 percent rock fragments, by volume; in the fine earth fraction, at least 35 percent clay, by weight.

Particle-size distribution. The amounts of the various soil separates, express as weight percentages.

Pebble. A rock fragment 2 millimeters to 7.5 cm (3 inches) in diameter.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedology. Soil science.

Pedon. The smallest volume that can be called "a soil". A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 1 square meter to 10 square meters, depending on the variability of the soil.

Permeability. The ease with which water moves through the soil.

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Regolith includes both soil and any unconsolidated substratum.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Schist. Metamorphic rock with closely foliated structure. The Redwood Creek schist is metamorphosed from Franciscan sedimentary rocks.

Seepage. The movement of water through soil or substratum.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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

Soil separates. Mineral particles less than 2 mm in size ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Stones. Clasts (rock fragments) 25 to 60 centimeters (10 to 24 inches) in diameter.

Subsoil. The B horizon. See horizon, soil.

Substratum. The C horizon. See horizon, soil.

Surface layer. The A horizon. See horizon, soil.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Temperature regime, soil. Refers to the mean annual temperature, and summer-to-winter difference in temperature, measured 50 cm below the ground surface. Three soil temperature regimes are recognized in Redwood National Park:

Mesic. Mean annual soil temperature is 8 to 15°C and summer-to-winter difference is greater than 5°C.

Isomesic. Mean annual soil temperature is 8 to 15°C and summer-to-winter difference is 5°C or less.

Thermic. Mean annual soil temperature is 15 to 22°C and summer-to-winter difference is greater than 5°C.

Other Redwood National Park Technical Reports

Redwood National Park Technical Report Series

Madej, Mary Ann, H. Kelsey, and W. Weaver. 1980. An Evaluation of 1978 Rehabilitation Sites and Erosion Control Techniques in Redwood National Park. Redwood National Park Technical Report Number 1. National Park Service, Redwood National Park. Arcata, California. 113 pp. (Out of print)

Kelsey, Harvey and P. Stroud. 1981. Watershed Rehabilitation in the Airstrip Creek Basin. Redwood National Park Technical Report Number 2. National Park Service, Redwood National Park. Arcata, California. 45 pp.

Kelsey, Harvey, M.A. Madej, J. Pitlick, M.Coghlan, D. Best, R. Belding and P. Stroud. 1981. Sediment Sources and Sediment Transport in the Redwood Creek Basin: A Progress Report. Redwood National Park Technical Report Number 3. National Park Service, Redwood National Park. Arcata, California. 114 pp. (Out of print)

Sacklin, John A. 1982. Wolf Creek Compost Facility, Operation and Maintenance Manual. Redwood National Park Technical Report Number 4. Second Edition. National Park Service, Redwood National Park. Arcata, California. 61 pp.

Reed, Lois J. and M.M. Hektner. 1981. Evaluation of 1978 Revegetation Techniques. Redwood National Park Technical Report Number 5. National Park Service, Redwood National Park. Arcata, California. 70 pp.

Muldavin, Esteban H., J.M. Lenihan, W.S. Lennox and S.D. Veirs, Jr. 1981. Vegetation Succession in the First Ten Years Following Logging of Coast Redwood Forests. Redwood National Park Technical Report Number 6. National Park Service, Redwood National Park. Arcata, California. 69 pp.

Lenihan, James M., W.S. Lennox, E.H. Muldavin, and S.D. Veirs, Jr. 1982. A Handbook for Classifying Early Post-Logging Vegetation in the Lower Redwood Creek Basin. Redwood National Park Technical Report Number 7. National Park Service, Redwood National Park. Arcata, California. 40 pp. (Out of print)

Pitlick, John. 1982. Sediment Routing in Tributaries of the Redwood Creek Basin: Northwestern California. Redwood National Park Technical Report Number 8. National Park Service, Redwood National Park. Arcata, California. 67 pp. (Out of print)

Best, David. 1984. Land Use of the Redwood Creek Basin. Redwood National Park Technical Report Number 9. National Park Service, Redwood National Park. Arcata, California. 24 pp plus maps.

Coghlan, Mike 1984. A Climatologically - Based Analysis of the Storm and Flood History of Redwood Creek. Redwood National Park Technical Report Number 10. National Park Service, Redwood National Park. Arcata, California. 47 pp. (Out of print)

Madej, Mary Ann. 1984. Recent Changes in Channel-Stored Sediment in Redwood Creek, California. Redwood National Park Technical Report Number 11. National Park Service, Redwood National Park. Arcata, California 54 pp. (Out of print)

Varnum, Nick. 1984. Channel Changes at Cross Sections in Redwood Creek, California. Redwood National Park Technical Report Number 12. National Park Service, Redwood National Park. Arcata, California. 51 pp. (Out of print)

Madej, Mary Ann. 1984. Redwood Creek Channel Maps. Redwood National Park Technical Report Number 13. National Park Service, Redwood National Park. Arcata, California. 11 pp plus maps.

Purkerson, Jeff, J. Sacklin, and L.L. Purkerson. 1985. Temperature Dynamics, Oxygen Consumption and Nitrogen Utilization in Static Pile Composting. Redwood National Park Technical Report 14. National Park Service, Redwood National Park. Arcata, California. 26 pp.

Ricks, Cynthia L. 1985. Flood History and Sedimentation at the Mouth of Redwood Creek, Humboldt County, California. Redwood National Park Technical Report 15. National Park Service, Redwood National Park. Arcata, California. 154 pp.

Walter, Tom. 1985. Prairie Gully Erosion in the Redwood Creek Basin, California. Redwood National Park Technical Report 16. National Park Service, Redwood National Park. Arcata, California. 24 pp.

Madej, Mary Ann, C. O'Sullivan, and N. Varnum. 1986. An Evaluation of Land Use, Hydrology, and Sediment Yield in the Mill Creek Watershed. Redwood National Park Technical Report 17. National Park Service, Redwood National Park. Arcata, California. 66 pp.

Varnum, Nick and V. Ozaki. 1986. Recent Channel Adjustments in Redwood Creek, California. Redwood National Park Technical Report 18. National Park Service, Redwood National Park. Arcata, California. 74 pp.

Weaver, William E., M.M. Hektner, D.K. Hagans, L.J. Reed, R.A. Sonnevil, G.J. Bundros. 1987. An Evaluation of Experimental Rehabilitation Work, Redwood National Park. Redwood National Park Technical Report 19. National Park Service, Redwood National Park. Arcata, California.

Popenoe, James H. 1987. Soil Series Descriptions and Laboratory Data from Redwood National Park. Redwood National Park Technical Report Number 20. National Park Service, Redwood National Park. Orick, California.

Sugihara, Neil G. and L.J. Reed. 1987. Vegetation Ecology of the Bald Hills Oak Woodlands of Redwood National Park. Redwood National Park Technical Report 21. National Park Service, Redwood National Park. Orick, California.