United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
United States Department
of Agriculture, Forest
Service; United States
Department of the
Interior, Bureau of Land
Management and Bureau
of Indian Affairs; and the
Regents of the University
of California (Agricultural
Experiment Station)

Soil Survey of Mendocino County, Eastern Part, and Trinity County, Southwestern Part, California

How To Use This Soil Survey

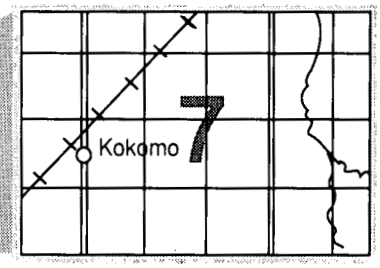
General Soil Map

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

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

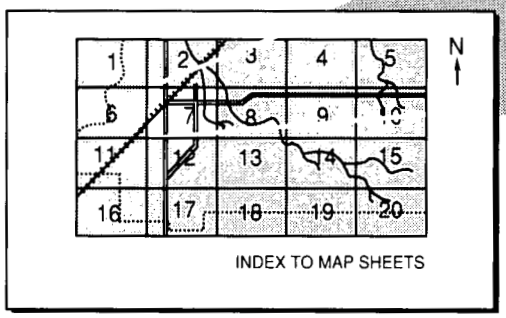
Detailed Soil Maps

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



MAP SHEET

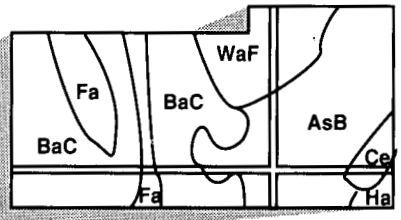
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

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

MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the Bureau of Land Management, the Bureau of Indian Affairs, and the Regents of the University of California (Agricultural Experiment Station). It is part of the technical assistance furnished to the Mendocino County and Trinity County Resource Conservation Districts. Financial assistance was provided by the Georgia-Pacific Corporation.

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

Cover: Vineyards and pear orchards on Cole and Russian soils in Ukiah Valley. Cole soils have been drained.

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Foreword

This soil survey contains information that can be used in land-planning programs in Mendocino County, eastern part, and Trinity County, southwestern part. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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Soil Survey of Mendocino County, Eastern Part, and Trinity County, Southwestern Part, California

By Richard F. Howard and Roy H. Bowman, Soil Conservation Service

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United States Department of Agriculture, Soil Conservation Service, in cooperation with
United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Land Management and Bureau of Indian Affairs; and Regents of the University of California (Agricultural Experiment Station)

The survey area is in the northwestern part of California (fig. 1). It has a total area of about 1,700 square miles, or 1,103,912 acres. Of the total acreage, 991,160 acres is in the eastern part of Mendocino County and 112,752 acres is in the southwestern part of Trinity County. Ukiah, the largest city and the county seat of Mendocino County, lies along the Russian River, in the southern part of the area. Highway 101 runs through the survey area from the southeast to the northwest.

All of the eastern part of Mendocino County and about half of the southwestern part of Trinity County have been included in earlier surveys. Surveys for the Ukiah and Willits areas *(52, 53)* were published in 1914 and 1918, respectively. Mendocino County was the first county in California to be covered by a soil-vegetation study *(23, 24)*. Parts of Trinity County were included in the soil-vegetation surveys of Mendocino, Humboldt, and Trinity Counties. An interim report for the bottom lands of Mendocino County was published in 1973 *(22)*. The present survey updates the earlier surveys and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of

Figure 1.—Location of Mendocino County, eastern part, and Trinity County, southwestern part, in California.

better knowledge of soils, modifications in series concepts, revised classification standards in the new international system of soil taxonomy, intensity of mapping, or the extent of soils within the survey area.

The bottom lands and terraces of the valleys in this survey area were mapped at a more detailed level, or at a higher intensity, than were the uplands. The areas on uplands, or those mapped at the less detailed level, are indicated by an asterisk in the detailed soil map legend. Some areas were not mapped because access was denied by the landowner. These areas are marked "Access Denied" on the detailed soil maps.

General Nature of the Survey Area

This section provides general information about the survey area. It briefly discusses history and development, physiography, and climate.

History and Development

By Maxine J. Levine, soil scientist, Soil Conservation Service.

Before white settlers arrived in the survey area, it was populated by four major Indian tribes—the Pomo, the Athapascan, the Huchnom, and the Yuki Proper. As food gatherers, they lived on acorns, native fruit and berries, freshwater fish, small game, and deer. They used willows and rushes to make tightly woven baskets that were used for cooking and storage *(40)*. The Round Valley Indian Reservation, just north of Covelo, was established in 1858 *(25)*. Still in operation, it is the largest reservation in the survey area. Members of more than 15 different tribes were transferred there from as far away as the Sacramento Valley and the Pitt River Basin.

The first documented settlers in the survey area were Mexican soldiers who received land grants in what is now Mendocino County. In 1844 Fernando Feliz received a large tract of land near the Russian River, in Sanel Valley. He lived there with his family, devoting his time to agriculture and cattle. In 1845 the Yokayo grant in Ukiah Valley was given to Cayetano Juarez. Subsequent owners surveyed the property and sold it in tracts to new settlers *(26)*.

The town of Ukiah, taking its name from the Indian word for deep valley, was first settled in the mid-1850's. In 1859, Sonoma County officials were relieved of administration of the area and Ukiah was chosen as the county seat of Mendocino County. Settlement then proceeded rapidly in the interior valleys.

The town of Willits, in Little Lake Valley, was settled in 1853 and incorporated in 1888. The Long Valley-Laytonville area was first settled in 1857. Round Valley, which began as a subsidiary cattle ranch to provide beef for the Nome Lackee Indian Reservation, was settled in 1856. Valued initially only as summer range by sheep and cattle ranchers in Mendocino and Humboldt Counties, the southwestern part of Trinity County was not permanently settled until the 1860's *(10)*.

In the 1850's the settlers used the interior valleys and nearby foothills as open range for cattle. Livestock could graze the hills and be walked to market. In the southwestern part of Trinity County sheep were more important than cattle because it was easier to pack the wool than to drive cattle to the nearest accessible port on the coast *(46)*. From the 1870's to the late 1880's the emphasis shifted to sheep throughout the survey area. Ranches that were partly or entirely fenced began to replace open range. During the late 1880's cattle ranching began to regain popularity and beef cattle gradually replaced sheep as the dominant livestock enterprise.

Poor transportation and isolation prevented the development of any other form of agriculture or commerce until the 1890's, when the railroad finally connected interior Mendocino County with San Francisco and coastal towns. Although roads were built in the 1870's and 1880's, they generally were poor and were virtually closed during the rainy season. Because travel often was difficult, agriculture in the early years of settlement served only local needs. Common crops were hay, grain, hops, grapes, pears, and potatoes. Around World War I, the acreage of pear and prune orchards increased. In the Hopland and Ukiah Valleys, grapes were originally planted only on the uplands and high terraces, leaving the bottom lands to be used for hops, alfalfa, grain, and fruit orchards. Grapes were introduced because they could be planted on soils that were not so well suited to these other crops. Gradually grapes became the major crop on the bottom lands as well, replacing grain and hay in the early 1900's, hops in the 1930's, and pears and prunes in recent years.

Poor transportation prevented lumber, cordwood, and tanoak bark, which is used in the leather tanning industry, from being important factors in the economic development of the survey area until the 20th century. The rivers of the interior were unsuited to rafting logs to tidewater mills, and the railroad was slow to penetrate the difficult terrain. When the railroad did reach the interior, the lumber industry developed rapidly. Large-scale commercial logging began in the 1930's and accelerated with World War II and the postwar construction boom. From 80 to 90 percent of the timber

harvested before World War II was redwood. During the building boom of the 1950's, Douglas fir, ponderosa pine, sugar pine, and redwood were logged extensively in the survey area. Nearly all the old growth timber stands on private land have now been totally or partially harvested *(39)*.

Mining and mineral development has consisted more of hopes and promotions than actual production. Gold, silver, copper, and coal were prospected in Mendocino County, but the deposits were too small to make mining economically feasible. From 1915 to 1930, there was a mine in Island Mountain, in the southwestern part of Trinity County, that was temporarily successful. It produced 9,000,000 pounds of copper, 144,000 ounces of silver, and 8,600 ounces of gold *(18)*.

Today, along with agriculture and timber, tourism is a major source of income for the survey area. The Redwood Highway provides a scenic route through the wine country of Hopland and Ukiah Valleys and the forest lands northward. Lake Mendocino, a flood control project of the 1950's, and the Talmage Dams and Reservoirs, built in the early 1900's, are used for camping, fishing, swimming, and boating. Mineral baths and hot sulfur springs, located near Ukiah and Hopland, are still used as sources of bottled mineral water and as sites for vacation retreats *(16)*.

Physiography

Lisa A. Hokholt, soil scientist, Soil Conservation Service, helped to prepare this section.

The survey area lies within the northern Coast Range of California. The rocks of the Franciscan Formation have been folded and faulted into parallel mountain ridges running to the north-northwest. These ridges are dissected by the Eel and Russian Rivers and their tributaries. Most of the valleys, making up about 10 percent of the survey area, follow the north-northwest trend of the ridges; an exception is Round Valley, which is a large basin surrounded by faults. The highest point in the area is Black Butte, in Trinity County, which is at an elevation of 5,922 feet. The lowest points, at about 350 feet, are where the Russian and Eel Rivers leave Mendocino and Trinity Counties at the southern and northern edges of the survey area.

The uplands are a mosaic of rolling, grassy hills and steep, forested or brushy mountain slopes. The mountains dissected by the Eel River are especially rugged. Nearly barren landslide areas that plunge into the river are common.

Intermontane valleys are filled with stream and lake deposits on flood plains, alluvial fans, and terraces. The thickness of the deposits ranges from 200 feet in Laytonville Valley to several thousand feet in the Ukiah and Sanel Valleys *(16)*. In general, the nearly level flood plains occupy the centers of the valleys and the foothills rise directly above them at the northern end of the valleys. Gently sloping fans develop at the mouths of streams on either side of the valleys. The older terraces tend to be at the southern and eastern ends of the valleys. The most obvious exceptions are in Laytonville Valley, where the terraces occupy the Cahto Creek drainageway west of the main valley, and in the Redwood Valley-Calpella area of terrace soils, where the flood plain is restricted to a narrow strip along the streams. Terraces in some areas are nearly level, but some of the older ones, such as those south of Morrison Creek, have been uplifted, tilted, and dissected so much that they look like the adjacent uplands.

The major watershed boundary between the Russian and Eel Rivers lies along a line drawn roughly from the northern end of Potter Valley to the Ridgewood Summit. The Eel River and its South, Middle, and North Forks drain the northern part of Mendocino County and all of the part of Trinity County that is in the survey area. The Russian River flows south from its headwaters above Redwood Valley and is joined by its tributaries—the East Fork of the Russian River, Forsythe Creek, Feliz Creek, and Pieta Creek. Just northeast of Ukiah, Coyote Dam forms the 1,500-acre Lake Mendocino on the East Fork of the Russian River. The Eel River has served as a tributary of the East Fork of the Russian River since 1908, when Van Arsdale Dam was built and water was diverted by a tunnel through the mountains north of Potter Valley. Dry Creek runs through Yorkville and joins the Russian River further south in Sonoma County.

Small areas along the western edge of the survey area are drained directly to the Pacific Ocean by west-flowing streams such as Rancheria Creek and other tributaries of the Navarro River and the branches of Big River and the Noyo River.

Climate

The climate of the survey area is transitional between that of the coast and that of the interior. It is characterized by warm, dry summers and cool, wet winters. The Pacific Ocean, about 20 miles west of the area, moderates the temperature both in summer and in winter. At the survey's western edge, summer temperatures are reduced by fog and winter temperatures are increased by the relatively warm

marine air. Moving east, the maritime influence lessens because of distance and the long mountain ridges that block the inland flow of marine air. Vegetation and soils change as the climate becomes more continental.

Temperature and precipitation data for Covelo, Forest Glen, Ukiah, and Willits are given in table 1 *(9)*.

The mean annual air temperature in the Ukiah Valley and nearby areas is about 59 degrees F. To the north, Willits and Covelo have a mean annual temperature of about 55 degrees. There are few weather stations on the uplands, and none collects temperature data at elevations of more than 3,000 feet. At about 2,000 feet in Blocksburg, just outside the survey area in Humboldt County, and on the Ridgewood Summit, between Ukiah and Willits, the mean annual temperature is about 54 degrees. Extrapolation of temperatures to higher elevations is difficult because the temperature drops from south to north. For example, the mean annual temperature at about 2,500 feet is 57 degrees near Hopland and 50 degrees at Forest Glen, 15 miles northeast of Zenia, in Trinity County. The best estimate for most of the survey area is that the mean annual temperature in areas under forest cover is about 53 degrees at an elevation of 3,000 feet and 47 degrees at 5,000 feet. Temperatures are warmer in areas under grass, on south-facing slopes, and along the western edges of the survey area.

In summer, the daily fluctuation of temperature is more than 40 degrees in the valleys. Nighttime temperature in summer is 51 degrees, while daytime temperature rises to more than 90 degrees. In September 1955, a temperature of 115 degrees was recorded at Ukiah. On the average, there are 80 days per year when the temperature at Ukiah is more than 90 degrees *(37)*. Above the valleys, the days are cooler and cold air drainage causes warmer nighttime temperatures. There is only a 20-degree difference between nighttime and daytime summer temperatures at the Hopland Field Station Orchard (2,900 feet).

In winter, January is the coldest month, with average low temperatures of 35 degrees at Ukiah, 33 degrees at Willits, 29 degrees at Covelo, and 26 degrees at Forest Glen. Daytime temperatures are 22 degrees higher at the three Mendocino County stations and 18 degrees higher at Forest Glen.

The coldest temperature recorded at Ukiah since 1951 was 13 degrees in 1972, while the temperature at Forest Glen and Covelo, which are subject to the influence of more continental airmasses, has dropped below 0 degrees. Ukiah has an average of 43 days per year when the temperature is below freezing. The probability of frost in spring and fall is shown in table 2. The last freezing temperature in spring generally occurs in April or early in May in the valleys. The first freezing temperature occurs in October or early in November. The growing season, or the average period from the last frost (32 degrees) in spring to the first frost in fall, ranges from about 150 to 250 days in the valleys. Although Willits and Covelo have an average growing season of more than 160 days, freezing temperatures have been recorded in every month except July and August, making the growing of crops susceptible to frost damage risky.

Because of the complex interaction of slope, aspect, elevation, latitude, and coastal influence, the frost-free season is highly variable on the uplands. It ranges from about 125 days in the interior mountains of the northwestern corner of the survey area to 270 days at the lower elevations of the redwood belt at the western edge of the area.

California has been divided into five grape-growing regions based on the number of growing degree-days above 50 degrees for the April 1 to October 31 growing period. Willits is in Region I, with 2,224 annual degree-days. Redwood Valley, with 2,914 degree-days, falls into Region II. Covelo (3,005 degree-days), Hopland (3,113 degree-days), Potter Valley (3,341 degree-days), and Ukiah (3,460 degree-days) are in Region III. While Covelo has a high total, it has about 90 fewer degree-days for October than do the other Region III stations.

From October through April, 90 to 95 percent of the total annual precipitation falls in the survey area. Mean totals are as much as 60 inches at the Russian River drainageway in the south, and they range from 45 to 70 inches at the Eel River drainageway. Totals are lowest in the southern valleys and highest in the northern mountains. There is a greater chance for summer thundershowers in the north. Zenia, in Trinity County, at the north end of the survey area, has more than 1 inch of rainfall in June and September.

In this part of the Coast Range, total precipitation for a given year varies widely from the mean. In the course of this survey, Ukiah's lowest and highest annual totals were recorded. There were 14.08 inches of precipitation in 1976 and 77.97 inches in 1983.

Less than 1 inch of snow falls in Ukiah and the other southern valleys, but the northern mountains may receive more than 20 inches per year. Covelo has about 7 inches per year, the Willits Howard Forest Ranger Station at Ridgewood Summit (elevation 1,925 feet) averages 14 inches, and Forest Glen, in Trinity County, records about 33 inches per year.

Winds over the survey area generally follow the ridgelines from the northwest or southeast. Winds can

be expected to reach 40 miles per hour once every 2 years and 80 miles per hour every 50 years. Local topography in the mountains affects both direction and speed of the wind.

In most areas in the survey area the sun shines about 50 percent of the time in winter and 80 percent in summer and fall. In the redwood belt, on the western edge of the area, fog reduces the sunshine to 65 percent in summer.

How This Survey Was Made

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

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

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

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

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

The general soil map does not join, in all instances, with the general soil maps of adjacent survey areas. Differences in the maps have resulted from recent advances in classification.

The general soil map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Map Unit Descriptions

Valley soils under crops

Three map units are in this group. They make up about 11 percent of the survey area.

1. Feliz-Russian

Very deep, nearly level to moderately sloping, well drained loam

This map unit is on low stream terraces and flood plains in valleys. Elevation ranges from about 400 to 1,500 feet.

This unit makes up about 3 percent of the survey area.

Feliz soils typically have a loam surface layer underlain by a clay loam subsoil. Slope ranges from 0 to 8 percent.

Russian soils typically have a loam surface layer over stratified underlying material of loam and very fine sandy loam. Slope ranges from 0 to 2 percent.

Of minor extent in this unit are Talmage soils, Xerofluvents, and Riverwash.

Most areas of this unit in Ukiah Valley are used for irrigated crops. The area near Covelo is used for hay and pasture. Areas of this unit that are protected from flooding have few limitations for crops. These areas are also suited to use as homesites.

2. Cole

Very deep, nearly level and gently sloping, somewhat poorly drained clay loam

This map unit is on alluvial plains and alluvial fans and in basins in Hopland, Covelo, and Potter Valleys. In many areas, the water table has been lowered by artificial drainage. Elevation ranges from about 350 to 1,500 feet.

This unit makes up about 3 percent of the survey area.

Cole soils typically have a clay loam surface layer underlain by a clay loam, clay, and silty clay loam subsoil. Slope ranges from 0 to 5 percent.

Of minor extent in this unit are Clear Lake, Maxwell, and Talmage soils.

This unit is used mainly for irrigated crops. The area near Covelo is used for hay and pasture. The areas near Hopland and Potter Valleys are used mostly for vineyards and orchards and as homesites.

This unit is limited for crops mainly by the slow permeability of the soils and for buildings mainly by the low soil strength.

3. Pinole-Yokayo-Redvine

Very deep, nearly level to moderately steep, well drained gravelly loam, sandy loam, and sandy clay loam

This map unit is on terraces of Ukiah, Redwood, Willits, and Laytonville Valleys. The soils formed in old alluvium derived from sedimentary rock. Elevation ranges from about 400 to 1,500 feet.

This unit makes up about 5 percent of the survey area.

Pinole soils typically have a gravelly loam surface layer over a clay loam and sandy clay loam subsoil. Slope ranges from 0 to 30 percent.

Yokayo soils have a sandy loam surface layer over a clay and clay loam subsoil. Slope ranges from 0 to 30 percent.

Redvine soils have a sandy clay loam surface layer over a clay loam and clay subsoil. Slope ranges from 2 to 30 percent.

Of minor extent in this unit are Pinnobie soils, Argixerolls, and Haploxeralfs.

Most areas of this unit in Ukiah and Redwood Valleys are used for irrigated crops. Areas in Willits and Laytonville Valleys are used for livestock grazing. Where slopes are less than 15 percent, this unit is used for homesite development. The Redvine and Yokayo soils are limited for crops by slow and very slow permeability and are limited for homesite development by high shrink-swell potential. The Pinole soils have few limitations for crops or homesite development.

Upland soils under grass and oaks

Three map units are in this group. They make up about 37 percent of the survey area.

4. Yorkville-Yorktree-Squawrock

Moderately deep to very deep, rolling to very steep, well drained and moderately well drained loam and cobbly loam

This map unit is mainly on south-facing slopes and ridgetops of uplands. The vegetation is grass and oaks. Elevation ranges from about 350 to 3,000 feet.

This unit makes up about 21 percent of the survey area.

Yorkville soils are very deep and moderately well drained. They have a loam surface layer over a clay, clay loam, and gravelly clay loam subsoil. Slope ranges from 9 to 50 percent.

Yorktree soils are deep and well drained. They have a loam surface layer over a gravelly loam, clay, and gravelly clay loam subsoil. Fractured graywacke is below the subsoil. Slope ranges from 15 to 75 percent.

Squawrock soils are moderately deep and well drained. They have a cobbly loam surface layer over an extremely cobbly loam and very gravelly loam subsoil. Fractured sandstone is below the subsoil. Slope ranges from 15 to 75 percent.

Of minor extent in this unit are Bearwallow, Hellman, Hopland, and Witherell soils.

Areas of this unit are used for livestock grazing, recreation, watershed, and wildlife habitat. A few areas are used for firewood production.

Livestock grazing on the Yorkville and Yorktree soils is limited by their susceptibility to compaction by livestock when wet. The Squawrock soils are limited by restricted available water capacity. The main limitations for harvesting of firewood are steepness of slope, the instability of the soils, and seasonal wetness.

5. Shortyork-Yorkville-Witherell

Shallow, moderately deep, and very deep, strongly sloping to very steep, moderately well drained to somewhat excessively drained loam, gravelly loam, and sandy loam

This map unit is on uplands in the Covelo area, near the Mendocino National Forest, and in the Bell Springs area. The vegetation is mainly grasses. Elevation ranges from about 500 to 4,000 feet.

This unit makes up about 4 percent of the survey area.

Shortyork soils are moderately deep and well drained. They have a gravelly loam surface layer over a very gravelly clay loam subsoil that is underlain by fractured graywacke and schist. Slope ranges from 9 to 75 percent.

Yorkville soils are very deep and moderately well drained. They have a loam surface layer underlain by a clay, clay loam, and gravelly clay loam subsoil. Slope ranges from 9 to 50 percent.

Witherell soils are shallow and somewhat excessively drained. They have a sandy loam surface layer and subsoil over fractured sandstone. Slope ranges from 9 to 75 percent.

Of minor extent in this unit are Tyson and Yorktree soils.

This unit is used for livestock grazing and as watershed and wildlife habitat.

The Shortyork and Witherell soils are limited for production of forage by restricted available water capacity. The Yorkville soils are limited by the susceptibility to compaction by livestock when moist and by the instability of the slopes.

6. Hopland-Yorktree-Witherell

Shallow to deep, rolling to very steep, well drained and somewhat excessively drained loam and sandy loam

This map unit is on uplands near Hopland, Ukiah, Covelo, and Potter Valley. Elevation ranges from about 500 to 3,500 feet.

This unit makes up about 12 percent of the survey area.

Hopland soils are moderately deep and well drained. They have a loam surface layer over a loam and clay loam subsoil that is underlain by soft sandstone. Slope ranges from 15 to 75 percent.

Yorktree soils are deep and well drained. They have a loam surface layer over a gravelly loam, clay, and gravelly clay loam subsoil that is underlain by fractured graywacke. Slope ranges from 15 to 75 percent.

Witherell soils are shallow and somewhat excessively drained. They have a sandy loam surface layer and subsoil over fractured sandstone. Slope ranges from 9 to 75 percent.

Of minor extent in this unit are Cummiskey, Squawrock, and Woodin soils.

This unit is used mainly for firewood production and as watershed and recreation areas. The less sloping areas are used for homesite development. This unit supports sparse stands of plants suitable for use as forage.

Steepness of slope and, in some areas, restricted available water capacity are the main limitations of this unit.

Upland soils under brush

Two map units are in this group. They make up about 17 percent of the survey area.

7. Maymen-Etsel-Snook

Very shallow and shallow, hilly to very steep, somewhat excessively drained sandy loam and gravelly loam

This map unit is on uplands. Elevation ranges from about 1,000 to 4,000 feet.

This unit makes up about 14 percent of the survey area.

Maymen soils are shallow. They have a sandy loam surface layer and subsoil over hard, fractured sandstone. Slope ranges from 15 to 75 percent.

Etsel soils are very shallow. They have a gravelly loam and very gravelly loam surface layer over fractured sandstone. Slope ranges from 15 to 75 percent.

Snook soils are very shallow. They have a gravelly loam surface layer over fractured sandstone. Slope ranges from 30 to 75 percent.

Of minor extent in this unit are Mayacama, Neuns, and Woodin soils and Rock outcrop.

This unit is used mainly as watershed and wildlife habitat.

Restricted soil depth and restricted available water capacity are the main limitations of this unit.

8. Dingman-Beaughton-Henneke

Shallow and moderately deep, gently rolling to very steep, well drained gravelly loam and cobbly clay loam

This map unit is on uplands throughout the survey area. Elevation ranges from 500 to 3,800 feet.

This unit makes up about 3 percent of the survey area.

Dingman soils are moderately deep. They have a cobbly clay loam surface layer over a cobbly clay loam and gravelly clay subsoil that is underlain by weathered serpentine and peridotite. Slope ranges from 5 to 50 percent.

Beaughton soils are shallow. They have a gravelly loam surface layer over a gravelly clay and very gravelly clay subsoil that is underlain by fractured serpentine. Slope ranges from 5 to 50 percent.

Henneke soils are shallow. They have a gravelly loam surface layer over a very gravelly clay loam subsoil that is underlain by serpentine. Slope ranges from 15 to 75 percent.

Of minor extent in this unit are Maxwell, Maymen, Montara, and Yorkville soils.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

Restricted soil depth, restricted available water capacity, and low soil fertility because of the low ratio of calcium to magnesium are the main limitations of this unit.

Upland soils under forest

Six map units are in this group. They make up about 32 percent of the survey area.

9. Hopland-Sanhedrin-Kekawaka

Moderately deep to very deep, undulating to very steep, well drained loam and gravelly loam

This map unit is on uplands near Potter Valley and west of Ukiah. Elevation ranges from about 500 to 3,500 feet.

This unit makes up about 7 percent of the survey area.

Hopland soils are moderately deep. They have a loam surface layer over a loam and clay loam subsoil that is underlain by soft sandstone. Slope ranges from 15 to 75 percent.

Sanhedrin soils are deep. They have a gravelly loam surface layer over a gravelly loam and gravelly clay loam subsoil that is underlain by interbedded sandstone and siltstone. Slope ranges from 2 to 75 percent.

Kekawaka soils are very deep. They have a loam surface layer over a clay loam and clay subsoil. Slope ranges from 2 to 75 percent.

Of minor extent in this unit are deep Updegraff and Wohly soils.

This unit is used for firewood production, as watershed, as recreation areas, and for some timber production.

Steepness of slope, seasonal wetness, and the hazard of erosion are the main limitations of this unit.

10. Neuns-Bluenose-Tyson

Moderately deep and very deep, gently rolling to very steep, well drained very gravelly sandy loam and very gravelly loam

This map unit is on uplands along the Mendocino-Trinity County line and northeast of Potter Valley. Elevation ranges from about 2,500 to 5,922 feet.

This unit makes up about 6 percent of the survey area.

The Neuns soils are moderately deep. They have a very gravelly loam surface layer over a very gravelly sandy loam subsoil that is underlain by fractured sandstone. Slope ranges from 8 to 75 percent.

The Bluenose soils are very deep. They have a very gravelly sandy loam surface layer over a very gravelly sandy clay loam and very gravelly sandy loam subsoil. Slope ranges from 8 to 75 percent.

The Tyson soils are moderately deep. They have a very gravelly loam surface layer over a gravelly loam and very gravelly loam subsoil that is underlain by fractured shale. Slope ranges from 30 to 75 percent.

Of minor extent in this unit are Gudgrey and Updegraff soils.

Most areas of this unit are used for timber production and as watershed and wildlife habitat. Small areas are used for firewood production.

The main limitations for harvesting timber and firewood are steepness of slope, seasonal wetness, and the hazard of erosion.

11. Sanhedrin-Speaker-Kekawaka

Moderately deep to very deep, undulating to very steep, well drained loam and gravelly loam

This map unit is on uplands, mostly north of Willits. Elevation ranges from about 1,000 to 4,200 feet.

This unit makes up about 6 percent of the survey area.

Sanhedrin soils are deep. They have a gravelly loam surface layer over a gravelly loam and gravelly clay loam subsoil that is underlain by interbedded sandstone and siltstone. Slope ranges from 2 to 75 percent.

Speaker soils are moderately deep. They have a gravelly loam surface layer over a clay loam subsoil that is underlain by fractured sandstone. Slope ranges from 2 to 75 percent.

Kekawaka soils are very deep. They have a loam surface layer over a clay loam and clay subsoil. Slope ranges from 2 to 75 percent.

Of minor extent in this unit are Asabean, Nashmead, Neuns, Updegraff, Woodin, and Yorktree soils.

This unit is used for timber production, as watershed, as wildlife habitat, and for some firewood production.

Steepness of slope, seasonal wetness, and the hazard of erosion are the main limitations of this unit.

12. Casabonne-Wohly-Pardaloe

Moderately deep and deep, rolling to very steep, well drained loam and gravelly loam

This map unit is on uplands south of Yorkville and around Willits and Longvale. Elevation is about 500 to 3,000 feet.

This unit makes up about 6 percent of the survey area.

The Casabonne soils are deep. Typically, they have a loam surface layer underlain by a clay loam and gravelly clay loam subsoil. The substratum is gravelly clay loam over soft sandstone. Slope ranges from 9 to 75 percent.

The Wohly soils are moderately deep. They have a loam surface layer over a gravelly clay loam subsoil that is underlain by fractured sandstone. Slope ranges from 9 to 75 percent.

The Pardaloe soils are deep. They have a gravelly loam surface layer over a very gravelly sandy loam and very gravelly loam subsoil that is underlain by fractured siltstone. Slope ranges from 30 to 75 percent.

Of minor extent in this unit are Bearwallow, Etsel, Hellman, Maymen, and Snook soils.

This unit is used for timber production and as watershed and wildlife habitat.

Steepness of slope, seasonal wetness, and the hazard of erosion are the main limitations of this unit.

13. Pardaloe-Wohly-Holohan

Moderately deep to very deep, rolling to very steep, well drained loam, gravelly loam, and very gravelly sandy loam

This map unit is on uplands north of Laytonville. Elevation is about 500 to 4,000 feet.

This unit makes up about 6 percent of the survey area.

The Pardaloe soils are deep. They have a gravelly loam surface layer over a very gravelly sandy loam and very gravelly loam subsoil that is underlain by fractured siltstone. Slope ranges from 30 to 75 percent.

The Wohly soils are moderately deep. They have a loam surface layer over a gravelly clay loam subsoil that is underlain by fractured sandstone. Slope ranges from 9 to 75 percent.

The Holohan soils are very deep. They have a very gravelly sandy loam surface layer over a very cobbly loam and very gravelly sandy loam subsoil. The substratum is extremely gravelly loamy sand and is underlain by fractured sandstone. Slope ranges from 9 to 75 percent.

Of minor extent in this unit are Casabonne, Hollowtree, Kekawaka, and Woodin soils.

This unit is used for timber production and as watershed and wildlife habitat. Small areas are used for firewood production.

Steepness of slope, seasonal wetness, and the hazard of erosion are the main limitations of this unit.

14. Asabean-Sanhedrin-Speaker

Moderately deep to very deep, hilly to very steep, well drained gravelly loam

This map unit is on uplands north of the North Fork of the Eel River, in the southwestern part of Trinity County, and north of Willits. Elevation ranges from about 2,500 to 4,200 feet.

This unit makes up about 1 percent of the survey area.

The Asabean soils are very deep. They have a gravelly loam surface layer over a very gravelly loam, very gravelly sandy clay loam, and very gravelly sandy loam subsoil. Slope ranges from 15 to 75 percent.

The Sanhedrin soils are deep. They have a gravelly loam surface layer over a gravelly loam and gravelly clay loam subsoil that is underlain by interbedded sandstone and siltstone. Slope ranges from 15 to 75 percent.

The Speaker soils are moderately deep. They have a gravelly loam surface layer over a clay loam subsoil that is underlain by fractured sandstone. Slope ranges from 30 to 75 percent.

Of minor extent in this unit are Etsel, Maymen, Squawrock, Witherell, Woodin, and Yorkville soils.

This unit is used for timber production, as watershed and wildlife habitat, and for some firewood production.

Steepness of slope, seasonal wetness, and the hazard of erosion are the main limitations of this unit.

Upland soils under forest influenced by coastal fog

One map unit is in this group. It makes up about 3 percent of the survey area.

15. Ornbaun-Zeni-Yellowhound

Moderately deep and deep, rolling to very steep, well drained loam and very gravelly loam

This map unit is on uplands along the western boundary of the survey area. It is influenced by coastal fog, which produces a climate that supports redwoods. Elevation ranges from about 500 to 2,500 feet.

This unit makes up about 3 percent of the survey area.

The Ornbaun soils are deep. They have a loam surface layer over a gravelly clay loam subsoil that is underlain by sandstone. Slope ranges from 9 to 75 percent.

The Zeni soils are moderately deep. They have a loam surface layer over a clay loam subsoil that is underlain by soft sandstone. Slope ranges from 9 to 75 percent.

The Yellowhound soils are deep. They have a very gravelly loam surface layer and subsoil. The substratum is extremely gravelly sandy clay loam and is underlain by strongly weathered conglomerate. Slope ranges from 30 to 75 percent.

Of minor extent in this unit are Frenchman, Gschwend, and Kibesillah soils.

This unit is used for timber production and as watershed and wildlife habitat.

Steepness of slope is the main limitation of this unit.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

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

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Cole loam, drained, 2 to 5 percent slopes, is one of several phases in the Cole series.

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

A *complex* consists of two or more soils or

miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Yokayo-Pinole-Pinnobie complex, 0 to 15 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Etsel-Rock outcrop-Neuns association, 30 to 75 percent slopes, is an example.

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

This survey was mapped at two levels of detail. At the most detailed level, map units are narrowly defined. This means that map unit boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Boundaries were plotted and verified at wider intervals. The broadly defined units are indicated by an asterisk in the map legend. The detail of mapping was selected to meet the anticipated long-term use of the survey, and the map units were designed to meet the needs for that use.

Table 3 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

101—Asabean-Sanhedrin gravelly loams, 15 to 30 percent slopes. This map unit is on ridgetops and side slopes of hills and mountains. The native vegetation is mainly conifers and scattered oaks. Elevation is 2,500 to 4,200 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 50 percent Asabean gravelly loam and 35 percent Sanhedrin gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Neuns, Speaker, and Updegraff soils. Also included are areas of Asabean and Sanhedrin soils that have slopes of less than 15 percent, small areas of soils in Trinity County that have base saturation of less than 35 percent in the subsoil, and small areas of poorly drained soils. Included areas make up about 15 percent of the total acreage.

The Asabean soil is very deep and well drained. It formed in material derived dominantly from sandstone, metasedimentary rock, or chert. Typically, the surface is covered with a mat of decomposed and undecomposed leaves, needles, and twigs about 2 inches thick. The surface layer is brown gravelly loam about 9 inches thick. The upper 28 inches of the subsoil is reddish yellow very gravelly loam over very gravelly sandy clay loam, and the lower 27 inches is very pale brown very gravelly sandy loam. In some areas the subsoil is cobbly.

Permeability of the Asabean soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, California black oak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 122 on the Asabean soil and 125 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 129 on the Asabean soil and 121 on the Sanhedrin soil. The potential annual production from a fully stocked stand of ponderosa pine is 685 board feet per acre on the Asabean soil and 585 board feet on the Sanhedrin soil. Among the trees of limited extent are sugar pine, Oregon white oak, canyon live oak, and white fir.

The main limitation for the harvesting of timber is

seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts and can damage the roots of trees. Unsurfaced roads and skid trails on the Sanhedrin soil are slippery when wet, and they may be impassable during rainy periods. Roads on the Sanhedrin soil are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber on this unit. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are poison oak, reed fescue, gooseberry, and bedstraw.

This map unit is in capability unit IVe-1 (5), nonirrigated.

102—Asabean-Sanhedrin-Speaker gravelly loams, 30 to 50 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly conifers and scattered oaks. Elevation is 2,500 to 4,200 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 45 percent Asabean gravelly loam, 25 percent Sanhedrin gravelly loam, and 15 percent Speaker gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Casabonne, Neuns, and Wohly soils. Also included are small areas of soils that have slopes of less than 30 percent or more than 50 percent and are in drainageways and small areas of soils in Trinity County that have base saturation of less than 35 percent in the subsoil. Included areas make up about 15 percent of the total acreage.

The Asabean soil is very deep and well drained. It formed in material derived dominantly from sandstone, metasedimentary rock, or chert. Typically, the surface is covered with a mat of decomposed and undecomposed leaves, needles, and twigs about 2 inches thick. The surface layer is brown gravelly loam about 9 inches thick. The upper 28 inches of the subsoil is reddish yellow very gravelly loam over very gravelly sandy clay loam, and the lower 27 inches is very pale brown very gravelly sandy loam. In some areas the subsoil is cobbly.

Permeability of the Asabean soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate to high.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate to high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as watershed and wildlife habitat.

Douglas fir, ponderosa pine, California black oak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 122 on the Asabean soil, 125 on the Sanhedrin soil, and 107 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 129 on the Asabean soil, 121 on the Sanhedrin soil, and 106 on the Speaker soil. The potential annual production from a fully stocked stand of ponderosa pine is 685 board feet per acre on the Asabean soil, 585 board feet on the Sanhedrin soil, and 425 board feet on the Speaker soil. Among the

trees of limited extent are sugar pine, Oregon white oak, canyon live oak, and white fir.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber on this unit. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are poison oak, reed fescue, gooseberry, and bedstraw.

This map unit is in capability subclass VIe (5), nonirrigated.

103—Asabean-Speaker-Neuns complex, 50 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly conifers and scattered oaks. Elevation is 2,500 to 4,200 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 40 percent Asabean gravelly loam, 20 percent Speaker gravelly loam, and 20 percent Neuns very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Maymen, Sanhedrin, Updegraff, Woodin, and Yorktree soils and Rock outcrop. Also included are small areas of soils in Trinity County that have less than 35 percent base saturation in the subsoil and soils that are similar to the Neuns soil but are less than 20 inches deep to bedrock. Included areas make up about 20 percent of the total acreage.

The Asabean soil is very deep and well drained. It formed in material derived dominantly from sandstone, metasedimentary rock, or chert. Typically, the surface is covered with a mat of decomposed and undecomposed leaves, needles, and twigs about 2 inches thick. The surface layer is brown gravelly loam about 9 inches thick. The upper 28 inches of the subsoil is reddish yellow very gravelly loam over very gravelly sandy clay loam, and the lower 27 inches is very pale brown very gravelly sandy loam. In some areas the subsoil is cobbly.

Permeability of the Asabean soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown over very pale brown gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as watershed and wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 122 on the Asabean soil, 107 on the Speaker soil, and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is

129 on the Asabean soil, 106 on the Speaker soil, and 106 on the Neuns soil. The potential annual production from a fully stocked stand of ponderosa pine is 685 board feet per acre on the Asabean soil, 425 board feet on the Speaker soil, and 425 board feet on the Neuns soil. Among the trees of limited extent are sugar pine, Pacific madrone, and tanoak.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails on the Speaker soil are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Rocks and loose soil material may slide onto roads on the Asabean and Neuns soils, increasing the need for road maintenance. Establishing plant cover on steep cuts and fills reduces erosion on the Speaker soil. Revegetation of exposed subsoil material is difficult on the Neuns soil because of the large amount of coarse fragments in the subsoil.

Plant competition is a concern in the production of timber on this unit. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes of the Asabean and Neuns soils. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. Loose material on the surface may move down the slope and reduce seedling survival in the steeper areas of the Neuns soil.

Among the common forest understory plants are bedstraw, perennial fescue, brackenfern, and princes pine.

This map unit is in capability subclass VIIe (5), nonirrigated.

104—Bearwallow-Hellman loams, 15 to 30 percent slopes. This map unit is on rolling, unstable side slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 40 percent Bearwallow loam and 30 percent Hellman loam. The Bearwallow soil is on plane to convex slopes, and the Hellman soil is on concave slopes and in drainageways. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Hopland, Maymen, Squawrock, Witherell, Yorktree, and Yorkville soils. Also included are small areas of Bearwallow and Hellman soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 30 percent of the total acreage.

The Bearwallow soil is moderately deep and well drained. It formed in material weathered from soft sandstone or shale. Typically, the surface layer is reddish yellow loam about 8 inches thick. The subsoil is reddish yellow loam about 27 inches thick over fractured, soft sandstone. Depth to soft sandstone ranges from 20 to 40 inches.

Permeability of the Bearwallow soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Hellman soil is very deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown and strong brown loam about 14 inches thick. The upper 37 inches of the subsoil is brown, strong brown, reddish yellow, and yellowish red gravelly clay loam, and the lower 21 inches is reddish yellow and strong brown clay. Sandstone is at a depth of 72 inches.

Permeability of the Hellman soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used mainly for livestock grazing and as recreation areas, watershed, and wildlife habitat. It is also used for homesite development.

This unit has few limitations for the production of forage. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The characteristic plant community on this unit is mainly wild oat, soft chess, and filaree.

This unit is poorly suited to homesite development. It is susceptible to slumping, and disturbing the soil increases the risk. If this unit is used for septic tank absorption fields, the limitation of restricted permeability

can be overcome by increasing the size of the absorption field and using low volume flush toilets. Buildings and roads should be designed to offset the effects of shrinking and swelling.

This map unit is in capability unit IVe-1 (15), nonirrigated.

105—Bearwallow-Hellman-Witherell complex, 30 to 50 percent slopes. This map unit is on unstable side slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 35 percent Bearwallow loam, 25 percent Hellman loam, and 15 percent Witherell sandy loam. The Bearwallow soil is on convex slopes, the Hellman soil is on concave slopes, and the Witherell soil is on convex slopes and spur ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Hopland, Maymen, Squawrock, Yorktree, and Yorkville soils and Rock outcrop. Also included are small areas of Bearwallow, Hellman, and Witherell soils that have slopes of more than 50 percent or less than 30 percent. Included areas make up about 25 percent of the total acreage.

The Bearwallow soil is moderately deep and well drained. It formed in material weathered from soft sandstone or shale. Typically, the surface layer is reddish yellow loam about 8 inches thick. The subsoil is reddish yellow loam about 27 inches thick over fractured, soft sandstone. Depth to soft sandstone ranges from 20 to 40 inches.

Permeability of the Bearwallow soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Hellman soil is very deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown and strong brown loam about 14 inches thick. The upper 37 inches of the subsoil is brown, strong brown, reddish yellow, and yellowish red gravelly clay loam, and the lower 21 inches is reddish yellow and strong brown clay. Sandstone is at a depth of 72 inches.

Permeability of the Hellman soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick over yellowish brown sandy loam 5 inches thick. The subsoil is reddish yellow sandy loam 5 inches thick. Fractured sandstone is at a depth of 12 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for livestock grazing and as recreation areas, watershed, and wildlife habitat (fig. 2).

The production of forage on this unit is limited by the very low available water capacity and shallow rooting depth of the Witherell soil. The Bearwallow and Hellman soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding on these soils is steepness of slope. Seeding and fertilization should be done by aerial application. Rangeland seeding generally is not practical on the Witherell soil.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. The characteristic plant community on this unit is mainly wild oat, soft chess, and filaree.

This map unit is in capability subclass VIe (15), nonirrigated.

106—Bluenose-Neuns-Gudgrey complex, 8 to 30 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oaks. Elevation is 2,500 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 40 percent Bluenose very gravelly sandy loam, 25 percent Neuns very gravelly loam, and 15 percent Gudgrey gravelly sandy clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey,

Figure 2.—An area of Bearwallow-Hellman-Witherell complex, 30 to 50 percent slopes, used for range.

Etsel, and Tyson soils. Also included are areas of soils that are similar to the Gudgrey soil but have a very gravelly subsoil and soils in areas where the average annual air temperature is less than 47 degrees. Included areas make up about 20 percent of the total acreage.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches is yellowish brown very gravelly sandy loam. In some areas the subsoil is very gravelly or gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Gudgrey soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface is covered with a mat of decomposing pine needles, bark, and twigs about 1.5 inches thick. The surface layer is gray gravelly sandy clay loam about 28 inches thick. The upper 11 inches of the subsoil is light brownish gray gravelly clay loam, and the lower 19 inches is variegated light gray and yellowish brown gravelly clay loam. The substratum to a depth of 70 inches is gray gravelly sandy clay loam.

Permeability of the Gudgrey soil is moderate.

Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 129 on the Bluenose soil, 113 on the Neuns soil, and 131 on the Gudgrey soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 120 on the Bluenose soil, 106 on the Neuns soil, and 144 on the Gudgrey soil. The potential annual production from a fully stocked stand of ponderosa pine is 570 board feet per acre on the Bluenose soil, 425 board feet on the Neuns soil, and 905 board feet on the Gudgrey soil. Among the trees of limited extent are sugar pine, white fir, bigleaf maple, and Pacific madrone.

The main limitation for the harvesting of timber is seasonal wetness. Unsurfaced roads and skid trails on the Gudgrey soil are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Roads on the Gudgrey soil are dusty when dry. Surface treatment may be desirable during periods of heavy use.

Seedling survival is a concern in the production of timber on the Bluenose and Neuns soils. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Plant competition is a concern on this unit. When openings are made in the canopy, invading plants can prevent the establishment of planted or natural seedlings, especially on the Gudgrey soil. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings on this unit. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are rose, snowberry, poison oak, and scattered perennial grasses.

This map unit is in capability unit IVs-4 (5), nonirrigated.

107—Bluenose-Neuns-Gudgrey complex, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oaks. Elevation is 2,500 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 40 percent Bluenose very gravelly sandy loam, 25 percent Neuns very gravelly loam, and 15 percent Gudgrey gravelly sandy clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Etsel, Tyson, Updegraff, Yorktree, and Yorkville soils. Also included are soils in areas where the average annual air temperature is less than 47 degrees and soils that are similar to the Gudgrey soil but have a very gravelly subsoil. Included areas make up about 20 percent of the total acreage.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches is yellowish brown very gravelly sandy loam. In some areas the subsoil is very gravelly or gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Gudgrey soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface is covered with a mat of decomposing pine needles, bark, and twigs about 1.5 inches thick. The surface layer is gray gravelly sandy clay loam about 28 inches thick. The upper 11 inches of the subsoil is light brownish gray gravelly clay loam, and the lower 19 inches is variegated light gray and yellowish brown gravelly clay loam. The substratum to a depth of 70 inches is gray gravelly sandy clay loam.

Permeability of the Gudgrey soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 129 on the Bluenose soil, 113 on the Neuns soil, and 131 on the Gudgrey soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 120 on the Bluenose soil, 106 on the Neuns soil, and 144 on the Gudgrey soil. The potential annual production from a fully stocked stand of ponderosa pine is 570 board feet per acre on the Bluenose soil, 425 board feet on the Neuns soil, and 905 board feet on the Gudgrey soil. Among the trees of limited extent are sugar pine, white fir, bigleaf maple, and Pacific madrone.

The main limitations for the harvesting of timber are seasonal wetness, steepness of slope, and restricted available water capacity in some areas. Unsurfaced roads and skid trails on the Gudgrey soil are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads commonly is available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on this unit. Revegetation of cuts on the Neuns soil is difficult because of the restricted available water capacity and the high content of coarse fragments.

Seedling survival is a concern in the production of timber on the Bluenose and Neuns soils. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Plant competition is a concern on this unit. When openings are made in the canopy, invading plants can prevent the establishment of planted or natural seedlings, especially on the Gudgrey soil. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are rose, snowberry, poison oak, and scattered perennial grasses.

This map unit is in capability subclass VIe (5), nonirrigated.

108—Bluenose-Neuns-Gudgrey complex, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oaks. Elevation is 2,500 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 35 percent Bluenose very gravelly sandy loam, 35 percent Neuns very gravelly loam, and 15 percent Gudgrey gravelly sandy clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Etsel, Tyson, Updegraff, Yorktree, and Yorkville soils. Also included are small areas of soils in areas where the average air temperature is less than 47 degrees and soils that are similar to the Gudgrey soil but have a very gravelly subsoil. Included areas make up about 15 percent of the total acreage.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches is yellowish brown very gravelly sandy loam. In some areas the subsoil is very gravelly or gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Gudgrey soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface is covered with a mat of decomposing pine needles, bark, and twigs about 1.5 inches thick. The surface layer is gray gravelly sandy clay loam about 28 inches thick. The upper 11 inches of the subsoil is light brownish gray

gravelly clay loam, and the lower 19 inches is variegated light gray and yellowish brown gravelly clay loam. The substratum to a depth of 70 inches is gray gravelly sandy clay loam.

Permeability of the Gudgrey soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 129 on the Bluenose soil, 113 on the Neuns soil, and 131 on the Gudgrey soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 120 on the Bluenose soil, 106 on the Neuns soil, and 144 on the Gudgrey soil. The potential annual production from a fully stocked stand of ponderosa pine is 570 board feet per acre on the Bluenose soil, 425 board feet on the Neuns soil, and 905 board feet on the Gudgrey soil. Among the trees of limited extent are sugar pine, white fir, bigleaf maple, and Pacific madrone.

The main limitation for the harvesting of timber is steepness of slope, which limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unsurfaced roads and skid trails on the Gudgrey soil are slippery when wet, and they may be impassable during rainy periods. Roads on the Gudgrey soil are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is available in areas of this unit. Rocks and loose soil material may slide down road cuts on the Bluenose and Neuns soils, increasing the need for road maintenance. Establishing plant cover on steep cuts and fills reduces erosion on this unit.

Seedling survival is a concern in the production of timber on the Bluenose and Neuns soils. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Plant competition is a concern on this unit. When openings are made in the canopy, invading plants can prevent the establishment of planted or natural seedlings, especially on the Gudgrey soil. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are rose, snowberry, poison oak, and scattered perennial grasses.

This map unit is in capability subclass VIIe (5), nonirrigated.

109—Casabonne-Wohly loams, 9 to 30 percent slopes. This map unit is on ridgetops of hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 55 percent Casabonne loam and 30 percent Wohly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Hellman, Hopland, Pardaloe, and Woodin soils. Also included are small areas of Casabonne and Wohly soils that have slopes of less than 9 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

The Casabonne soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is reddish yellow loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Casabonne soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

The Wohly soil is moderately deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Most areas of this unit are used for timber production and as watershed and wildlife habitat. A few areas are

used for livestock grazing and homesite development.

Douglas fir, tanoak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 153 on the Casabonne soil and 118 on the Wohly soil. The potential annual production from a fully stocked stand of Douglas fir is 750 board feet per acre on the Casabonne soil and 420 board feet on the Wohly soil. Among the trees of limited extent are redwood and ponderosa pine.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants can prevent the establishment of planted or natural seedlings. Reforestation can be accomplished by planting Douglas fir, redwood, or ponderosa pine seedlings on south-facing slopes. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs infrequently. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes of the Wohly soil. Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial bromes and fescues.

Desirable forage species such as hardinggrass and soft chess grow well in previously wooded areas that have been cleared and seeded; however, the soils in this unit retain their tendency to produce woody species. Grass is difficult to maintain in most areas.

This unit is poorly suited to homesite development. The main limitations are the steepness of slope, low soil strength, and hazard of erosion. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. Revegetating disturbed areas around construction sites helps to control erosion.

This map unit is in capability unit IVe-1 (5), nonirrigated.

110—Casabonne-Wohly loams, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 50 percent Casabonne loam and 30 percent Wohly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Hellman, Hopland, Pardaloe, and Woodin soils. Also included are small areas of Casabonne and Wohly that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The Casabonne soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is reddish yellow loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. In some areas the surface layer is gravelly loam or is darker in color. Depth to soft bedrock ranges from 40 to 60 inches.

Permeability of the Casabonne soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for timber production and as wildlife habitat. A few areas are used for livestock grazing and homesite development.

Douglas fir, tanoak, and madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 153 on the Casabonne soil and 118 on the Wohly soil. The potential annual production from a fully stocked stand of Douglas fir is 750 board feet per acre on the

Casabonne soil and 420 board feet on the Wohly soil. Among the trees of limited extent are redwood and ponderosa pine.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants can prevent the establishment of planted or natural seedlings. Reforestation can be accomplished by planting Douglas fir, redwood, or ponderosa pine seedlings on south aspects. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs infrequently. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes of the Wohly soil.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial bromes and fescues.

Desirable forage species such as hardinggrass and soft chess grow well in previously wooded areas that have been cleared and seeded; however, the soils in this unit retain their tendency to produce woody species. Grass is difficult to maintain in most areas.

This unit is poorly suited to homesite development. The main limitations are the steepness of slope, low soil strength, and hazard of erosion. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. Revegetating disturbed areas around construction sites helps to control erosion.

This map unit is in capability subclass VIe (5), nonirrigated.

111—Casabonne-Wohly-Pardaloe complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 700 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 40 percent Casabonne gravelly loam, 30 percent Wohly loam, and 15 percent Pardaloe gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Witherell, and Woodin soils. Also included are small areas of Casabonne, Wohly, and Pardaloe soils that have slopes of less than 50 percent or more than 75 percent. Included areas make up about 15 percent of the total acreage.

The Casabonne soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. In some areas the surface layer is loam. Depth to soft bedrock ranges from 40 to 60 inches.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Pardaloe soil is deep and well drained. It formed in material weathered from sandstone, siltstone, or shale. Typically, the surface is covered with a mat of conifer needles, oak leaves, and twigs about 0.5 inch thick. The surface layer is dark yellowish brown gravelly loam about 10 inches thick. The upper 17 inches of the subsoil is pale brown very gravelly sandy loam, and the lower part to a depth of 58 inches is light yellowish brown very gravelly loam. Fractured siltstone is at a

depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is very gravelly loam or gravelly sandy loam.

Permeability of the Pardaloe soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as watershed and wildlife habitat.

Douglas fir and tanoak are the main tree species on this unit. Among the trees of limited extent are California black oak, Pacific madrone, and redwood. On the basis of a 100-year site curve, the mean site index for Douglas fir is 144 on the Casabonne soil, 118 on the Wohly soil, and 122 on the Pardaloe soil. The potential annual production from a fully stocked stand of Douglas fir is 665 board feet per acre on the Casabonne soil and 420 board feet on the Wohly soil. The potential annual production from a fully stocked stand of Douglas fir on the Pardaloe soil is 455 board feet per acre; however, it commonly is difficult to achieve a fully stocked stand of trees on this soil.

The main limitations for the harvesting of timber are the steepness of slope and hazard of erosion. When harvesting timber, steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails on the Casabonne and Wohly soils are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on the Casabonne and Wohly soils. Revegetation of exposed subsoil material is difficult on the Pardaloe soil because of the amount of coarse fragments. Roads may fail and landslides may occur following deep soil disturbance.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir, redwood, and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs infrequently. The high soil temperature and limited soil moisture during the growing season increase the mortality rate of seedlings, especially on the south- and southwest-facing slopes of the Wohly and Pardaloe soils.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial bromes and fescues.

This map unit is in capability subclass VIIe (5), nonirrigated.

112—Clear Lake clay, 0 to 2 percent slopes. This very deep, poorly drained soil is in basins. It formed in fine textured alluvium derived dominantly from sedimentary rock. It is protected from flooding. In some areas the water table has been lowered by stream entrenchment. The vegetation in areas not cultivated is mainly annual grasses and water tolerant plants. Elevation is 400 to 1,400 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 225 days.

Typically, the surface layer is dark grayish brown over very dark gray clay about 25 inches thick. The upper 24 inches of the substratum is grayish brown clay, and the lower part to a depth of 60 inches or more is very dark grayish brown clay loam. In some areas the surface layer is clay loam or silty clay loam, the substratum is redder in color, or the profile is slightly calcareous.

Included in this unit are small areas of Cole loam, drained; Cole loam; and Feliz and Gielow soils. Also included are small areas of soils in Little Lake Valley that are subject to flooding. In the Laytonville area, this unit is mapped at elevations of as much as 1,700 feet, rainfall is higher, and soil temperature is lower. Included areas make up about 15 percent of the total acreage.

Permeability of this Clear Lake soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is ponded, and the hazard of erosion is slight. Where the water table has not been lowered by stream entrenchment, it is at a depth of 18 to 36 inches from December to March. The shrink-swell potential is high.

This unit is used mainly for orchards, vineyards, hay, and pasture. Some areas are used for homesite development.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by the slow permeability and seasonal wetness. Crops that can tolerate wetness in winter should be selected. Climatically adapted crops that require good drainage can be grown if a properly designed tile drainage system is installed. In summer, irrigation is needed for maximum production of most

crops. Sprinkler irrigation is the most suitable method of applying water. Because of the slow permeability of the soil in this unit, the application of water should be regulated so that water does not stand on the surface and damage the crops.

This unit is suited to hay and pasture. The main limitations are the slow permeability and the seasonal high water table. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

If this unit is used for homesite development, the main limitations are low soil strength, seasonal wetness, slow permeability, and high shrink-swell potential. Surface drainage is needed for roads and building foundations. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If the soil is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets.

This map unit is in capability units IIw-3 (14), irrigated, and IIIw-3 (14), nonirrigated.

113—Cole loam, drained, 0 to 2 percent slopes. This very deep, somewhat poorly drained soil is on alluvial plains and fans. It formed in recent alluvium derived dominantly from sedimentary rock. The water table has been lowered by artificial drainage or stream entrenchment. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 350 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is grayish brown loam 15 inches thick over clay loam about 5 inches thick. The subsoil is grayish brown and brown clay loam to a depth of 60 inches or more. In some areas the surface layer is clay loam, silt loam, or silty clay loam throughout. Some pedons have less than 35 percent clay in the subsoil. In the Covelo area and along the Russian River, there are some areas where the soil has a sandy loam overwash as much as 12 inches thick.

Included in this unit are areas of Russian soils and, in Little Lake and Round Valleys, soils that have narrow bands of gravel and are present in as much as 3 percent of the unit. Also included are small areas of poorly drained Cole soils, more rapidly permeable soils that have lenses of coarse textured material in the subsoil, and droughtier soils that have a very gravelly substratum. Included areas make up about 15 percent of the total acreage.

Permeability of this Cole soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for orchards, vineyards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by slow permeability. Sprinkler irrigation is best suited to this unit, and its use helps to protect vineyards from frost. Irrigation water needs to be applied carefully to prevent the buildup of a high water table. Because of the short frost-free season in the Covelo and Laytonville areas, grapes commonly are not grown in these areas.

This unit is suited to hay and pasture. Grazing or using heavy equipment when the soil is moist results in compaction of the surface layer.

If this unit is used for homesite development, the main limitations are low soil strength, high shrink-swell potential, and slow permeability. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Surface drainage is needed for roads and building foundations. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. Buildings and roads can be designed to offset the effects of shrinking and swelling.

This map unit is in capability units IIs-3 (14), irrigated, and IIIs-3 (14), nonirrigated.

114—Cole loam, drained, 2 to 5 percent slopes. This very deep, somewhat poorly drained soil is on alluvial plains and fans. It formed in recent alluvium derived dominantly from sedimentary rock. The water table has been lowered by artificial drainage or stream entrenchment. The vegetation in areas not cultivated is mainly annual grasses and forbs with scattered oaks. Elevation is 500 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is grayish brown loam 15 inches thick over clay loam about 5 inches thick. The subsoil is grayish brown and brown clay loam to a depth of 60 inches or more. In some areas the surface layer is clay loam, silt loam, or silty clay loam throughout or the subsoil has less than 35 percent clay. In some places in the Covelo area, the soil has a sandy loam overwash as much as 10 inches thick.

Included in this unit are areas of Russian soils. Also included are small areas of soils in alluvial valleys where elevation is more than 1,500 feet, rainfall is higher, and soil temperature is lower. Included areas make up about 15 percent of the total acreage.

Permeability of this Cole soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for orchards, vineyards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by slow permeability. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is best suited to this unit, and its use helps to protect vineyards from frost. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil and by using minimum tillage. Cover crops also help to prevent crusting of the surface and increase the water intake rate. Cover crops should be managed by mowing instead of tillage to reduce water erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. It has few limitations. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

If this unit is used for homesite development, the main limitations are low soil strength, high shrink-swell potential, and slow permeability. Surface drainage is needed for roads and building foundations. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. Buildings and roads can be designed to offset the effects of shrinking and swelling.

This map unit is in capability units IIe-3 (14), irrigated, and IIIe-3 (14), nonirrigated.

115—Cole clay loam, 0 to 2 percent slopes. This very deep, somewhat poorly drained soil is on alluvial plains and in basins. It formed in recent alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is dark grayish brown clay loam about 8 inches thick. The upper 19 inches of the subsoil is dark gray clay loam over dark grayish brown clay, and the lower 14 inches is mottled, brown clay loam. The substratum to a depth of 60 inches or more is mottled, grayish brown silty clay loam. In some areas the surface layer is loam or gravelly sandy loam. In some areas the subsoil is less than 35 percent clay or is stratified with sandier layers.

Included in this unit are small areas of Clear Lake soils and Cole soils that are poorly drained and have a water table at a depth of less than 18 inches. In Little Lake and Round Valleys, there are narrow bands of gravel in the soils in as much as 3 percent of the unit. Also included are small areas of soils in alluvial valleys where elevation is more than 1,500 feet, rainfall is higher, and soil temperature is lower. Included areas make up about 5 percent of the total acreage.

Permeability of this Cole soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is ponded, and the hazard of erosion is slight. A high water table is at a depth of 18 to 36 inches year round.

This unit is used for orchards, vineyards, and hay and pasture.

This unit is poorly suited to irrigated orchards and vineyards. It is limited mainly by the high water table and slow permeability. Drainage is needed to improve production. Subsurface drainage can be used to lower the water table if a suitable outlet is available. Sprinkler irrigation is best suited to this unit, and its use helps to protect vineyards from frost. Because of the slow permeability of the soil in this unit, the application of water should be regulated so that water does not stand on the surface and damage the crops.

This unit is suited to hay and pasture. The main limitation is the high water table. Grazing or the use of heavy equipment when the soil is moist results in compaction of the surface layer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

This map unit is in capability unit IIIw-2 (14), irrigated and nonirrigated.

116—Cummiskey gravelly loam, 30 to 75 percent slopes. This very deep, well drained soil is on hills and mountains. It formed in material derived dominantly

from metasedimentary rock. The native vegetation is mainly oaks, annual grasses, and brush. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface is covered with a mat of leaves and twigs about 1 inch thick. The surface layer is weak red gravelly loam about 19 inches thick. The upper 6 inches of the subsoil is weak red gravelly clay loam, the next 23 inches is weak red and pale red very gravelly clay loam, and the lower part to a depth of 60 inches or more is weak red gravelly clay.

Included in this unit are small areas of Hopland, Sanhedrin, Squawrock, Witherell, and Yorkville soils and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of the Cummiskey soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly as wildlife habitat, watershed, and recreation areas. It is also used for firewood production and as a source of gravel for road construction.

California black oak, Oregon white oak, and Pacific madrone are the main tree species on this unit. Among the trees of limited extent is Douglas fir. This unit can produce about 60 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is steepness of slope. Wheeled and tracked equipment can be used only in the less sloping areas. Rock for construction of roads is readily available in areas of this unit. Revegetation of exposed subsoil material is difficult because of the content of coarse fragments. Rocks and loose soil material may slide onto roads in the steeper areas, increasing the need for road maintenance.

Plantings on this unit have little chance of survival because of the high soil temperature in summer and the large amount of coarse fragments on the surface. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done in December through May.

Among the common forest understory plants are wild oat, poison oak, bedstraw, and blue wildrye.

This map unit is in capability subclass VIIe (5), nonirrigated.

117—Dingman-Beaughton complex, 5 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral and mixed cypress-pine woodland. Elevation is 1,500 to 3,800 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 125 to 200 days.

This unit is 45 percent Dingman cobbly clay loam and 40 percent Beaughton gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Maxwell, Maymen, Montara, Sanhedrin, Shortyork, and Yorkville soils and soils that are similar to the Dingman soil but are 40 to 60 inches deep. Also included are small areas of Dingman and Beaughton soils that have slopes of less than 5 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Dingman soil is moderately deep and well drained. It formed in material derived dominantly from serpentinite and peridotite. Typically, the surface layer is dark reddish gray cobbly clay loam about 5 inches thick. The upper 9 inches of the subsoil is dark reddish gray cobbly clay loam, and the lower 12 inches is dark reddish brown gravelly clay. Strongly weathered serpentinite and peridotite are at a depth of 26 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Dingman soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The calcium-to-magnesium ratio is 1:1 or less.

The Beaughton soil is shallow and well drained. It formed in material derived dominantly from serpentinitic rock. Typically, the surface layer is dark reddish brown gravelly loam about 4 inches thick. The subsoil is dark reddish brown gravelly clay about 6 inches thick over very gravelly clay about 6 inches thick. Serpentinitic rock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of this Beaughton soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The calcium-to-magnesium ratio is 1:1 or less.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly brush because of the limited soil depth, limited available water capacity, low soil fertility caused by the ratio of calcium to magnesium, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat,

increases wildlife access and water production, and reduces the risk of wildfire. Conifer stands commonly are small and widely scattered. Harvesting of trees for timber or firewood usually is not economically feasible.

This map unit is in capability subclass VIIe (5), nonirrigated.

118—Dunsmuir-Maymen Variant complex, 5 to 15 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly knobcone pine and chaparral with scattered ponderosa pine and Douglas fir. Elevation is 1,000 to 3,600 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 40 percent Dunsmuir loam and 30 percent Maymen Variant clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Casabonne, Cummiskey, Dingman, Etsel, Kekawaka, Sanhedrin, and Wohly soils. Also included are small areas of soils that are similar to the Dunsmuir soil but have a very gravelly subsoil or are 20 to 40 inches deep and small areas of Dunsmuir and Maymen Variant soils that have slopes of less than 5 percent or more than 15 percent. Included areas make up about 30 percent of the total acreage.

The Dunsmuir soil is deep and well drained. It formed in material derived dominantly from metasedimentary rock. Typically, the surface layer is variegated yellowish red and dark yellowish brown loam about 5 inches thick. The upper 6 inches of the subsoil is yellowish red clay loam, and the lower 34 inches is red gravelly clay loam. Soft bedrock is at a depth of 45 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam or clay.

Permeability of the Dunsmuir soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Maymen Variant soil is shallow and well drained. It formed in material derived dominantly from metasedimentary rock. Typically, the surface layer is yellowish red clay loam about 2 inches thick. The subsoil is yellowish red clay and clay loam about 11 inches thick. Soft, fractured metasedimentary rock is at a depth of 13 inches. Depth to soft bedrock ranges from 10 to 20 inches.

Permeability of the Maymen Variant soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for recreation and as wildlife habitat. A few areas are used for timber and firewood production.

Knobcone pine, interior live oak, and scattered ponderosa pine and Douglas fir are the main tree species on the Dunsmuir soil. The natural vegetation on the Maymen Variant soil is mainly brush because of the limited soil depth, very low available water capacity, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire. If planting sites on the Dunsmuir soil are properly prepared, it is feasible to replace stands of brush and hardwoods with conifers. Large ponderosa pine seedlings would probably survive and grow on this soil. Because of the hazard of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations.

The main limitations for the harvesting of timber and firewood are the hazard of erosion and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on the Dunsmuir soil are dusty when dry. Surface treatment may be desirable during periods of heavy use. Establishing plant cover on steep cuts and fills reduces erosion on the soils in this unit.

This map unit is in capability subclass VIe (5), nonirrigated.

119—Dunsmuir-Maymen Variant complex, 15 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly knobcone pine and chaparral. Elevation is 1,000 to 3,600 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 40 percent Dunsmuir clay loam and 30 percent Maymen Variant clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Dingman, Etsel, Kekawaka, Woodin, and Wohly soils. Also included are small areas of soils that are similar to

the Dunsmuir soil but have a very gravelly subsoil or are 20 to 40 inches deep. Included areas make up about 30 percent of the total acreage.

The Dunsmuir soil is deep and well drained. It formed in material derived dominantly from metasedimentary rock. Typically, the surface layer is variegated yellowish red and dark yellowish brown loam about 5 inches thick. The upper 6 inches of the subsoil is yellowish red clay loam, and the lower 34 inches is red gravelly clay loam. Soft bedrock is at a depth of 45 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam or clay.

Permeability of the Dunsmuir soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is very high.

The Maymen Variant soil is shallow and well drained. It formed in material derived dominantly from metasedimentary rock. Typically, the surface layer is yellowish red clay loam about 2 inches thick. The subsoil is yellowish red clay and clay loam about 11 inches thick. Soft, fractured metasedimentary rock is at a depth of 13 inches. Depth to soft bedrock ranges from 10 to 20 inches.

Permeability of the Maymen Variant soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is very high.

Most areas of this unit are used for recreation and as wildlife habitat. A few areas are used for timber and firewood production.

Knobcone pine, interior live oak, and scattered ponderosa pine and Douglas fir are the main tree species on the Dunsmuir soil. The natural vegetation on the Maymen Variant soil is mainly brush because of the limited soil depth, very low available water capacity, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire. If planting sites on the Dunsmuir soil are properly prepared, it is feasible to replace stands of brush and hardwoods with conifers. Large ponderosa pine seedlings would probably survive and grow on this soil. Because of the hazard of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations in areas of this unit.

The main limitations for the harvesting of timber and firewood are the hazard of erosion, seasonal wetness, and steepness of slope. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Establishing plant cover on steep cuts and fills reduces erosion on the soils in this unit.

This map unit is in capability subclass VIe (5), nonirrigated.

120—Dunsmuir-Maymen Variant complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral and scattered knobcone pine and ponderosa pine. Elevation is 1,000 to 3,600 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 30 percent Dunsmuir loam and 30 percent Maymen Variant clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Dingman, Etsel, Kekawaka, Woodin, and Wohly soils and Rock outcrop. Also included are small areas of soils that are similar to the Dunsmuir soil but have a very gravelly subsoil or are 20 to 40 inches deep. Included areas make up about 40 percent of the total acreage.

The Dunsmuir soil is deep and well drained. It formed in material derived dominantly from metasedimentary rock. Typically, the surface layer is variegated yellowish red and dark yellowish brown loam about 5 inches thick. The upper 6 inches of the subsoil is yellowish red clay loam, and the lower 34 inches is red gravelly clay loam. Soft bedrock is at a depth of 45 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam or clay.

Permeability of the Dunsmuir soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Maymen Variant soil is shallow and well drained. It formed in material derived dominantly from metasedimentary rock. Typically, the surface layer is yellowish red clay loam about 2 inches thick. The subsoil is yellowish red clay and clay loam about 11 inches thick. Soft, fractured metasedimentary rock is at a depth of 13 inches. Depth to soft bedrock ranges from 10 to 20 inches.

Permeability of the Maymen Variant soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly brush because of the limited soil depth and very low available water capacity of the Maymen Variant soil and climate. Using prescribed burning or chemical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire.

This map unit is in capability subclass VIIe (5), nonirrigated.

121—Etsel-Rock outcrop-Neuns association, 30 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly chaparral with scattered small groves of coniferous forest. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 175 days.

This unit is 45 percent Etsel gravelly loam, 25 percent Rock outcrop, and 15 percent Neuns very gravelly loam.

Included in this unit are small areas of Maymen, Tyson, and Witherell soils. Included areas make up about 15 percent of the total acreage.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

Rock outcrop consists of exposures of rock that commonly are devoid of vegetation. Runoff is very high, and the hazard of erosion is low.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from shale, schist, or sandstone. Typically, the surface layer is grayish brown and very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used as watershed, wildlife habitat, and recreation areas.

Conifer stands commonly are small and widely scattered. The areas of Rock outcrop limit timber yields substantially. Harvesting of trees is not economically feasible on this unit because of the steepness of slope and the areas of Rock outcrop.

Rock outcrop is in capability subclass VIIIs (5), and the Etsel and Neuns soils are in capability subclass VIIe (5), nonirrigated.

122—Etsel-Woodin-Rock outcrop association, 50 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly scattered brush, annual grasses, and occasional Douglas fir. Elevation is 1,000 to 3,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 58 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 30 percent Etsel gravelly loam, 30 percent Woodin gravelly sandy loam, and 20 percent Rock outcrop.

Included in this unit are small areas of Hopland, Mayacama, Squawrock, and Witherell soils, landslides, and colluvial land. Also included are small areas of soils on ridgetops that have slopes of less than 50 percent. Included areas make up about 20 percent of the total acreage.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of slightly decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of

23 inches. Depth to bedrock ranges from 20 to 40 inches. A layer of fine gravel as much as 3 inches thick is on the surface in some areas.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Rock outcrop consists of exposures of rock that commonly is devoid of vegetation. Runoff is very high, and the hazard of water erosion is low.

This unit is used as watershed, wildlife habitat, and recreation areas.

Vegetation naturally growing on this unit is mainly scattered brush because of limited soil depth, very low available water capacity, and climate. Conifer stands commonly are small and widely scattered. The areas of Rock outcrop limit timber yields substantially. Steepness of slope and the areas of Rock outcrop hinder harvesting.

The Etsel and Woodin soils are in capability subclass VIIe (5), nonirrigated, and Rock outcrop is in capability subclass VIIIs (5).

123—Feliz loam, 0 to 2 percent slopes. This very deep, well drained soil is on alluvial plains and fans. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is dark grayish brown loam over clay loam about 26 inches thick. The upper 29 inches of the substratum is dark grayish brown clay loam, and the lower part to a depth of 60 inches or more is dark grayish brown loam. In some areas the surface layer is silt loam or gravelly loam. Some soils have lenses of gravel in the subsoil or are underlain by gravel.

Included in this unit are areas of Russian loam. Also included are small areas of Cole, Pinnobie, Pinole, and Talmage soils and Xerofluvents. Included areas make up about 15 percent of the total acreage.

Permeability of this Feliz soil is moderate. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for vineyards, orchards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. It has few limitations. Sprinkler and trickle irrigation systems are suited to this unit. Sprinkler or spray systems are needed to provide protection from frost in spring. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.

This unit is suited to homesite development. It has few limitations.

This map unit is in capability class I (14), irrigated, and capability subclass IIIc (14), nonirrigated.

124—Feliz loam, 2 to 5 percent slopes. This very deep, well drained soil is on alluvial plains and fans. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is dark grayish brown loam over clay loam about 26 inches thick. The upper 29 inches of the substratum is dark grayish brown clay loam, and the lower part to a depth of 60 inches or more is dark grayish brown loam. In some areas the surface layer is gravelly loam.

Included in this unit are areas of Russian loam. Also included are small areas of Cole, Pinnobie, Pinole, and Talmage soils, Xerofluvents, and soils that have slopes of more than 5 percent. This unit has been mapped in some areas of Trinity County where elevation is as much as 3,000 feet. Included areas make up about 15 percent of the total acreage.

Permeability of this Feliz soil is moderate. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for vineyards, orchards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. It has few limitations. Sprinkler and trickle irrigation systems are suited to this unit. Sprinkler or spray systems are needed to provide protection from frost in spring. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. It has few

limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to protect the unit from erosion.

This unit is suited to homesite development. It has few limitations. Excavation for roads and buildings increases the risk of erosion. The risk of erosion is also increased if the soil is left exposed during site development.

This map unit is in capability units IIe-l (14), irrigated, and IIIe-1 (14), nonirrigated.

125—Feliz clay loam, gravelly substratum, 0 to 2 percent slopes. This very deep, well drained soil is on flood plains. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and cottonwood trees. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is brown clay loam over grayish brown and dark grayish brown clay loam about 46 inches thick. The substratum to a depth of 60 inches or more is dark brown and brown very gravelly sandy clay loam. In some areas the surface layer is gravelly loam or loam. In some areas the substratum is very gravelly sand, very gravelly loam, gravelly loam, or gravelly sandy loam. In some areas the substratum is not gravelly.

Included in this unit are small areas of Cole, Pinnobie, Pinole, and Russian soils. Also included are Feliz soils that have a water table at a depth of 40 to 60 inches in winter. Included areas make up about 10 percent of the total acreage.

Permeability of this Feliz soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for orchards, vineyards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. Sprinkler or trickle irrigation systems are best suited to this unit. Sprinkler or spray systems are needed to provide protection from frost in spring. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to protect the unit from erosion and compaction.

This unit is suited to homesite development. It has few limitations. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage.

This map unit is in capability class I (14), irrigated, and capability subclass IIIc (14), nonirrigated.

126—Feliz clay loam, gravelly substratum, 2 to 8 percent slopes. This very deep, well drained soil is on alluvial plains and fans. It formed in alluvium derived dominantly from sedimentary rock. Slope is mainly 2 to 5 percent. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is brown clay loam over grayish brown and dark grayish brown clay loam about 46 inches thick. The substratum to a depth of 60 inches or more is dark brown and brown very gravelly sandy clay loam. In some areas the surface layer is sandy loam, gravelly loam, or loam. In some areas the substratum is not gravelly.

Included in this unit are small areas of Cole, Pinnobie, Pinole, and Russian soils. Also included are areas of soils that have a water table at a depth of 40 to 60 inches in winter. Some areas of this unit have been mapped in high mountain valleys in Mendocino and Trinity Counties where elevation is as much as 3,000 feet. Included areas make up about 15 percent of the total acreage.

Permeability of this Feliz soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight.

This unit is used for vineyards, orchards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. Sprinkler or trickle irrigation systems are best suited to this unit. Sprinkler or spray systems are needed to provide protection from frost in spring. Cover crops should be managed by mowing instead of tilling to reduce water erosion, increase the water intake rate, and limit energy consumption. All vineyard and orchard layouts and tillage should be completed on the contour to prevent sheet, rill, and gully erosion.

This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to protect the soil from erosion.

This unit is suited to homesite development. It has few limitations. If the density of housing is moderate to

high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage. Excavation for roads and buildings increases the risk of erosion. The risk of erosion is further increased if the soil is left exposed during site development.

This map unit is in capability units IIe-1 (14), irrigated, and IIIe-1 (14), nonirrigated.

127—Fluvaquents, 0 to 1 percent slopes. These very deep, poorly drained and very poorly drained soils are on flood plains. They formed in recent alluvium derived dominantly from sedimentary rock. The native vegetation is mainly annual and perennial grasses and forbs. Elevation is 1,300 to 1,400 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 200 to 250 days.

No single profile of Fluvaquents is typical, but one commonly observed in the survey area has a mottled, light gray very fine sandy loam surface layer about 2 inches thick. The subsurface layer is mottled, brown very fine sandy loam about 2 inches thick. The subsoil is mottled, light yellowish brown silt loam about 21 inches thick. The substratum to a depth of 30 inches is mottled, pale brown loamy sand. The next layer to a depth of 42 inches is a buried surface layer of mottled, pale brown silt loam. Below this to a depth of 63 inches or more is stratified, mottled, light yellowish brown, light brownish gray, and gray sand, loamy sand, and silt loam. In some areas the surface layer is loam or clay loam or the subsoil is loam, silty clay loam, or clay loam stratified with sandy material.

Included in this unit are small areas of Cole and Gielow soils. Also included are small areas of Haplaquepts in basins toward the northern end of Little Lake Valley. Included areas make up about 15 percent of the total acreage.

Permeability of these Fluvaquents is moderately slow to moderately rapid. Available water capacity generally is high, but it is lower in areas where sandy material makes up more than half of the upper 60 inches of the profile. Effective rooting depth is 60 inches or more. Runoff is very slow to ponded, and the hazard of water erosion is slight. A seasonal high water table fluctuates between the surface and a depth of 18 inches from November through March.

This unit is used as rangeland in summer and as wildlife habitat in winter.

The suitability of this unit for rangeland seeding is poor. The main limitation is wetness, which causes seeds to rot or drowns commonly seeded rangeland grasses and legumes. The unit is too wet to grow field crops. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This map unit is in capability subclass Vw (14).

128—Gielow sandy loam, 0 to 5 percent slopes. This very deep, somewhat poorly drained soil is on alluvial plains and fans. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual and perennial grasses and forbs and occasional sedges and scattered oaks. Elevation is 500 to 1,750 feet. The average annual precipitation is 32 to 55 inches, the average annual air temperature is 54 to 57 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is stratified, brown sandy loam and loam about 18 inches thick. The subsoil is mottled, stratified, brown and light brownish gray sandy loam and fine sandy loam. The substratum to a depth of 60 inches or more is stratified, light yellowish brown sandy loam. In some areas the surface layer is loam or silt loam, in some areas brown colors are present in the subsoil where there is an aerated water table, and in some areas a gravelly substratum is at a depth of about 40 inches.

Included in this unit are small areas of Clear Lake, Cole, Feliz, Russian, and Talmage soils. In Little Lake and Pound Valleys, there are soils that have narrow bands of gravel and make up 1 to 5 percent of the unit. Also included are small areas of soils at elevations of as much as 2,800 feet in Hulls Valley, in Rodeo Valley, in the southwestern part of Trinity County, and near Cloverdale Peak. Included areas make up about 10 percent of the total acreage.

Permeability of this Gielow soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very slow to slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 18 and 36 inches from November through March.

Most areas of this unit are used for vineyards, orchards, hay and pasture, and wildlife habitat. A few areas are used for homesite development.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by seasonal wetness, which restricts accessibility of equipment early in spring. The water table, where present, generally is moving and may provide adequate soil aeration for water tolerant, deep rooted crops.

Sprinkler or trickle irrigation systems are suited to this unit. Sprinkler irrigation helps to protect crops from

frost. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. The main limitation is seasonal wetness, which makes the soil susceptible to compaction by livestock and limits equipment use. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. This unit is suited to sprinkler irrigation. The water table, where present, may provide some subirrigation.

This unit is poorly suited to homesite development. The main limitations are restricted drainage and, in some areas, the presence of a water table at a depth of 18 to 36 inches during some part of the year. Drainage is needed if roads and building foundations are constructed. Onsite sewage disposal systems often fail or do not function properly during periods of high rainfall.

This map unit is in capability units IIw-2 (14), irrigated, and IIIw-2, nonirrigated.

129—Gschwend-Frenchman complex, 0 to 9 percent slopes. This map unit is on river and stream terraces. The native vegetation is mainly redwood and Douglas fir forest; annual and perennial grasses are in cleared areas. Elevation is 400 to 1,600 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is about 53 degrees F, and the average frost-free period is 220 to 270 days.

This unit is 45 percent Gschwend loam and 35 percent Frenchman gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. The percentage varies from one area to another.

Included in this unit are small areas of Riverwash; Cole, Feliz, and Gielow soils; and Xerofluvents. Also included are small areas of wet soils, occasionally flooded soils, and Gschwend and Frenchman soils that have slopes of more than 9 percent. Included areas make up about 20 percent of the total acreage.

The Gschwend soil is very deep and well drained. It formed in alluvium derived dominantly from sandstone. Typically, the surface is covered with a mat of redwood needles and twigs about 3 inches thick. The surface layer is dark grayish brown loam about 7 inches thick. The upper 15 inches of the subsoil is yellowish brown loam, and the lower 17 inches is yellowish brown fine sandy loam. The upper 11 inches of the substratum is yellowish brown gravelly fine sandy loam, and the lower part to a depth of 61 inches or more is light yellowish brown very gravelly loamy sand. In some areas the surface layer is sandy loam and the subsoil is gravelly.

Permeability of the Gschwend soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The Frenchman soil is very deep and well drained. It formed in alluvium derived dominantly from sandstone. Typically, the surface is covered with a mat of slightly decomposed redwood needles and twigs about 1 inch thick. The surface layer is grayish brown gravelly loam about 10 inches thick. The subsoil is pale brown very gravelly loam about 20 inches thick. The upper 16 inches of the substratum is pale brown very gravelly loamy sand, and the lower part to a depth of 64 inches or more is pale brown extremely gravelly sand. In some areas the surface layer is very gravelly loam or sandy loam.

Permeability of the Frenchman soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used for timber production and as watershed and wildlife habitat.

Redwood, Douglas fir, and tanoak are the main tree species on this unit. Among the trees of limited extent are Pacific madrone and California laurel. On the basis of a 100-year site curve, the mean site index for redwood is 157 on the Gschwend soil and 132 on the Frenchman soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 168 on the Gschwend soil and 154 on the Frenchman soil. The potential annual production from a fully stocked stand of redwood trees 100 years old is 1,466 board feet per acre on the Gschwend soil and 1,013 board feet on the Frenchman soil.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment.

Plant competition is a concern in the production of timber on this unit. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. After cutting, redwoods can regenerate by stump sprouting; however, the sprouts seldom provide optimum stocking. Reforestation can be accomplished by planting redwood or Douglas fir seedlings in

harvested areas. Among the common forest understory plants are California huckleberry, tanoak, and brackenfern.

This map unit is in capability unit IVe-1 (4), nonirrigated.

130—Gudgrey-Bluenose-Neuns complex, 8 to 30 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oaks. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 50 percent Gudgrey gravelly sandy clay loam, 25 percent Bluenose very gravelly sandy loam, and 15 percent Neuns very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sanhedrin, Shortyork, Speaker, Tyson, and Yorkville soils. Also included are small areas of soils that are similar to the Gudgrey soil but have a very gravelly subsoil or are 40 to 60 inches deep. Included areas make up about 10 percent of the total acreage.

The Gudgrey soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface is covered with a mat of decomposing pine needles, bark, and twigs about 1.5 inches thick. The surface layer is gray gravelly sandy clay loam about 28 inches thick. The upper 11 inches of the subsoil is light brownish gray gravelly clay loam, the next 19 inches is variegated, light gray and yellowish brown gravelly clay loam, and the lower part to a depth of 70 inches or more is gray gravelly sandy clay loam.

Permeability of the Gudgrey soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches or more is yellowish brown very gravelly sandy loam. In some areas the subsoil is gravelly or very gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. Among the trees of limited extent are sugar pine, white fir, bigleaf maple, and Pacific madrone. On the basis of a 100-year site curve, the mean site index for Douglas fir is 131 on the Gudgrey soil, 129 on the Bluenose soil, and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 144 on the Gudgrey soil, 120 on the Bluenose soil, and 106 on the Neuns soil. The potential annual production from a fully stocked stand of ponderosa pine is 905 board feet per acre on the Gudgrey soil, 570 board feet on the Bluenose soil, and 425 board feet on the Neuns soil.

The main limitation for the harvesting of timber is the seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts and can damage the roots of trees. Unsurfaced roads and skid trails on the Gudgrey soil are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Roads on the Gudgrey soil are dusty when dry. Surface treatment may be desirable during periods of heavy use.

Plant competition is a concern in the production of timber on this unit, especially on the Gudgrey soil. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on south- and southwest-facing

slopes of the Bluenose and Neuns soils. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are gooseberry, raspberry, bedstraw, and scattered perennial grasses.

This map unit is in capability unit IVe-1 (5), nonirrigated.

131—Gudgrey-Bluenose-Neuns complex, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oaks. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 50 percent Gudgrey gravelly sandy clay loam, 25 percent Bluenose very gravelly sandy loam, and 15 percent Neuns very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sanhedrin, Shortyork, Speaker, Tyson, and Yorkville soils. Also included are small areas of soils that are similar to the Gudgrey soil but have a very gravelly subsoil or are 40 to 60 inches deep. Included areas make up about 10 percent of the total acreage.

The Gudgrey soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface is covered with a mat of decomposing pine needles, bark, and twigs about 1.5 inches thick. The surface layer is gray gravelly sandy clay loam about 28 inches thick. The upper 11 inches of the subsoil is light brownish gray gravelly clay loam, and the lower 19 inches is variegated, light gray and yellowish brown gravelly clay loam. The substratum to a depth of 70 inches or more is gray gravelly sandy clay loam.

Permeability of the Gudgrey soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches or more is yellowish brown very gravelly sandy loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. Among the trees of limited extent are sugar pine, white fir, bigleaf maple, and Pacific madrone. On the basis of a 100-year site curve, the mean site index for Douglas fir is 131 on the Gudgrey soil, 129 on the Bluenose soil, and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 144 on the Gudgrey soil, 120 on the Bluenose soil, and 106 on the Neuns soil. The potential annual production from a fully stocked stand of ponderosa pine is 905 board feet per acre on the Gudgrey soil, 570 board feet on the Bluenose soil, and 425 board feet on the Neuns soil.

The main limitations for the harvesting of timber are the hazard of erosion and seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts and can damage the roots of trees. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails on the Gudgrey soil are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on this unit; however, revegetation of cuts on the Neuns soil is difficult because of the very low available water capacity and the large amount of coarse

fragments. Roads on the Gudgrey soil are dusty when dry. Surface treatment may be desirable during periods of heavy use.

Plant competition is a concern in the production of timber on this unit, especially on the Gudgrey soil. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on south- and southwest-facing slopes of the Bluenose and Neuns soils. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are gooseberry, raspberry, bedstraw, and scattered perennial grasses.

This map unit is in capability subclass VIe (5), nonirrigated.

132—Gudgrey-Bluenose-Neuns complex, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oaks. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 50 percent Gudgrey gravelly sandy clay loam, 25 percent Bluenose very gravelly sandy loam, and 15 percent Neuns very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sanhedrin, Shortyork, Speaker, Tyson, and Yorkville soils. Also included are small areas of soils that are similar to the Gudgrey soil but have a very gravelly subsoil or are 40 to 60 inches deep. Included areas make up about 10 percent of the total acreage.

The Gudgrey soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface is covered with a mat of decomposing pine needles, bark, and twigs about 1.5 inches thick. The surface layer is gray gravelly sandy clay loam about 28 inches thick. The upper 11 inches of the subsoil is light brownish gray gravelly clay loam, and the lower 19 inches is variegated, light gray and yellowish brown gravelly clay loam. The substratum to a depth of 70 inches or more is gray gravelly sandy clay loam.

Permeability of the Gudgrey soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches or more is yellowish brown very gravelly sandy loam. In some areas the subsoil is gravelly or very gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. Among the trees of limited extent are sugar pine, white fir, bigleaf maple, and Pacific madrone. On the basis of a 100-year site curve, the mean site index for Douglas fir is 131 on the Gudgrey soil, 129 on the Bluenose soil, and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 144 on the Gudgrey soil, 120 on the Bluenose soil, and 106 on the Neuns soil. The potential annual production from a fully stocked stand of ponderosa pine is 905 board feet per acre on the Gudgrey soil, 570 board feet on the Bluenose soil, and 425 board feet on the Neuns soil.

The main limitations for the harvesting of timber are the steepness of slope and hazard of erosion. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant

cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails on the Gudgrey soil are slippery when wet, and they may be impassable during rainy periods. Roads on the Gudgrey soil are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on this unit; however, revegetation of cuts on the Neuns soil is difficult because of the very low available water capacity and the large amount of coarse fragments. Rocks and loose soil material may slide onto roads on the Bluenose and Neuns soils, increasing the need for road maintenance.

Plant competition is a concern in the production of timber on this unit, especially on the Gudgrey soil. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on south- and southwest-facing slopes on the Bluenose and Neuns soils. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are gooseberry, raspberry, bedstraw, and scattered perennial grasses.

This map unit is in capability subclass VIIe (5), nonirrigated.

133—Haplaquepts, 0 to 1 percent slopes. These very deep, poorly drained soils are in basins and on flood plains. They formed in alluvium derived dominantly from sedimentary rock. The native vegetation is mainly aquatic herbs, sedges, and annual grasses. Elevation is 1,300 to 1,400 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 200 to 250 days.

No single profile of Haplaquepts is typical, but one commonly observed in the survey area has a grayish brown clay loam surface layer about 3 inches thick. The subsurface layer is light olive brown clay loam about 5 inches thick. The subsoil is light brownish gray over gray silty clay loam about 29 inches thick. The substratum to a depth of 72 inches or more is gray silty clay. In some areas the surface layer is silty clay or clay.

Included in this unit are small areas of Cole clay loam bordering basin areas. Also included are small areas of Gielow sandy loam adjacent to drainageways and Fluvaquents along old creek bottoms and drainageways. Included areas make up about 10 percent of the total acreage.

Permeability of these Haplaquepts is slow to moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is ponded, and the hazard of water erosion is slight. A seasonal high water table is 12 inches above the surface to 12 inches below the surface from December to April.

This unit is used for pasture and as wildlife habitat and recreation areas.

This unit is poorly suited to most crops. It is limited mainly by poor drainage.

This unit is suited to hay and pasture. The main limitations are frequent, very long periods of ponding and restricted permeability. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to protect the soil from compaction. Grazing should be deferred when the surface layer is saturated.

This map unit is in capability subclass Vw (14).

134—Haploxeralfs-Argixerolls complex, 0 to 9 percent slopes. This map unit is on dissected stream terraces. Typically, the unit has hummocky microrelief. The native vegetation is mainly scattered oaks, ponderosa pine, and Douglas fir; manzanita and annual and perennial grasses are in cleared areas. Elevation is 1,600 to 2,600 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 150 to 175 days.

This unit is 60 percent Haploxeralfs and 30 percent Argixerolls. The Haploxeralfs are in gently rolling areas on the higher lying, convex positions, and the Argixerolls are on the shoulders and foot slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of poorly drained soils in concave positions and soils in which the temperature is more than 59 degrees F because of selective clearing. In Hoaglin and Kettenpom Valleys, in Trinity County, are soils that have lower base saturation in the subsoil. Also included are small areas of soils

that have slopes of more than 9 percent and are along drainageways. Included areas make up about 10 percent of the total acreage.

Haploxeralfs are very deep and well drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in the survey area has a brown sandy loam over strong brown loam surface layer 9 inches thick. The subsoil is reddish yellow loam about 21 inches thick. The upper 7 inches of the substratum is reddish yellow gravelly sandy loam, and the lower part to a depth of 60 inches or more is yellowish brown very gravelly sandy loam. In some areas the surface layer is gravelly loam.

Permeability of the Haploxeralfs is moderate to moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Argixerolls are very deep and moderately well drained to well drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in the survey area has a brown gravelly loam or loam surface layer 11 inches thick. The upper 11 inches of the subsoil is yellowish brown gravelly clay loam, and the lower 15 inches is reddish yellow gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown clay. In some areas the surface layer is loam or the subsoil has base saturation of less than 50 percent. Depth to a dense clay layer ranges from 35 to 55 inches.

Permeability of the Argixerolls is slow to moderately rapid. Available water capacity is high to very high. Water is sometimes perched above the dense clay layer in the rainy months of December through March. Effective rooting depth is 35 to 55 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used mainly for homesite development. Some areas are used for timber production, firewood production, and pasture.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 109 on the Haploxeralfs and 120 on the Argixerolls. On the basis of a 100-year site curve, the mean site index for Douglas fir is 107 on the Haploxeralfs and 110 on the Argixerolls. The potential annual production from a fully stocked stand of ponderosa pine is 455 board feet per acre on the Haploxeralfs and 570 board feet on the Argixerolls.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are soft when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Seedling survival is a concern in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on south- and southwest-facing slopes. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs frequently. Natural Douglas fir seedlings usually do not survive. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings.

Among the common forest understory plants are manzanita, reed fescue, poison oak, and bedstraw.

The production of forage on this unit is limited by the tendency of the soils to produce woody species. Where oaks and brush are present, forage production can be increased by harvesting trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. This unit responds well to fertilization, rangeland seeding, and proper grazing use. The main limitation for seeding is the abundance of woody species. Among the common understory plants are purple needlegrass, soft chess, and filaree.

If this unit is used for homesite development, the main limitations are the seasonal perched water table in the Argixerolls and the hazard of erosion in the steeper areas. Onsite sewage disposal systems often fail or do not function properly during periods of high rainfall because of the restrictive clay layer in the Argixerolls and drainage from higher lying areas. During the rainy season, effluent from onsite sewage disposal systems may seep at points downslope. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclass IIIe (5), nonirrigated.

135—Haploxeralfs, wet-Argixerolls complex, 0 to 5 percent slopes. This map unit is on dissected stream terraces. Typically, the unit has hummocky microrelief. The native vegetation is mainly annual and perennial grasses and scattered oaks, manzanita, and ponderosa pine. Elevation is 1,640 to 1,800 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 150 to 175 days.

This unit is 50 percent Haploxeralfs, wet, and 40 percent Argixerolls. The Haploxeralfs are in undulating areas of depressional areas and drainageways, and the Argixerolls are in the higher lying, convex areas. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that have more than 35 percent rock fragments in the subsoil and substratum and soils near active streams that are sandy and better drained. Included areas make up about 10 percent of the total acreage.

Haploxeralfs, wet, are very deep and poorly drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in the survey area has a surface layer of brown loam 0.5 inch thick over pale brown loam 12.5 inches thick. The upper 11 inches of the subsoil is light gray loam, and the lower 17 inches is very pale brown clay loam. Below this to a depth of 60 inches or more is light yellowish brown clay loam. In some areas the surface layer is sandy loam or fine sandy loam.

Permeability of the Haploxeralfs is moderately slow to very slow. Available water capacity is very high. A seasonal high water table fluctuates between the surface and a depth of 20 inches below the surface in November through April. Effective rooting depth is 60 inches for water-tolerant plants but is limited to a depth of 30 inches for non-water-tolerant plants. Runoff is ponded to slow, and the hazard of erosion is none to slight.

The Argixerolls are very deep and moderately well drained. They formed in alluvium derived from various kinds of rock. No single profile is typical of these soils, but one commonly observed in the survey area has a brown gravelly loam or loam surface layer 11 inches thick. The upper 11 inches of the subsoil is yellowish brown gravelly clay loam, and the lower 15 inches is reddish yellow gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown clay. In some areas the subsoil has base saturation of less than 50 percent. Depth to a dense clay layer ranges from 35 to 55 inches.

Permeability of the Argixerolls is slow to moderately rapid. Available water capacity is high to very high. Water is sometimes perched above the dense clay layer in December through March. Effective rooting depth is 35 to 55 inches. Runoff is slow, and the hazard of erosion is none to slight.

Most areas of this unit are used as wildlife habitat and watershed. A few areas are used for firewood production, timber production, nonirrigated pasture, and homesite development.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Haploxeralfs and 120 on the Argixerolls. On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Haploxeralfs and 110 on the Argixerolls. The potential annual production from a fully stocked stand of ponderosa pine is 290 board feet per acre on the Haploxeralfs and 570 board feet on the Argixerolls.

The main limitation for the harvesting of timber and firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are soft when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Seedling survival is a concern in the production of timber on this unit. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs frequently. Natural Douglas fir seedlings usually do not survive. Ponding during the rainy season reduces root respiration, which results in a low survival rate of seedlings in the wet areas. Because the rooting depth is restricted by a water table, trees are sometimes subject to windthrow.

Among the common forest understory plants are reed fescue, poison oak, bedstraw, and rushes.

This unit is suited to hay and pasture. The main limitations are very slow permeability in some areas, a seasonal high water table, and standing water in drainageways during the wet season. Plants that tolerate wetness should be seeded. Grazing should be limited to late in spring and in summer to protect the soils from trampling, which reduces productivity.

If this unit is used for homesite development, the

main limitations are ponding on the Haploxeralfs and the perched water table in the Argixerolls. Restricted permeability and the perched water table increase the possibility of failure of septic tank absorption fields.

This map unit is in capability subclass IIIw (5), nonirrigated.

136—Henneke-Montara complex, 15 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral. Elevation is 500 to 2,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 35 percent Henneke gravelly loam and 30 percent Montara loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Squawrock soils and small areas of Maxwell soils on toe slopes, in swales, and in small valleys. Also included are small areas of Henneke and Montara soils that have slopes of more than 50 percent or less than 15 percent. Included areas make up about 35 percent of the total acreage.

The Henneke soil is shallow and well drained. It formed in material derived dominantly from serpentinitic rock. Typically, the surface layer is dark brown gravelly loam about 4 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 15 inches thick. Serpentinitic rock is at a depth of 19 inches.

Permeability of the Henneke soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high. The calcium-to-magnesium ratio is 1:1 or less.

The Montara soil is shallow and well drained. It formed in material derived dominantly from serpentinitic rock. Typically, the surface is covered with a mat of decayed cypress needles and twigs about 2 inches thick. The surface layer is dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown over dark brown loam about 10 inches thick. Fractured serpentinite is at a depth of 13 inches. In some areas the surface layer is gravelly loam.

Permeability of the Montara soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high. The calcium-to-magnesium ratio is 1:1 or less.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly brush because of the limited soil depth, very low available water capacity, low soil fertility because of the ratio of calcium to magnesium, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire.

This map unit is in capability subclass VIIe (15), nonirrigated.

137—Henneke-Montara complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral. Elevation is 500 to 2,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 35 percent Henneke gravelly loam and 30 percent Montara loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Squawrock soils and small areas of Maxwell soils on toe slopes, in swales, and in small valleys. Also included are small areas of Henneke and Montara soils that have slopes of more than 75 percent or less than 50 percent. Included areas make up about 35 percent of the total acreage.

The Henneke soil is shallow and well drained. It formed in material derived dominantly from serpentinitic rock. Typically, the surface layer is dark brown gravelly loam about 4 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 15 inches thick. Serpentinitic rock is at a depth of 19 inches.

Permeability of the Henneke soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high. The calcium-to-magnesium ratio is 1:1 or less.

The Montara soil is shallow and well drained. It formed in material derived dominantly from serpentinitic rock. Typically, the surface is covered with a mat of decayed cypress needles and twigs about 2 inches thick. The surface layer is dark grayish brown loam about 3 inches thick. The subsurface layer is dark grayish brown over dark brown loam about 10 inches thick. Fractured serpentinite is at a depth of 13 inches. In some areas the surface layer is gravelly loam.

Permeability of the Montara soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the

hazard of erosion is very high. The calcium-to-magnesium ratio is 1:1 or less.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly brush because of the limited soil depth, very low available water capacity, low soil fertility because of the ratio of calcium to magnesium, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire.

This map unit is in capability subclass VIIe (15), nonirrigated.

138—Holohan-Hollowtree-Casabonne complex, 9 to 30 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 1,000 to 4,000 feet. The average annual precipitation is 45 to 65 inches, the average annual air temperature is 52 to 58 degrees F, and the average frost-free period is 175 to 200 days.

This unit is 40 percent Holohan very gravelly sandy loam, 20 percent Hollowtree gravelly sandy loam, and 20 percent Casabonne gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Kekawaka, Maymen, Pardaloe, Sanhedrin, Shortyork, Updegraff, Woodin, and Yorkville soils. Also included are small areas of soils that have slopes of more than 30 percent. Included areas make up about 20 percent of the total acreage.

The Holohan soil is very deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat about 0.5 inch thick. The mat consists of partially decomposed Douglas fir needles, tanoak leaves, and twigs mixed with fine gravel. The surface layer is brown very gravelly sandy loam about 6 inches thick. The upper 9 inches of the subsoil is brown very cobbly loam, and the lower 40 inches is light yellowish brown and very pale brown very gravelly sandy loam. The substratum is very pale brown extremely gravelly loamy sand about 6 inches thick. Sandstone is at a depth of 61 inches. Depth to bedrock ranges from 60 to 80 inches. In some areas the subsoil is redder in color or has base saturation of less than 35 percent.

Permeability of the Holohan soil is moderate. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

The Hollowtree soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed leaves and twigs mixed with fine gravel about 0.5 inch thick. The surface layer is dark grayish brown gravelly sandy loam about 4 inches thick. The upper 5 inches of the subsoil is yellowish brown gravelly loam, and the lower 15 inches is brown very gravelly loam. The substratum is light yellowish brown extremely cobbly sandy loam about 11 inches thick. Sandstone is at a depth of 35 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Hollowtree soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

The Casabonne soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam and is darker in color.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This unit is used mainly for timber and firewood production. It is also used as wildlife habitat and watershed.

Tanoak, canyon live oak, Pacific madrone, and Douglas fir are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 132 on the Holohan soil, 106 on the Hollowtree soil, and 144 on the Casabonne soil. The potential annual production from a fully stocked stand of Douglas fir is 550 board feet per acre on the Holohan soil, 310 board feet on the Hollowtree soil, and 665 board feet on the Casabonne soil.

There are no major soil limitations for the harvesting of timber on this unit. Rock for construction of roads is available in areas of this unit. Revegetation of exposed subsoil material is difficult on the Holohan and Hollowtree soils because of the large amount of coarse fragments and very low to low available water capacity. Establishing plant cover on steep cuts and fills reduces erosion on this unit, especially on the Casabonne soil.

Plant competition and seedling survival are concerns in the production of timber on this unit. If planting sites on this unit are properly prepared, it is feasible to replace stands of brush and hardwoods with conifers. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently because of the predominance of tanoak on this unit.

Among the common forest understory plants are tanoak, poison oak, brackenfern, and pyrola. Beargrass is common in recently harvested areas.

This map unit is in capability subclass VIs (5), nonirrigated.

139—Holohan-Hollowtree-Casabonne complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 1,000 to 4,000 feet. The average annual precipitation is 45 to 65 inches, the average annual air temperature is 52 to 58 degrees F, and the average frost-free period is 175 to 200 days.

This unit is 45 percent Holohan very gravelly sandy loam, 20 percent Hollowtree gravelly sandy loam, and 15 percent Casabonne gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Kekawaka, Maymen, Pardaloe, Sanhedrin, Shortyork, Updegraff, Woodin, and Yorkville soils and Rock outcrop. Also included are small areas of soils that have slopes of more than 50 percent or less than 30 percent. Included areas make up about 20 percent of the total acreage.

The Holohan soil is very deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat about 0.5 inch thick. The mat consists of partially decomposed Douglas fir needles, tanoak leaves, and twigs mixed with fine gravel. The surface layer is brown very gravelly sandy loam about 6 inches thick. The upper 9 inches of the subsoil is brown very cobbly loam, and the lower 40 inches is light yellowish brown and very pale brown very gravelly sandy loam. The substratum is very pale brown extremely gravelly loamy sand about 6 inches thick. Sandstone is at a depth of 61 inches. Depth to bedrock ranges from 60 to 80 inches.

Permeability of the Holohan soil is moderate. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Hollowtree soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed leaves and twigs mixed with fine gravel about 0.5 inch thick. The surface layer is dark grayish brown gravelly sandy loam about 4 inches thick. The upper 5 inches of the subsoil is yellowish brown gravelly loam, and the lower 15 inches is brown very gravelly loam. The substratum is light yellowish brown extremely cobbly sandy loam about 11 inches thick. Sandstone is at a depth of 35 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Hollowtree soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Casabonne soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam and is darker in color.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for timber and firewood production. It is also used as wildlife habitat and watershed.

Tanoak, canyon live oak, Pacific madrone, and Douglas fir are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 132 on the Holohan soil, 106 on the Hollowtree soil, and 144 on the Casabonne soil. The potential annual production from a fully stocked stand of Douglas fir is 570 board feet per acre on the Holohan soil, 310 board feet on the Hollowtree soil, and 665 board feet on the Casabonne soil.

The main limitation for the harvesting of timber is steepness of slope. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper

areas. Rock for construction of roads is available in areas of this unit. Revegetation of exposed subsoil material is difficult on the Holohan and Hollowtree soils because of the large amount of coarse fragments in the soil and the very low to low available water capacity.

Plant competition and seedling survival are concerns in the production of timber on this unit. If planting sites are properly prepared, it is feasible to replace stands of brush and hardwoods with conifers. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently because of the predominance of tanoak on this unit.

Among the common forest understory plants are tanoak, poison oak, brackenfern, and pyrola. Beargrass is common in recently harvested areas.

This map unit is in capability subclass VIe (5), nonirrigated.

140—Holohan-Hollowtree complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 1,000 to 4,000 feet. The average annual precipitation is 45 to 65 inches, the average annual air temperature is 52 to 58 degrees F, and the average frost-free period is 175 to 200 days.

This unit is 45 percent Holohan very gravelly sandy loam and 35 percent Hollowtree gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Casabonne, Maymen, Pardaloe, Sanhedrin, and Woodin soils and Rock outcrop. Also included are small areas of soils that have slopes of less than 50 percent. Included areas make up about 20 percent of the total acreage.

The Holohan soil is very deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat about 0.5 inch thick. The mat consists of partially decomposed Douglas fir needles, tanoak leaves, and twigs mixed with fine gravel. The surface layer is brown very gravelly loam about 6 inches thick. The upper 9 inches of the subsoil is brown very cobbly loam, and the lower 40 inches is light yellowish brown very pale brown very gravelly sandy loam. The substratum is very pale brown extremely gravelly loamy sand about 6 inches thick. Sandstone is at a depth of 61 inches. Depth to bedrock ranges from 60 to 80 inches.

Permeability of the Holohan soil is moderate. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Hollowtree soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed leaves and twigs mixed with fine gravel about 0.5 inch thick. The surface layer is dark grayish yellowish brown gravelly sandy loam about 4 inches thick. The upper 5 inches of the subsoil is brown gravelly loam, and the lower 15 inches is brown very gravelly loam. The substratum is light yellowish brown extremely cobbly sandy loam about 11 inches thick. Sandstone is at a depth of 35 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the subsoil is redder in color or has base saturation of less than 35 percent.

Permeability of the Hollowtree soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly for timber and firewood production. It is also used as wildlife habitat and watershed.

Tanoak, canyon live oak, Pacific madrone, and Douglas fir are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 132 on the Holohan soil and 106 on the Hollowtree soil. The potential annual production from a fully stocked stand of Douglas fir is 550 board feet per acre on the Holohan soil and 310 board feet on the Hollowtree soil.

The main limitation for the harvesting of timber is steepness of slope. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Rock for construction of roads is available in areas of this unit. Rocks and loose soil material may slide onto roads, increasing the need for road maintenance. Revegetation of exposed subsoil material is difficult on the soils in this unit because of the large amount of coarse fragments and very low to low available water capacity.

Plant competition and seedling survival are concerns in the production of timber on this unit. If planting sites on this unit are properly prepared, it is feasible to replace stands of brush and hardwoods with conifers. When openings are made in the canopy, invading

brushy plants can prevent the establishment of seedlings. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently because of the predominance of tanoak on this unit.

Among the common forest understory plants are tanoak, poison oak, brackenfern, and pyrola. Beargrass is common in recently harvested areas.

This map unit is in capability subclass VIIe (5), nonirrigated.

141—Hopland loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on hills and mountains. It formed in material weathered from sandstone and shale. The native vegetation is mainly oaks, annual grasses, forbs, and some Douglas fir. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Bearwallow, Casabonne, Cummiskey, Hellman, Kekawaka, Squawrock, Witherell, Wohly, Yorktree, and Yorkville soils. Also included are small areas of Hopland soils that have slopes of less than 30 percent or more than 50 percent and soils that are similar to this Hopland soil but have 35 to 45 percent coarse fragments in the subsoil. Included areas make up about 20 percent of the total acreage.

Permeability of this Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly for firewood production and as watershed and recreation areas. It is also used for homesite development.

California black oak and Pacific madrone are the main tree species on this unit. The unit can produce about 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 44. Among the trees of limited extent are Douglas fir, Oregon white oak, interior live oak, and blue oak.

The main limitations for the harvesting of firewood are steepness of slope, the hazard of erosion, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done in December through May.

Among the common forest understory plants are iris, blue wildrye, and dogtail.

This unit is poorly suited to homesite development. The main limitations are depth to bedrock, slope, low soil strength, and the high hazard of erosion. Cuts needed to provide essentially level building sites can expose rock. Access roads must be designed to provide adequate cut slope grade, and drains are needed to control surface runoff. Revegetating disturbed areas around construction sites helps to control erosion. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load.

This map unit is in capability subclass VIe (5), nonirrigated.

142—Hopland loam, 50 to 75 percent slopes. This moderately deep, well drained soil is on hills and mountains. It formed in material weathered from sandstone and shale. The native vegetation is mainly oaks, annual grasses, forbs, and some Douglas fir. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Bearwallow, Casabonne, Cummiskey, Hellman, Kekawaka, Squawrock, Witherell, Wohly, Yorktree, and Yorkville soils. Also included are small areas of Hopland soils

that have slopes of less than 50 percent or more than 75 percent and soils that are similar to this Hopland soil but have 35 to 45 percent coarse fragments in the subsoil. Included areas make up about 25 percent of the acreage.

Permeability of this Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used as watershed and recreation areas. A few areas are also used for firewood production.

California black oak and Pacific madrone are the main tree species on this unit. The unit can produce about 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 44. Among the trees of limited extent are live oak, Oregon white oak, and Douglas fir. Estimates of the site index and yield for Douglas fir have not been made.

Harvesting of trees usually is not feasible on this unit because of the steepness of slope, hazard of erosion, and seasonal wetness. When harvesting firewood, steepness of slope limits the use of wheeled and tracted equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following deep soil disturbance.

Among the common forest understory plants are iris, blue wildrye, and dogtail.

This map unit is in capability subclass VIIe (15), nonirrigated.

143—Hopland-Maymen-Etsel complex, 30 to 50 percent slopes. This map unit is mainly on side slopes and ridgetops of hills and mountains. The native vegetation is mainly oaks and chaparral. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 35 percent Hopland loam, 30 percent Maymen sandy loam, and 20 percent Etsel gravelly loam. The Hopland soil is on concave side slopes, and the Maymen and Etsel soils are on convex side slopes, spur ridges, and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Dingman, Sanhedrin, and Speaker soils and soils that are similar to the Hopland soil but have a clay subsoil. Also included are small areas of Hopland, Maymen, and Etsel soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. In some areas the surface layer is gravelly loam. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam 3 inches thick over very gravelly loam about 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The vegetation on this unit is mainly oaks and knobcone pine on the Hopland soil and chaparral on the Maymen and Etsel soils. The natural vegetation on this

unit is mainly brush because of the limited soil depth, restricted available water capacity in some areas, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire. Firebreaks constructed on ridgetops help to control wildfires that result in erosion. If the Hopland and Maymen soils are cleared for firebreaks, seeding grass helps to prevent erosion. The Etsel soil will not support a good stand of grass.

This map unit is in capability subclass VIIe (5), nonirrigated.

144—Hopland-Maymen-Etsel complex, 50 to 75 percent slopes. This map unit is mainly on side slopes and ridgetops of hills and mountains. The native vegetation is mainly oaks and chaparral. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 35 percent Hopland loam, 30 percent Maymen sandy loam, and 20 percent Etsel gravelly loam. The Hopland soil is on concave side slopes, and the Maymen and Etsel soils are on convex side slopes, spur ridges, and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Dingman, Sanhedrin, and Speaker soils and soils that are similar to the Hopland soil but have a clay subsoil. Also included are small areas of Hopland, Maymen, and Etsel soils that have slopes of less than 50 percent or more than 75 percent. Included areas make up about 15 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. In some areas the surface layer is gravelly loam. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

Vegetation is oaks and knobcone pine on the Hopland soil and chaparral on the Maymen and Etsel soils. The natural vegetation on this unit is mainly brush because of the limited soil depth, restricted available water capacity in some areas, and climate. Using prescribed burning or chemical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire. Firebreaks constructed on ridgetops help to control wildfire that results in erosion. Rocks and loose soil material may slide onto roads along side slopes, increasing the need for road maintenance. If the Hopland and Maymen soils are cleared for firebreaks, seeding grass helps to prevent erosion. The Etsel soil will not support a good stand of grass.

This map unit is in capability subclass VIIe (5), nonirrigated.

145—Hopland-Sanhedrin-Kekawaka complex, 15 to 30 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oak woodland with scattered conifers. Elevation is 1,000 to 3,500 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 45 percent Hopland loam, 20 percent Sanhedrin gravelly loam, and 15 percent Kekawaka loam. The components of this unit are so intricately

intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Casabonne, Cummiskey, Etsel, Hellman, Mayacama, Speaker, Witherell, Wohly, Woodin, and Yorkville soils. Also included are areas of Rock outcrop. Included areas make up about 20 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of needles, twigs, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded, hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is clay loam or gravelly loam.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used for firewood production, as recreation areas, watershed, and wildlife habitat, and for timber production.

California black oak, Oregon white oak, and Pacific madrone are the main tree species on the Hopland soil. Among the trees of limited extent is blue oak. On the basis of a 50-year site curve, the mean site index for California black oak is 44. This soil can produce about 35 cords of wood per acre from a stand of trees 50 years old.

Ponderosa pine, Douglas fir, California black oak, and Pacific madrone are the main tree species on the Sanhedrin and Kekawaka soils. Among the trees of limited extent are sugar pine and Oregon white oak. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 111 on the Sanhedrin soil and 113 on the Kekawaka soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 113 on the Sanhedrin soil and 106 on the Kekawaka soil. The potential annual production from a fully stocked stand of ponderosa pine is 475 board feet per acre on the Sanhedrin soil and 495 board feet on the Kekawaka soil.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on the Kekawaka soil are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. The Kekawaka soil has a tendency to slump in some areas.

Seedling survival and plant competition are concerns in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings on the Kekawaka and Sanhedrin soils. Plantings on the Hopland soil have little chance of survival because of the high soil temperature and limited soil moisture.

Among the common forest understory plants are poison oak, bedstraw, and scattered perennial grasses.

This map unit is in capability unit IVe-1 (5), nonirrigated.

146—Hopland-Sanhedrin-Kekawaka complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oak

woodland with scattered conifers. Elevation is 1,000 to 3,500 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 45 percent Hopland loam, 20 percent Sanhedrin gravelly loam, and 15 percent Kekawaka loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Casabonne, Cummiskey, Speaker, Witherell, Wohly, Woodin, and Yorkville soils. Also included are areas of Rock outcrop and soils that are more than 35 percent rock fragments. Included areas make up about 20 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposing litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded, hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is gravelly loam or clay loam, and in some areas the depth to soft sandstone is less than 60 inches.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used for firewood production, as recreation areas, watershed, and wildlife habitat, and for timber production.

California black oak, Oregon white oak, and Pacific madrone are the main tree species on the Hopland soil. Among the trees of limited extent is blue oak. On the basis of a 100-year site curve, the mean site index for California black oak is 44. This soil can produce about 35 cords of wood per acre for a stand of trees 50 years old.

Ponderosa pine, Douglas fir, California black oak, and Pacific madrone are the main tree species on the Sanhedrin and Kekawaka soils. Among the trees of limited extent are sugar pine and Oregon white oak. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 111 on the Sanhedrin soil and 113 on the Kekawaka soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 113 on the Sanhedrin soil and 106 on the Kekawaka soil. The potential annual production from a fully stocked stand of ponderosa pine is 475 board feet per acre on the Sanhedrin soil and 495 board feet on the Kekawaka soil.

The main limitations for the harvesting of timber are the seasonal wetness, hazard of erosion, and steepness of slope. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on the Kekawaka soil are very dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. The Kekawaka soil has a tendency to slump along roadcuts in some areas.

Seedling survival and plant competition are concerns in the production of timber on this unit. The high soil temperature and limited soil moisture during the

growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings on the Kekawaka and Sanhedrin soils. Plantings on the Hopland soil have little chance of survival because of the high soil temperature and limited soil moisture.

Among the common forest understory plants are poison oak, bedstraw, and scattered perennial grasses.

This map unit is in capability subclass VIe (5), nonirrigated.

147—Hopland-Sanhedrin-Kekawaka complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oak woodland with scattered conifers. Elevation is 1,000 to 3,500 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 45 percent Hopland loam, 20 percent Sanhedrin gravelly loam, and 15 percent Kekawaka loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Casabonne, Cummiskey, Speaker, Witherell, Wohly, Woodin, and Yorkville soils. Included areas make up about 20 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded, hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is gravelly loam or clay loam, and in some areas the depth to soft sandstone is less than 60 inches.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for firewood production, as recreation areas, watershed, and wildlife habitat, and for timber production.

California black oak, Oregon white oak, and Pacific madrone are the main tree species on the Hopland soil. Among the trees of limited extent is blue oak. On the basis of a 50-year site curve, the mean site index for California black oak is 44. This soil can produce about 35 cords of wood per acre for a stand of trees 50 years old.

Ponderosa pine, Douglas fir, California black oak, and Pacific madrone are the main tree species on the Sanhedrin and Kekawaka soils. Among the trees of limited extent are sugar pine and Oregon white oak. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 111 on the Sanhedrin soil and 113 on the Kekawaka soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 113 on the Sanhedrin soil and 106 on the Kekawaka soil. The potential annual production from a fully stocked stand of ponderosa pine is 475 board feet per acre on the Sanhedrin soil and 495 board feet on the Kekawaka soil.

The main limitations for the harvesting of timber are steepness of slope, the hazard of erosion, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling

and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on the Kekawaka soil are very dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on this unit. Roads may fail and landslides may occur following deep soil disturbance. The Kekawaka soil has a tendency to slump in some areas.

Seedling survival and plant competition are concerns in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings on the Kekawaka and Sanhedrin soils. Plantings on the Hopland soil have little chance of survival because of the high soil temperature and limited soil moisture.

Among the common forest understory plants are poison oak, bedstraw, and scattered perennial grasses.

This map unit is in capability subclass VIIe (5), nonirrigated.

148—Hopland-Witherell-Squawrock complex, 15 to 30 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly annual grasses and oaks. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 35 percent Hopland loam, 30 percent Witherell sandy loam, and 20 percent Squawrock cobbly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Etsel, Maymen, Yorktree, and Yorkville soils and Rock outcrop. Also included are small areas of Hopland, Witherell, and Squawrock soils that have slopes of less than 15 percent or more than 30 percent and soils that are similar to the Hopland soil but have more than 35 percent rock fragments in the subsoil. Included areas make up about 15 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. In some areas the surface layer is gravelly loam. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Witherell soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick over yellowish brown sandy loam 5 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Squawrock soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The characteristic plant community on the Witherell and Squawrock soils is mainly soft chess, wild oat, and filaree. The production of forage is limited by the restricted available water capacity, the shallow rooting depth of the Witherell soil, and the hazard of erosion. Rangeland seeding and fertilization generally are not practical. Livestock grazing should be managed to protect this unit from erosion. Loss of the surface layer results in a decrease in productivity and in the potential of the unit to produce forage.

California black oak, Oregon white oak, and blue oak are the main tree species on the Hopland soil. Among the trees of limited extent are Pacific madrone,

California laurel, and Douglas fir. On the basis of a 50-year site curve, the mean site index for California black oak is 44 on the Hopland soil. This soil can produce about 35 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on the Hopland soil. Revegetation of cuts and fills is difficult on the Witherell and Squawrock soils because of the large amount of coarse fragments in the soils and the restricted available water capacity. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

This map unit is in capability subclass VIe (15), nonirrigated.

149—Hopland-Witherell-Squawrock complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly annual grasses and oaks. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 35 percent Hopland loam, 30 percent Witherell sandy loam, and 20 percent Squawrock cobbly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Etsel, Maymen, Yorktree, and Yorkville soils and Rock outcrop. Also included are small areas of Hopland, Witherell, and Squawrock soils that have slopes of less than 30 percent or more than 50 percent and soils that are similar to the Hopland soil but have more than 35 percent rock fragments in the subsoil. Included areas make up about 15 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth 31 inches. In some areas the surface layer is gravelly loam. Depth to soft bedrock is 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick over yellowish brown sandy loam 5 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Squawrock soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and hazard of erosion is high.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The characteristic plant community on the Witherell and Squawrock soils is mainly soft chess, wild oat, and filaree. The production of forage is limited by the steepness of slope, by the restricted available water capacity, and by the shallow rooting depth of the Witherell soil. Rangeland seeding and fertilization generally are not practical. Steepness of slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities help to promote uniform distribution of livestock grazing.

California black oak, Oregon white oak, and blue oak are the main tree species on the Hopland soil. Among the trees of limited extent are Pacific madrone, California laurel, and Douglas fir. This soil can produce

about 35 cords of wood per acre from a stand of trees 50 years old.

The main limitations for the harvesting of firewood are the steepness of slope, hazard of erosion, and seasonal wetness. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion on the Hopland soil. Revegetation of cuts and fills is difficult on the Squawrock and Witherell soils because of the restricted available water capacity. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

This map unit is in capability subclass VIe (15), nonirrigated.

150—Hopland-Wohly loams, 30 to 50 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly oaks and scattered pockets of Douglas fir. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 65 percent Hopland loam and 15 percent Wohly loam. The Hopland soil is on all aspects of side slopes. The Wohly soil is on north-facing side slopes and in east-facing areas of draws that have favorable microclimate for growth of conifers. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow soils on ridge shoulders that have south aspects, Casabonne soils on toe slopes that have north and east aspects, Hellman soils on wide ridgetops and structural benches, and Squawrock soils surrounding rock outcroppings and in areas of slightly metamorphosed sandstone. Also included are small areas of Hopland soils that have 15 to 30 percent gravel throughout the profile and Hopland and Wohly soils that have slopes of more than 50 percent or less than 30 percent. Included areas make up about 20 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. In some areas the surface layer is sandy loam. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish brown loam about 5 inches thick over brown loam 6 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used as recreation areas, wildlife habitat, and watershed. A few areas are used for firewood and timber production and for livestock grazing.

California black oak, Oregon white oak, and Pacific madrone are the main tree species on the Hopland soil. On the basis of a 50-year site curve, the mean site index for California black oak is 44. This soil can produce about 35 cords of wood per acre from a stand of trees 50 years old.

Douglas fir, California black oak, and Pacific madrone are the main tree species on the Wohly soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 118. The potential annual production from a fully stocked stand of Douglas fir is 420 board feet per acre.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit.

Establishing plant cover on steep cuts and fills reduces erosion.

Seedling mortality is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on south- and southwest-facing slopes. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are blue wildrye, iris, dogtail, and soft chess. Desirable forage species such as soft chess and hardinggrass grow well in previously forested areas that have been cleared and seeded; however, the soils in this unit retain their tendency to produce woody species. Grass is difficult to maintain in most areas.

This map unit is in capability subclass VIe (5), nonirrigated.

151—Hopland-Wohly loams, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oaks and scattered pockets of Douglas fir. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 65 percent Hopland loam and 15 percent Wohly loam. The Hopland soil is on all aspects. The Wohly soil is on north-facing slopes and in east-facing areas of draws that have favorable microclimate for growth of conifers. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow soils on ridge shoulders that have south aspects, Casabonne soils on toe slopes that have north and east aspects, Hellman soils on wide ridgetops and structural benches, and Squawrock soils surrounding rock outcroppings and in areas of slightly metamorphosed sandstone. Also included are small areas of Hopland soils that have 15 to 30 percent gravel throughout the profile and Hopland and Wohly soils that have slopes of more than 75 percent or less than 50 percent. Included areas make up about 20 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. In some areas the surface layer is sandy loam. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish brown loam about 5 inches thick over brown loam 6 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used as recreation areas, wildlife habitat, and watershed. A few areas are used for firewood and timber production and for livestock grazing.

California black oak, Oregon white oak, and Pacific madrone are the main tree species on the Hopland soil. On the basis of a 50-year site curve, the mean site index for California black oak is 44. This soil can produce about 35 cords of wood per acre from a stand of trees 50 years old.

Douglas fir, California black oak, and Pacific madrone are the main tree species on the Wohly soil. On the basis of a 100-year site curve, the mean site index is 118 for Douglas fir. The potential annual production from a fully stocked stand of Douglas fir is 420 board feet per acre.

Harvesting of trees usually is not feasible on this unit. The main limitations are the steepness of slope, hazard of erosion, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may

occur following deep soil disturbance.

Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on the south- and southwest-facing slopes. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done in December through May.

If this unit is used for livestock grazing, steepness of slope limits access by livestock and creates a very high risk of erosion. Among the common forest understory plants are blue wildrye, iris, melic, and soft chess.

This map unit is in capability subclass VIIe (5), nonirrigated.

152—Hopland-Woodin complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oaks, annual grasses, and occasional Douglas fir. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 45 percent Hopland loam and 25 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Etsel, Maymen, Witherell, Yorktree, and Yorkville soils. Also included are small areas of Rock outcrop and soils that are similar to the Hopland soil but have 35 to 45 percent coarse fragments. Included areas make up about 30 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used as watershed and wildlife habitat. A few areas are used for firewood production.

Oregon white oak and blue oak are the main tree species on this unit. Among the trees of limited extent are Douglas fir, California black oak, Pacific madrone, and California laurel. This unit can produce 25 to 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 44 on the Hopland soil. Scattered Douglas fir trees on the Woodin soil have a site index of 97.

Harvesting of firewood is limited mainly by steepness of slope. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Woodin soil because of the very low available water capacity. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done in December through May.

Among the common forest understory plants are melic, blue wildrye, and iris. California nutmeg commonly is present on the Woodin soil.

This map unit is in capability subclass VIe (5), nonirrigated.

153—Hopland-Woodin complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oaks, annual grasses, and occasional Douglas fir. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the

average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 40 percent Hopland loam and 30 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Etsel, Maymen, Witherell, Yorktree, and Yorkville soils. Also included are small areas of Rock outcrop and soils that are similar to the Hopland soil but have 35 to 45 percent coarse fragments. Included areas make up about 30 percent of the total acreage.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. A layer of fine gravel as much as 3 inches thick is on the surface in some areas.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used as watershed and wildlife habitat. A few areas are used for firewood production.

Oregon white oak and blue oak are the main tree species on this unit. Among the trees of limited extent are Douglas fir, California black oak, Pacific madrone, and California laurel. This unit can produce 25 to 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 44 on the Hopland soil. Scattered Douglas fir trees on the Woodin soil have a site index of 97.

Harvesting of firewood generally is not feasible on this unit because of the steepness of slope. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Woodin soil because of the very low available water capacity. Roads may fail and landslides may occur following deep soil disturbance. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done from December through May.

Among the common forest understory plants are melic, blue wildrye, and iris. California nutmeg commonly is present on the Woodin soil.

This map unit is in capability subclass VIIe (5), nonirrigated.

154—Kekawaka-Casabonne-Wohly loams, 15 to 30 percent slopes. This map unit is on side slopes, ridgetops, and toe slopes of hills and mountains. The native vegetation is mainly coniferous forest. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 35 percent Kekawaka loam, 25 percent Casabonne loam, and 15 percent Wohly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Hellman, Pardaloe, Sanhedrin, and Yorktree soils and soils that are similar to the Casabonne and Kekawaka soils but have more than 35 percent rock fragments in the subsoil. Also included are small areas of Kekawaka, Casabonne, and Wohly soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 25 percent of the total acreage.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is clay loam or the depth to soft sandstone is less than 60 inches.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate.

The Casabonne soil is deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is reddish yellow loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Casabonne soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Wohly soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

Most areas of this unit are used for timber and firewood production and as wildlife habitat.

Douglas fir, tanoak, Pacific madrone, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 154 on the Kekawaka soil, 153 on the Casabonne soil, and 118 on the Wohly soil. Ponderosa pine grows on the Kekawaka soil in some areas. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 147. The potential annual production from a fully stocked stand of Douglas fir is 760 board feet per acre on the Kekawaka soil, 750 board feet on the Casabonne soil, and 420 board feet on the Wohly soil.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. The Kekawaka soil is unstable in some places. Roads may fail and landslides may occur following deep soil disturbance in these areas.

Plant competition is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically, especially on the Kekawaka and Casabonne soils. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial bromes and fescues.

This map unit is in capability unit IVe-1 (5), nonirrigated.

155—Kekawaka-Casabonne-Wohly complex, 30 to 50 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly coniferous forest. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 35 percent Kekawaka loam, 20 percent Casabonne gravelly loam, and 20 percent Wohly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Sanhedrin, Pardaloe, and Woodin soils, Rock outcrop, and soils that are similar to the Casabonne and Kekawaka soils but have more than 35 percent rock fragments in the subsoil. Also included are small areas of Kekawaka, Casabonne, and Wohly soils that have slopes of less than 30 percent or more than 50 percent and soils south of Ukiah that are at an elevation of less than 1,000 feet. Included areas make up about 25 percent of the total acreage.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish

red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is gravelly loam or clay loam, and in some areas the depth to soft sandstone is less than 60 inches.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of the erosion is high.

The Casabonne soil is deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for timber and firewood production and as wildlife habitat.

Douglas fir, tanoak, Pacific madrone, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 154 on the Kekawaka soil, 144 on the Casabonne soil, and 118 on the Wohly soil. Ponderosa pine grows on the Kekawaka soil in some areas. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 147. The potential annual production from a fully stocked stand of Douglas fir is 760 board feet per acre on the Kekawaka soil, 665 board feet on the Casabonne soil, and 420 board feet on the Wohly soil.

The main limitations for the harvesting of timber are the steepness of slope, seasonal wetness, and hazard of erosion. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. The Kekawaka soil is unstable in some areas. Roads may fail and landslides may occur following deep soil disturbance in these areas.

Plant competition is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically, especially on the Kekawaka and Casabonne soils. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial bromes and fescues.

This map unit is in capability subclass VIe (5), nonirrigated.

156—Maxwell clay, 0 to 9 percent slopes. This very deep, somewhat poorly drained soil is in basins and on alluvial fans. It formed in material derived dominantly from serpentinitic rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 500 to 1,700 feet. The average annual precipitation is 32 to 50 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Typically, the surface is covered with a mat of decomposing roots about 2 inches thick. The surface layer is very dark gray clay about 37 inches thick. The upper 19 inches of the underlying material is very dark gray, slightly effervescent clay, and the lower part to a depth of 60 inches or more is dark gray, slightly effervescent clay. In some areas the surface layer is clay loam and is very dark brown or very dark grayish brown throughout the profile. In some areas the underlying material is not effervescent.

Included in this unit are small areas of Clear Lake and Cole soils. Small areas of this unit are mapped at elevations of as much as 4,100 feet. Also included are

soils on alluvial toe slopes of more than 9 percent. Included areas make up about 15 percent of the total acreage.

Permeability of the Maxwell soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 42 and 60 inches in December through March. The water table drops to a depth of more than 60 inches during the growing season. The shrink-swell potential is high. The calcium-to-magnesium ratio is less than 2:1.

Most areas of this unit are used for livestock grazing, hay and pasture, watershed, and wildlife habitat. A few areas are used for orchards and vineyards.

If this unit is used for orchards and vineyards, the main limitation is the low soil fertility because of the ratio of calcium to magnesium. Overcoming this limitation is not economically feasible because of the large amount of calcium needed.

This unit is suited to hay and pasture. The main limitations are the low soil fertility because of the ratio of calcium to magnesium and the very slow permeability. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction. Fertilizer is needed to ensure optimum growth of grasses and legumes.

The production of forage is limited by the low soil fertility because of the ratio of calcium to magnesium and the susceptibility of the soil to compaction when it is moist. Seeding on this unit generally is not practical. Grazing should be deferred when the surface layer is saturated. Common plants on this unit are slender oat, soft chess, wild oat, and annual clover.

This map unit is in capability unit IIIe-5 (14), irrigated and nonirrigated.

157—Mayacama-Hopland-Etsel complex, 30 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly chaparral, oaks, and occasional knobcone pine. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 40 percent Mayacama gravelly loam, 30 percent Hopland loam, and 15 percent Etsel gravelly loam. The Mayacama and Hopland soils are on side slopes of drainageways. The Etsel soil is on upper side slopes and ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Dunsmuir, Henneke, Maymen, Montara, Snook, and Witherell soils and soils that are similar to the Mayacama and Hopland soils but are more than 40 inches deep. Also included are small areas of Rock outcrop and Mayacama, Hopland, and Etsel soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material derived dominantly from sandstone and metasedimentary rock. Typically, the surface layer is brown gravelly loam about 4 inches thick. The upper 9 inches of the subsoil is brown very gravelly loam, and the lower 11 inches is light brown very gravelly loam. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam or sandy loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used as watershed and wildlife habitat. A few areas are used for firewood production.

Interior live oak, Oregon white oak, Pacific madrone, and California black oak are the main tree species on this unit. The Mayacama and Hopland soils also support scrub oak, California bay, manzanita, and occasional knobcone pine. On the basis of a 50-year site curve, the mean site index for California black oak is 35 on the Mayacama soil and 44 on the Hopland soil. The Mayacama soil can produce about 20 cords of wood per acre from a stand of trees 50 years old. The Hopland soil can produce about 35 cords of wood per acre from a stand of trees 50 years old. The natural vegetation on the Etsel soil is mainly brush because of the limited soil depth, very low available water capacity, and climate.

The main limitations for the harvesting of firewood are the steepness of slope and hazard of erosion. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Rocks and loose soil material may slide onto roads, increasing the need for road maintenance. Rock for construction of roads usually is available in areas of this unit. Revegetation of exposed underlying layers is difficult in some areas because of the large amount of coarse fragments and the restricted available water capacity. Establishing plant cover on steep cuts and fills reduces the risk of erosion.

Plantings of conifers on this unit have little chance of survival because of the high soil temperature and limited soil moisture during the growing season. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are iris, poison oak, interior live oak, and scattered annual grasses and forbs.

This map unit is in capability subclass VIIe (5), nonirrigated.

158—Maymen-Etsel-Hopland complex, 15 to 50 percent slopes. This map unit is on dissected ridgetops and mountains. The native vegetation is mainly chaparral, oaks, and knobcone pine. Elevation is 1,800 to 3,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 40 percent Maymen sandy loam, 20 percent Etsel gravelly loam, and 20 percent Hopland loam. The Maymen soil is on ridgetops, the Etsel soil is on side slopes, and the Hopland soil is on ridgetops and shoulders and in drainageways. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Henneke, Mayacama, and Maymen Variant soils and soils that are similar to the Hopland soil but are more than 40 inches deep. Also included are small areas of Maymen, Hopland, and Etsel soils that have slopes of less than 15 percent. Included areas make up about 20 percent of the total acreage.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is rapid, and the hazard of erosion is high.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam or sandy loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used as watershed and wildlife habitat. A few areas are used for firewood production.

California black oak, Pacific madrone, and knobcone pine are the main tree species on the Hopland soil. This soil also supports manzanita. On the basis of a 50-year site curve, the mean site index for California black oak is 44. The Hopland soil can produce about 35 cords of wood per acre from a stand of trees 50 years old. The natural vegetation on the Maymen and Etsel soils is mainly brush because of the limited soil depth, restricted available water capacity, and climate.

The main limitations for the harvesting of firewood are the hazard of erosion, steepness of slope, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. In some areas revegetation of exposed underlying layers is difficult because of the limited soil depth and the large amount of rock fragments. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are soft chess, ripgut brome, and wild oat.

This map unit is in capability subclass VIIe (5), nonirrigated.

159—Maymen-Etsel-Mayacama complex, 30 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral and oaks. Elevation is 1,000 to 3,500 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 225 days.

This unit is 35 percent Maymen sandy loam, 25 percent Etsel gravelly loam, and 25 percent Mayacama gravelly loam. The Maymen and Etsel soils are on side slopes and ridgetops, and the Mayacama soil is on side slopes of drainageways. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Cummiskey, Henneke, Hopland, and Montara soils. Also included are small areas of Maymen, Etsel, and Mayacama soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material derived dominantly from sandstone and metasedimentary rock. Typically, the surface layer is brown gravelly loam about 4 inches thick. The upper 9 inches of the subsoil is brown very gravelly loam, and the lower 11 inches is light brown very gravelly loam. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is chaparral on the Maymen and Etsel soils and oaks and manzanita on the Mayacama soil. The vegetation is mainly brush because of the limited soil depth, restricted available water capacity, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire.

This unit is suited to livestock grazing. Firebreaks constructed on ridgetops help to control wildfire that results in erosion. Rocks and loose soil material may slide onto roads along side slopes, increasing the need for road maintenance. During heavy rainstorms, the soil in this unit becomes saturated and water flows across the surface. If the Maymen and Mayacama soils are cleared for firebreaks, seeding grass helps to prevent erosion. The Etsel soil will not support good stands of grass.

This map unit is in capability subclass VIIe (5), nonirrigated.

160—Maymen-Etsel-Snook complex, 30 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral. Elevation is 1,000 to 4,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 225 days.

This unit is 35 percent Maymen sandy loam, 25 percent Etsel gravelly loam, and 25 percent Snook gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Cummiskey, Henneke, Hopland, Montara, Squawrock, and Witherell soils and areas of Rock outcrop and landslips. Also included in the northeastern corner of the survey area are areas of Tyson soils at elevations of as much as 5,300 feet. Included areas make up about 15 percent of the total acreage.

The Maymen soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches. In some areas in the southern part of the survey area, the soil is redder in color. In some areas the soil is clay loam.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Snook soil is very shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is light yellowish brown gravelly loam about 5 inches thick. Fractured sandstone is at a depth of 5 inches. Depth to bedrock ranges from 4 to 10 inches. In some areas the surface layer is sandy loam or gravelly sandy loam. In some areas a gravel pavement is on the surface.

Permeability of the Snook soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly brush because of limited soil depth, very low available water capacity, and climate. Properly planned and applied prescribed burning, chemical treatment, or mechanical treatment can be used in small areas of 10 to 50 acres to improve wildlife habitat, increase wildlife access and water production, and reduce the risk of wildfire. Firebreaks constructed on ridgetops help to control wildfire, which results in erosion. Where the Maymen soil is cleared for firebreaks, seeding grass helps to prevent erosion. The Etsel and Snook soils will not support good stands of grass. Rocks and loose soil material may slide onto roads along side slopes, increasing the need for road maintenance.

This map unit is in capability subclass VIIe (5), nonirrigated.

161—Maymen-Woodin-Etsel complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral and oaks. Elevation is 1,000 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 225 days.

This unit is 35 percent Maymen sandy loam, 30 percent Woodin gravelly sandy loam, and 20 percent Etsel gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hopland, Kekawaka, Sanhedrin, and Speaker soils on north-facing concave slopes, Dingman and Henneke soils that are underlain by serpentinitic rock, and Snook soils on

ridgetops. Also included are small areas of Maymen, Woodin, and Etsel soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly brush because of the limited soil depth, very low available water capacity, and climate. Using prescribed burning, chemical treatment, or mechanical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire. Where the Maymen and Woodin soils are cleared for firebreaks, seeding grass helps to prevent erosion. The Etsel soil will not support good stands of grass.

This map unit is in capability subclass VIIe (5), nonirrigated.

162—Maymen-Woodin-Etsel complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral and oaks. Elevation is 1,000 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 225 days.

This unit is 35 percent Maymen sandy loam, 30 percent Woodin gravelly sandy loam, and 20 percent Etsel gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hopland, Sanhedrin, and Speaker soils on north-facing concave slopes, Dingman and Henneke soils that are underlain by serpentinitic rock, and Snook soils on ridgetops. Also included are small areas of Maymen, Woodin, and Etsel soils that have slopes of less than 50 percent or more than 75 percent. Areas of this unit north of Cow Mountain Ridge have been mapped at elevations of as much as 3,700 feet. Included areas make up about 15 percent of the total acreage.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is light yellowish brown sandy loam about 5 inches thick. The subsoil is light yellowish brown sandy loam about 6 inches thick. Hard, fractured sandstone is at a depth of 11 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. A layer

consisting of pebbles 2 to 25 millimeters in diameter and as much as 3 inches thick is on the surface in some areas.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Etsel soil is very shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is light yellowish brown gravelly loam about 3 inches thick over very gravelly loam 4 inches thick. Fractured sandstone and shale are at a depth of 7 inches. Depth to bedrock ranges from 4 to 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 4 to 10 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used mainly as watershed, wildlife habitat, and recreation areas.

The natural vegetation on this unit is mainly chaparral; some oak is on north-facing slopes of the Woodin soil. The vegetation is mainly brush because of the limited soil depth, very low available water capacity, and climate. Using prescribed burning or chemical treatment in small areas of 10 to 50 acres improves wildlife habitat, increases wildlife access and water production, and reduces the risk of wildfire. Rocks and loose soil material may slide onto roads along side slopes, increasing the need for road maintenance. Where the Maymen and Woodin soils are cleared for firebreaks, seeding grass helps to prevent erosion. The Etsel soil will not support good stands of grass.

This map unit is in capability subclass VIIe (5), nonirrigated.

163—Nashmead-Updegraff-Woodin complex, 30 to 50 percent slopes. This map unit is on north- and east-facing side slopes of mountains. The native vegetation is mainly conifers with scattered oaks. Elevation is 600 to 2,200 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 35 percent Nashmead gravelly sandy loam, 30 percent Updegraff loam, and 20 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Hopland, Sanhedrin, Shortyork, Squawrock, Witherell, Yorktree, and Yorkville soils. Also included are small areas of Nashmead, Updegraff, and Woodin soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Nashmead soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface is covered with a layer that consists of decomposed roots, leaves, and twigs mixed with fine gravel and is about 1 inch thick. The surface layer is brown gravelly sandy loam about 11 inches thick. The upper 13 inches of the subsoil is pale brown very gravelly loam, and the lower 10 inches is light yellowish brown very cobbly loam. The substratum is light yellowish brown very cobbly sandy clay loam about 17 inches thick. Fractured sandstone is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Nashmead soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate to high.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of slightly decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate to high.

This unit is used for timber and firewood production

and as watershed and wildlife habitat.

Douglas fir, Pacific madrone, California laurel, and California black oak are the main tree species on this unit. Among the trees of limited extent are canyon live oak, interior live oak, Oregon white oak, and ponderosa pine. On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Nashmead soil, 101 on the Updegraff soil, and 97 on the Woodin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is estimated to be 105 on the Nashmead soil, 110 on the Updegraff soil, and 105 on the Woodin soil. The potential annual production from a fully stocked stand of Douglas fir is 305 board feet per acre on the Nashmead soil, 275 board feet on the Updegraff soil, and 245 board feet on the Woodin soil. Because a fully stocked stand is difficult to achieve on this unit, yields commonly are substantially less than those of normal stands. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

The main limitations for the harvesting of timber are the hazard of erosion, steepness of slope, and seasonal wetness. Slumps and earthflows occur on the Updegraff soil. Roads may fail and landslides may occur following deep soil disturbance. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on the Updegraff soil. Revegetation of exposed subsoil material is difficult on the Nashmead and Woodin soils because of the large amount of coarse fragments.

Seedling mortality and plant competition are concerns in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation can be accomplished by planting large ponderosa pine and Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently because a dense cover of annual and perennial grasses develops on the Nashmead soil in most places. Plantings on the Nashmead and Woodin soils have little chance of survival because of the restricted available water capacity.

Among the common forest understory plants are poison oak, reed fescue, blue wildrye, melic, and, on the Woodin soil, California buckeye.

This map unit is in capability subclass VIe (5), nonirrigated.

164—Nashmead-Updegraff-Woodin complex, 50 to 75 percent slopes. This map unit is on north- and east-facing side slopes of mountains. The native vegetation is mainly conifers and scattered oaks. Elevation is 900 to 2,800 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 40 percent Nashmead gravelly sandy loam, 25 percent Updegraff loam, and 20 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Hopland, Maymen, Sanhedrin, Squawrock, Witherell, Yorktree, and Yorkville soils. Also included are small areas of Rock outcrop, landslides, and Nashmead, Updegraff, and Woodin soils that have slopes of less than 50 percent or more than 75 percent. Included areas make up about 15 percent of the total acreage.

The Nashmead soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface is covered with a mat about 1 inch thick. It consists of decomposed roots, leaves, and twigs mixed with fine gravel. The surface layer is brown gravelly sandy loam about 11 inches thick. The upper 13 inches of the subsoil is pale brown very gravelly loam, and the lower 10 inches is light yellowish brown very cobbly loam. The substratum is light yellowish brown very cobbly sandy clay loam about 17 inches thick. Fractured sandstone is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Nashmead soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is high.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the

subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of partially decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber and firewood production and as watershed and wildlife habitat.

Douglas fir, Pacific madrone, California laurel, and California black oak are the main tree species on this unit. Among the trees of limited extent are canyon live oak, interior live oak, Oregon white oak, and ponderosa pine. On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Nashmead soil, 101 on the Updegraff soil, and 97 on the Woodin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is estimated to be 105 on the Nashmead soil, 110 on the Updegraff soil, and 105 on the Woodin soil. The potential annual production from a fully stocked stand of Douglas fir is 305 board feet per acre on the Nashmead soil, 275 board feet on the Updegraff soil, and 245 board feet on the Woodin soil. Because a fully stocked stand is difficult to achieve on this unit, yields commonly are substantially less than those of normal stands. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, hazard of mass soil movement, and seasonal wetness. Rocks and loose soil material may slide onto roads on the Nashmead and Woodin soils, increasing the need for road maintenance. Slumps and earthflows occur on the Updegraff soil. Roads may fail and landslides may occur following deep soil disturbance. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on the Updegraff soil. Revegetation of exposed subsoil material is difficult on the Nashmead and Woodin soils because of the high content of coarse fragments.

Seedling mortality and plant competition are concerns in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation can be accomplished by planting large ponderosa pine and Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently because a dense cover of annual and perennial grasses develops on the Nashmead and Updegraff soils in most places. Plantings on the Nashmead and Woodin soils have little chance of survival because of the restricted available water capacity.

Among the common forest understory plants are poison oak, reed fescue, blue wildrye, melic, and, on the Woodin soil, California buckeye.

This map unit is in capability subclass VIIe (5), nonirrigated.

165—Nashmead-Woodin gravelly sandy loams, 30 to 50 percent slopes. This map unit is on side slopes of mountains. The native vegetation is mainly coniferous forest with scattered oaks. Elevation is 1,000 to 2,800 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 60 percent Nashmead gravelly sandy loam and 20 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sanhedrin, Speaker, and Yorktree soils. Also included are soils that have slopes of more than 50 percent or less than 30 percent. Included areas make up about 20 percent of the total acreage.

The Nashmead soil is deep and well drained. It

formed in material derived dominantly from sandstone or shale. Typically, the surface is covered with a mat that consists of decomposed roots, leaves, and twigs mixed with fine gravel and is about 1 inch thick. The surface layer is brown gravelly sandy loam about 11 inches thick. The upper 13 inches of the subsoil is pale brown very gravelly loam, and the lower 10 inches is light yellowish brown very cobbly loam. The substratum is light yellowish brown very cobbly sandy clay loam about 17 inches thick. Fractured sandstone is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Nashmead soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate to high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate to high.

Most areas of this unit are used for timber and firewood production and as wildlife habitat.

Douglas fir, ponderosa pine, Pacific madrone, canyon live oak, and California black oak are the main tree species on the Nashmead soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. On the basis of a 100-year site curve, the mean site index for ponderosa pine is estimated to be 105. The potential annual production from a fully stocked stand of Douglas fir is 305 board feet per acre.

California nutmeg, canyon live oak, Pacific madrone, and California laurel are the main tree species on the Woodin soil. On the basis of a 100-year site curve, the mean site index for scattered Douglas fir on this soil is 97. Because a fully stocked stand is difficult to achieve on the Woodin soil, yields commonly are well below those of normal stands.

The main limitations for the harvesting of timber are the steepness of slope and seasonal wetness. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Rock for construction of roads generally is available in areas of this unit. Revegetation of cuts and fills is difficult on this unit because of the high content of coarse fragments and the limited available water capacity in some areas.

Seedling survival is a concern in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation can be accomplished by planting ponderosa pine or large Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are reed fescue, blue wildrye, live oak, and manzanita.

This map unit is in capability subclass VIe (5), nonirrigated.

166—Nashmead-Woodin gravelly sandy loams, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest with scattered oaks. Elevation is 1,000 to 2,800 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 55 percent Nashmead gravelly sandy loam and 25 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Neuns, Sanhedrin, Speaker, and Yorktree soils. Also included are areas of soils that are at elevations of more than 2,800 feet and are near Black Rock, northeast of Laytonville. Included areas make up about 20 percent of the total acreage.

The Nashmead soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface is covered with a mat about 1 inch thick. It consists of decomposed roots, leaves, and twigs mixed with fine gravel. The surface layer is brown gravelly sandy loam about 11 inches thick. The upper 13 inches of the subsoil is pale brown very gravelly loam, and the lower 10 inches is light yellowish brown very cobbly loam. The substratum is light yellowish brown very cobbly sandy clay loam about 17 inches thick. Fractured sandstone is at a depth of 51

inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Nashmead soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. A layer of fine gravel as much as 3 inches thick is on the surface in some areas.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used for timber and firewood production and as wildlife habitat.

Douglas fir, ponderosa pine, Pacific madrone, and California black oak are the main tree species on the Nashmead soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. On the basis of a 100-year site curve, the mean site index for ponderosa pine is estimated to be 105. The potential annual production from a fully stocked stand of Douglas fir is 305 board feet per acre.

California nutmeg, canyon live oak, Pacific madrone, and California laurel are the main tree species on the Woodin soil. On the basis of a 100-year site curve, the mean site index for scattered Douglas fir on this soil is 97. Because a fully stocked stand is difficult to achieve on the Woodin soil, yields commonly are well below those of normal stands.

The main limitations for the harvesting of timber are the steepness of slope and hazard of erosion. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Rock for construction of roads is available in areas of this unit. Revegetation of cuts and fills is difficult on this unit because of the large amount of coarse fragments and the restricted available water capacity in some areas. Roads may fail and landslides may occur following deep soil disturbance. Rocks and loose soil material may slide onto roads, increasing the need for road maintenance.

Seedling survival is a concern in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation can be accomplished by planting ponderosa pine or large Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are reed fescue, blue wildrye, live oak, and manzanita.

This map unit is in capability subclass VIIe (5), nonirrigated.

167—Neuns-Bluenose-Tyson complex, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oak. Elevation is 2,500 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 45 percent Neuns very gravelly loam, 25 percent Bluenose very gravelly sandy loam, and 15 percent Tyson very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Etsel, Maymen, Gudgrey, Sanhedrin, Shortyork, Speaker, Updegraff, Yorktree, Yorkville, and Witherell soils. Also included are small areas of soils that are similar to the Bluenose soil but have less than 35 percent rock fragments throughout the profile. In the northeastern corner of the survey area, this unit is mapped at elevations above 5,000 feet. Included areas make up about 15 percent of the total acreage.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, and sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20

to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, and shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches is yellowish brown very gravelly sandy loam. In some areas the subsoil is very gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Tyson soil is moderately deep and well drained. It formed in material derived dominantly from shale or sandstone. Typically, the surface is covered with a mat of oak leaves and twigs about 1 inch thick. The surface layer is brown very gravelly loam about 7 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam, and the lower 11 inches is pale brown very gravelly loam. Fractured shale is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tyson soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on the Neuns and Bluenose soils. On the basis of a 100-year site curve, the mean site index for Douglas fir is 113 on the Neuns soil and 129 on the Bluenose soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil and 120 on the Bluenose soil. The potential annual production from a fully stocked stand of ponderosa pine is 425 board feet per acre on the Neuns soil and 570 board feet on the Bluenose soil. Among the trees of limited extent are white fir, sugar pine, Pacific madrone, and bigleaf maple.

Brewer oak is the main tree species on the Tyson soil. It can produce about 11 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of timber is steepness of slope. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less and are more suitable in the steeper areas. Rock for construction of roads is available in areas of this unit. Rocks and loose soil material may slide onto roads, increasing the need for road maintenance.

Seedling establishment and plant competition are concerns in the production of timber. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and white fir occurs infrequently. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Plantings on the Tyson soil have little chance of survival because of the limited available water capacity.

Among the common forest understory plants on the Neuns and Bluenose soils are gooseberry, poison oak, and snowberry. Scattered perennial grasses such as blue wildrye and reed fescue and forbs such as shootingstar are common on the Tyson soil.

This map unit is in capability subclass VIe (5), nonirrigated.

168—Neuns-Bluenose-Tyson complex, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly coniferous forest and scattered oak. Elevation is 2,500 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 45 percent Neuns very gravelly loam, 25 percent Bluenose very gravelly sandy loam, and 15 percent Tyson very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Etsel, Gudgrey, Maymen, Sanhedrin, Shortyork, Speaker, Updegraff, Yorktree, Yorkville, and Witherell soils. Also included are small areas of soils that are similar to the Bluenose soil but have less than 35 percent rock fragments throughout. Included areas make up about 15 percent of the total acreage.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale

brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Bluenose soil is very deep and well drained. It formed in material derived dominantly from sandstone, schist, or shale. Typically, the surface layer is dark grayish brown and dark brown very gravelly sandy loam about 15 inches thick. The subsoil is brown very gravelly sandy clay loam about 21 inches thick. The substratum to a depth of 62 inches is yellowish brown very gravelly sandy loam. In some areas the subsoil is very gravelly clay loam.

Permeability of the Bluenose soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Tyson soil is moderately deep and well drained. It formed in material derived dominantly from shale or sandstone. Typically, the surface is covered with a mat of oak leaves and twigs about 1 inch thick. The surface layer is brown very gravelly loam about 7 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam, and the lower 11 inches is pale brown very gravelly loam. Fractured shale is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tyson soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The unit is used for timber production and as watershed and wildlife habitat.

Douglas fir, ponderosa pine, and California black oak are the main tree species on the Neuns and Bluenose soils. On the basis of a 100-year site curve, the mean site index for Douglas fir is 113 on the Neuns soil and 130 on the Bluenose soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil and 120 on the Bluenose soil. The potential annual production from a fully stocked stand of ponderosa pine is 425 board feet per acre on the Neuns soil and 570 board feet on the Bluenose soil. Among the trees of limited extent are incense cedar, Oregon white oak, white fir, sugar pine, Pacific madrone, and bigleaf maple.

Brewer oak is the main tree species on the Tyson soil. It can produce about 11 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of timber is steepness of slope, which limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Rock for construction of roads is available in areas of this unit. Revegetation of cuts on this unit is difficult because of the large amount of coarse fragments in the soils. Rocks and loose soil material may slide onto roads, increasing the need for road maintenance.

Seedling establishment and plant competition are concerns in the production of timber. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and white fir occurs infrequently. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Plantings on the Tyson soil have little chance of survival because of the limited available water capacity.

Among the common forest understory plants on the Neuns and Bluenose soils are gooseberry, poison oak, and snowberry. Scattered perennial grasses such as blue wildrye and reed fescue and forbs such as shootingstar are common on the Tyson soil.

This map unit is in capability subclass VIIe (5), nonirrigated.

169—Ornbaun-Zeni loams, 9 to 30 percent slopes. This map unit is on ridges, upper side slopes, and toe slopes of mountains. The native vegetation is mainly Douglas fir, redwood, and tanoak. Elevation is 500 to 2,500 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 220 to 270 days.

This unit is 45 percent Ornbaun loam and 40 percent Zeni loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Casabonne, Kibesillah, Wohly, and Yellowhound soils, exposed bedrock along roadcuts, and soils that are similar to the Ornbaun soil but are more than 60 inches deep to bedrock or have less than 17 percent clay in the subsoil. Also included are small areas of soils on ridges and along draws that have slopes of less than 9 percent

and small areas of soils in gulches that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

The Ornbaun soil is deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of fresh and decomposed redwood and Douglas fir needles and tanoak leaves about 1 inch thick. The surface layer is pale brown over light yellowish brown loam about 9 inches thick. The upper 10 inches of the subsoil is very pale brown gravelly clay loam, and the lower 23 inches is reddish yellow gravelly clay loam. Hard, fractured sandstone is at a depth of 42 inches. Depth to sandstone ranges from 40 to 60 inches. In some areas the subsoil is more than 35 percent clay.

Permeability of the Ornbaun soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

The Zeni soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of tanoak leaves about 1 inch thick. The surface layer is brown loam about 7 inches thick. The subsoil is light yellowish brown clay loam about 16 inches thick. Soft sandstone is at a depth of 23 inches. Depth to soft sandstone ranges from 20 to 40 inches.

Permeability of the Zeni soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, redwood, tanoak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 155 on the Ornbaun soil and 129 on the Zeni soil. On the basis of a 100-year site curve, the mean site index for redwood is 152 on the Ornbaun soil and 127 on the Zeni soil. The potential annual production from a fully stocked stand of redwood is 1,310 board feet per acre on the Ornbaun soil and 935 board feet on the Zeni soil.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment. Roads are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brush can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and redwood seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs periodically. After cutting, redwood can regenerate by stump sprouting; however, these sprouts seldom provide optimum stocking.

Among the common forest understory plants are evergreen huckleberry, violet, iris, brackenfern, and swordfern.

This unit is in capability unit IVe-1 (4), nonirrigated.

170—Ornbaun-Zeni loams, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly Douglas fir, redwood, and tanoak. Elevation is 500 to 2,500 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 220 to 270 days.

This unit is 45 percent Ornbaun loam and 40 percent Zeni loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Casabonne, Kibesillah, Wohly, and Yellowhound soils, exposed bedrock along roadcuts, and soils that are similar to the Ornbaun soil but are more than 60 inches deep to bedrock or have less than 17 percent clay in the subsoil. Also included are small areas of soils on ridges and along draws that have slopes of less than 30 percent and small areas of soils in gulches that have slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Ornbaun soil is deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of fresh and decomposed redwood and Douglas fir needles and tanoak leaves about 1 inch thick. The surface layer is pale brown over light yellowish brown loam about 9 inches thick. The upper 10 inches of the subsoil is very pale brown gravelly clay loam, and the lower 23 inches is reddish yellow gravelly clay loam. Fractured

sandstone is at a depth of 42 inches. Depth to sandstone ranges from 40 to 60 inches. In some areas the subsoil is more than 35 percent clay.

Permeability of the Ornbaun soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is rapid, and the hazard of erosion is high.

The Zeni soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of tanoak leaves about 1 inch thick. The surface layer is brown loam about 7 inches thick. The subsoil is light yellowish brown clay loam about 16 inches thick. Soft sandstone is at a depth of 23 inches. Depth to soft sandstone ranges from 20 to 40 inches.

Permeability of the Zeni soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, redwood, tanoak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 155 on the Ornbaun soil and 129 on the Zeni soil. On the basis of a 100-year site curve, the mean site index for redwood is 152 on the Ornbaun soil and 127 on the Zeni soil. The potential annual production from a fully stocked stand of redwood is 1,310 board feet per acre on the Ornbaun soil and 935 board feet on the Zeni soil.

The main limitations for the harvesting of timber are the seasonal wetness, hazard of erosion, and steepness of slope. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of either wheeled and tracked equipment or cable yarding systems. Roads are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and redwood seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs periodically. After cutting, redwood can regenerate by stump sprouting; however, these sprouts seldom provide optimum stocking.

Among the common forest understory plants are evergreen huckleberry, violet, iris, brackenfern, and swordfern.

This map unit is in capability subclass VIe (4), nonirrigated.

171—Ornbaun-Zeni loams, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly Douglas fir, redwood, and tanoak. Elevation is 500 to 2,500 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 220 to 270 days.

This unit is 40 percent Ornbaun loam and 40 percent Zeni loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Casabonne, Kibesillah, Wohly, and Yellowhound soils, Rock outcrop, exposed bedrock along roadcuts, and soils that are similar to the Ornbaun soil but are more than 60 inches deep to bedrock or have less than 17 percent clay in the subsoil. Also included are small areas of soils on ridges that have slopes of less than 50 percent and small areas in gulches that have slopes of more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Ornbaun soil is deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of fresh and decomposed redwood and Douglas fir needles and tanoak leaves about 1 inch thick. The surface layer is pale brown over light yellowish brown loam about 9 inches thick. The upper 10 inches of the subsoil is very pale brown gravelly clay loam, and the lower 23 inches is reddish yellow gravelly clay loam. Fractured sandstone is at a depth of 42 inches. Depth to sandstone ranges from 40 to 60 inches. In some areas the subsoil has more than 35 percent clay.

Permeability of the Ornbaun soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches; however, some roots follow fractures in the bedrock and penetrate to a greater

depth. Runoff is very rapid, and the hazard of erosion is very high.

The Zeni soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of tanoak leaves about 1 inch thick. The surface layer is brown loam about 7 inches thick. The subsoil is light yellowish brown clay loam about 16 inches thick. Soft sandstone is at a depth of 23 inches. Depth to soft sandstone ranges from 20 to 40 inches.

Permeability of the Zeni soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, redwood, tanoak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 155 on the Ornbaun soil and 129 on the Zeni soil. On the basis of a 100-year site curve, the mean site index for redwood is 152 on the Ornbaun soil and 127 on the Zeni soil. The potential annual production from a fully stocked stand of redwood is 1,310 board feet per acre on the Ornbaun soil and 935 board feet on the Zeni soil.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Roads are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following deep soil disturbance in the steeper areas of this unit.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and redwood seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs periodically. After cutting, redwood can regenerate by stump sprouting; however, these sprouts seldom provide adequate stocking.

Among the common forest understory plants are evergreen huckleberry, violet, iris, brackenfern, and swordfern.

This map unit is in capability subclass VIIe (4), nonirrigated.

172—Pardaloe-Kekawaka-Casabonne complex, 50 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly coniferous forest. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 175 to 225 days.

This unit is 35 percent Pardaloe gravelly loam, 20 percent Kekawaka loam, and 20 percent Casabonne gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cummiskey, Sanhedrin, Wohly, and Woodin soils and Rock outcrop. Also included are small areas of Casabonne, Kekawaka, and Pardaloe soils that have slopes of less than 50 percent or more than 75 percent and soils south of Ukiah where elevation is less than 1,000 feet. Included areas make up about 25 percent of the total acreage.

The Pardaloe soil is deep and well drained. It formed in material derived dominantly from sandstone, siltstone, or shale. Typically, the surface is covered with a mat of conifer needles, tanoak leaves, and twigs about 5 inches thick. The surface layer is dark yellowish brown gravelly loam about 10 inches thick. The upper 17 inches of the subsoil is pale brown very gravelly sandy loam, and the lower part to a depth of 58 inches is light yellowish brown very gravelly loam. Fractured siltstone is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is very gravelly loam or gravelly sandy loam.

Permeability of the Pardaloe soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone or siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick.

The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is clay loam.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Casabonne soil is deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. Depth to soft bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber and firewood production and as wildlife habitat.

Douglas fir, tanoak, Pacific madrone, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 122 on the Pardaloe soil, 154 on the Kekawaka soil, and 144 on the Casabonne soil. Ponderosa pine grows on the Kekawaka soil in some areas. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 147 on the Kekawaka soil. The potential annual production from a fully stocked stand of Douglas fir is 455 board feet per acre on the Pardaloe soil, 760 board feet on the Kekawaka soil, and 665 board feet on the Casabonne soil.

The main limitations for the harvesting of timber are the steepness of slope and hazard of erosion. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Rocks may slide onto roads on the Pardaloe soil, increasing the need for road maintenance.

Revegetation of exposed subsoil material is difficult on the Pardaloe soil because of the amount of coarse fragments and the limited available water capacity. Establishing plant cover on steep cuts and fills in the Kekawaka and Casabonne soils reduces erosion. The Kekawaka soil is unstable in some areas. Roads may fail and landslides may occur following deep soil disturbance in these areas.

Plant competition is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs infrequently. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial bromes and fescues.

This map unit is in capability subclass VIIe (5), nonirrigated.

173—Pardaloe-Woodin-Casabonne complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 800 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 40 percent Pardaloe gravelly loam, 20 percent Woodin gravelly sandy loam, and 20 percent Casabonne gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Witherell, and Yorktree soils and Rock outcrop. Also included are small areas of Pardaloe, Woodin, and Casabonne soils that have slopes of less than 30 percent or more than 50 percent and small areas of soils at elevations of more than 3,000 feet. Included areas make up about 20 percent of the total acreage.

The Pardaloe soil is deep and well drained. It formed in material weathered from sandstone, siltstone, or shale. Typically, the surface is covered with a mat of conifer needles, tanoak leaves, and twigs about 0.5 inch thick. The surface layer is dark yellowish brown gravelly loam about 10 inches thick. The upper 17 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 31 inches is light yellowish brown very gravelly loam. Fractured siltstone is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60

inches. In some areas the surface layer is very gravelly loam or gravelly sandy loam and is grayer in color.

Permeability of the Pardaloe soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam.

Permeability of the Woodin soil is moderate. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Casabonne soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. In some areas the surface layer is loam throughout. Depth to soft bedrock ranges from 40 to 60 inches.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, tanoak, and Pacific madrone are the main tree species on the Pardaloe and Casabonne soils. On the basis of a 100-year site curve, the mean site index for Douglas fir is 122 on the Pardaloe soil and 144 on the Casabonne soil. The potential annual production from a fully stocked stand of Douglas fir is 455 board feet per acre on the Pardaloe soil and 665 board feet on the Casabonne soil.

California nutmeg, canyon live oak, Pacific madrone, and California laurel are the main tree species on the Woodin soil. On the basis of a 100-year site curve, the mean site index for scattered Douglas fir on this soil is 97. Estimates of the potential productivity have not been made. Because a fully stocked stand is difficult to achieve on the Woodin soil, yields generally are well below those of normal stands.

The main limitation for the harvesting of timber is steepness of slope. Wheeled and tracked equipment can be used in the less sloping areas. Cable yarding systems generally disturb the soil less and are suited to the steeper areas. Rock for construction of roads is available in areas of this unit. Revegetation of exposed subsoil material is difficult on the Pardaloe and Woodin soils because of the content of coarse fragments and limited available water capacity.

Seedling mortality is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings on the Pardaloe and Casabonne soils; however, planting can be difficult because of the large amount of gravel in the surface layer. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes of the Pardaloe and Woodin soils. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are California nutmeg, hairy manzanita, canyon live oak, and iris.

This map unit is in capability subclass VIe (5), nonirrigated.

174—Pardaloe-Woodin complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, and Pacific madrone. Elevation is 800 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 55 percent Pardaloe gravelly loam and 25 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Casabonne, and Yorktree soils. Also included are small areas of Pardaloe and Woodin soils that have slopes of less than 50 percent or more than 75 percent and soils that are similar to the Pardaloe and Woodin soils but are at elevations of more than 3,000 feet. Included areas make up about 20 percent of the total acreage.

The Pardaloe soil is deep and well drained. It formed in material weathered from sandstone, siltstone, or shale. Typically, the surface is covered with a mat of conifer needles, oak leaves, and twigs about 0.5 inch thick. The surface layer is dark yellowish brown gravelly

loam about 10 inches thick. The upper 17 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 31 inches is light yellowish brown very gravelly loam. Fractured siltstone is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is very gravelly loam or gravelly sandy loam and is grayer in color.

Permeability of the Pardaloe soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. A layer of fine gravel as much as 3 inches thick is on the surface in some areas.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, tanoak, and Pacific madrone are the main tree species on the Pardaloe soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 122. The potential annual production from a fully stocked stand of Douglas fir is 455 board feet per acre.

California nutmeg, canyon live oak, Pacific madrone, and California laurel are the main tree species on the Woodin soil. On the basis of a 100-year site curve, the mean site index for scattered Douglas fir on this soil is 97. Estimates of the potential productivity have not been made. Because a fully stocked stand is difficult to achieve on the Woodin soil, yields generally are well below those of normal stands.

The main limitation for the harvesting of timber is the steepness of slope, which limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Rock for construction of roads is available in areas of this unit. Revegetation of exposed subsoil material is difficult because of the content of coarse fragments and limited available water capacity. Coarse fragments and loose soil material may slide onto roads on this unit, increasing the need for road maintenance.

Seedling mortality is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings on the Pardaloe soil; however, planting can be difficult because of the large amount of gravel in the surface layer. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes. Movement of loose soil material on the surface can reduce the survival rate of seedlings in the steeper areas of this unit. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are California nutmeg, canyon live oak, iris, and manzanita.

This map unit is in capability subclass VIIe (5), nonirrigated.

175—Pinnobie loam, 0 to 2 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly brush, annual grasses, and forbs. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown loam about 11 inches thick. The subsoil is light yellowish brown loam about 31 inches thick. The upper 6 inches of the substratum is yellowish brown and light yellowish brown loam, and the lower part to a depth of 60 inches or more is yellowish brown and light yellowish brown clay loam. In some areas the surface layer or the part of the soil below a depth of 30 inches is sandy loam or gravelly loam.

Included in this unit are small areas of Pinole, Russian, and Talmage soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinnobie soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for vineyards, orchards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards, and vineyards. It has few limitations. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost.

This unit is suited to hay and pasture. It has few

limitations. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. It has few limitations. The moderate shrink-swell potential of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas.

This map unit is in capability class I (14), irrigated, and capability subclass IIIc (14), nonirrigated.

176—Pinnobie loam, 2 to 8 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly brush, annual grasses, and forbs. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown loam about 11 inches thick. The subsoil is light yellowish brown loam about 31 inches thick. The upper 6 inches of the substratum is yellowish brown and light yellowish brown loam, and the lower part to a depth of 60 inches or more is yellowish brown and light yellowish brown clay loam. In some areas the surface layer or the part of the soil below a depth of 30 inches is sandy loam or gravelly loam. The surface layer is lighter colored in some areas.

Included in this unit are small areas of Pinole, Russian, Talmage, and Yokayo soils. Also included are small areas of the Pinnobie soils that have slopes of less than 2 percent or more than 8 percent. Near Ukiah are small areas of Urban land that have been leveled, graveled, and compacted. Included areas make up about 20 percent of the total acreage.

Permeability of this Pinnobie soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

This unit is used for vineyards, orchards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. It has few limitations. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. This method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. It has few limitations. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. It has few limitations. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. The moderate shrink-swell potential of the soil should also be considered when designing and constructing foundations, concrete structures, and paved areas.

This map unit is in capability units IIe-1 (14), irrigated, and IIIe-1 (14), nonirrigated.

177—Pinole gravelly loam, 0 to 2 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown gravelly loam about 10 inches thick. The upper 27 inches of the subsoil is yellowish brown over variegated strong brown and yellow clay loam, and the lower 24 inches is strong brown and brownish yellow sandy clay loam. In some areas the surface layer is loam, gravelly sandy clay loam, or very gravelly loam, and in some areas it is less than 10 inches thick. In some areas the subsoil has a higher content of gravel.

Included in this unit are small areas of Pinnobie and Yokayo soils. Also included are small areas of soils at elevations of more than 1,200 feet. Included areas make up 10 percent of the total acreage.

Permeability of this Pinole soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for vineyards, orchards, hay and pasture, homesite development, and firewood production.

This unit is suited to irrigated orchards and vineyards. It has few limitations. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost.

This unit is suited to hay and pasture. It has few limitations. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. It has few limitations. The moderate shrink-swell potential of

the soil should be considered when designing and constructing foundations, concrete structures, and paved areas.

Oregon white oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are blue oak, interior live oak, California white oak, and ponderosa pine. On the basis of a 50-year site curve, the mean site index for California black oak is 25. This unit can produce about 12 cords of wood per acre from a stand of trees 50 years old.

This main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, soap plant, and Pacific madrone.

This map unit is in capability units IIs-1 (14), irrigated, and IIIs-1 (14), nonirrigated.

178—Pinole gravelly loam, 2 to 8 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown gravelly loam about 10 inches thick. The upper 27 inches of the subsoil is yellowish brown over variegated strong brown and yellow clay loam, and the lower 24 inches is strong brown and brownish yellow sandy clay loam. In some areas the surface layer is loam, gravelly sandy clay loam, or very gravelly loam, and in some areas it is less than 10 inches. In some areas the surface layer has a higher content of gravel and base saturation is less than 50 percent.

Included in this unit are small areas of Pinnobie and Yokayo soils. Also included are small areas of soils at elevations of more than 1,200 feet. Included areas make up about 10 percent of the total acreage.

Permeability of this Pinole soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This unit is used for vineyards, orchards, hay and pasture, homesite development, and firewood production.

This unit is suited to irrigated orchards and vineyards. The main limitation is the hazard of erosion. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. The main limitation is the hazard of erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

Oregon white oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are blue oak, interior live oak, California white oak, and ponderosa pine. On the basis of a 50-year site curve, the mean site index for Calfornia black oak is 25. This unit can produce about 12 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily when water is concentrated in unprotected ditches. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, soap plant, and Pacific madrone.

This unit is suited to homesite development. The main limitations are slope and the hazard of erosion. Revegetating disturbed areas around construction sites helps to control erosion. The moderate shrink-swell potential of the soil in this unit should be considered when designing and constructing foundations, concrete structures, and paved areas.

This map unit is in capability units IIe-1 (14), irrigated, and IIIe-1 (14), nonirrigated.

179—Pinole gravelly loam, 8 to 15 percent slopes. This very deep, well drained soil is on terraces. It

formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown gravelly loam about 10 inches thick. The upper 27 inches of the subsoil is yellowish brown over variegated strong brown and yellow clay loam, and the lower 24 inches is strong brown and brownish yellow sandy clay loam. In some areas the surface layer is loam or very gravelly loam, and in some areas it is less than 10 inches thick. In some areas the subsoil has a higher content of gravel.

Included in this unit are small areas of Pinnobie, Redvine, and Yokayo soils and soils that have slopes of less than 8 percent or more than 15 percent. Also included are small areas of soils at elevations of more than 1,200 feet and soils in the southeast corner of the survey area that formed in colluvium derived from ancient landslides. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinole soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

This unit is used for vineyards, orchards, pasture, homesite development, and firewood production.

This unit is suited to vineyards and orchards. It is limited mainly by slope, the hazard of erosion, and the susceptibility of the soil to compaction, which can result in reduced permeability and poor tilth. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

Irrigation is needed to establish grapevines. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion and compaction. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

Oregon white oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are blue oak, interior live oak, California white oak, and ponderosa pine. On the basis of a 50-year site curve, the mean site index for California black oak is 25. This unit can produce about 12 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily if water is concentrated in unprotected ditches.

After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, soap plant, and Pacific madrone.

If the unit is used for homesite development, the main limitations are the steepness of slope, hazard of erosion, and moderately slow permeability. Suitable building sites are limited to areas on knolls and areas of the less sloping soils included in this unit. Revegetating disturbed areas around construction sites helps to control erosion. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field or by using specially designed sewage disposal systems.

This map unit is in capability unit IIIe-1 (14), irrigated and nonirrigated.

180—Pinole gravelly loam, 15 to 30 percent slopes. This very deep, well drained soil is on dissected terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 400 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown gravelly loam about 10 inches thick. The upper 27 inches of the subsoil is yellowish brown over variegated strong brown and yellow clay loam, and the lower 24 inches is strong brown and brownish yellow sandy clay loam. In some areas the surface layer is loam or very gravelly loam, and in some areas it is less than 10 inches thick. In

some areas the subsoil has a higher content of gravel.

Included in this unit are small areas of Pinnobie, Redvine, and Yokayo soils. Also included are small areas of soils that have slopes of less than 15 percent and are on knolls, soils that have slopes of more than 30 percent and are in drainageways and on terrace escarpments, and soils at elevations of more than 1,200 feet. In the southeastern corner of the survey area are soils that formed in colluvium derived from ancient landslides. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinole soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

This unit is used for vineyards, pasture, homesite development, and firewood production.

This unit is poorly suited to vineyards. It is limited mainly by slope, the hazard of erosion, and the susceptibility of the soil to compaction, which can result in reduced permeability and poor tilth. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

Irrigation is needed to establish grapevines. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

This unit is suited to pasture. The main limitations are slope and the hazard of erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

Oregon white oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are blue oak, interior live oak, California white oak, and ponderosa pine. On the basis of a 50-year site curve, the mean site index for California black oak is 25. This unit can produce about 12 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily if water is concentrated in unprotected ditches.

After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, soap plant, and Pacific madrone.

If this unit is used for homesite development, the main limitations are the steepness of slope, hazard of erosion, and moderately slow permeability. Extensive cutting and filling are required for building sites. Cuts are susceptible to erosion. Revegetating disturbed areas around construction sites helps to control erosion. Intensive runoff control measures are also needed. Septic tank absorption lines should be installed on the contour. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field or by using a specially designed sewage disposal system.

This map unit is in capability unit IVe-1 (14), irrigated and nonirrigated.

181—Pinole very gravelly loam, 0 to 2 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 400 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown very gravelly loam about 10 inches thick. The subsoil is brown gravelly clay loam over very gravelly sandy clay loam about 50 inches thick. In some areas the surface layer is loam or gravelly loam, and in some areas it is less than 10 inches thick.

Included in this unit are small areas of Pinnobie and Yokayo soils and soils that have more than 35 percent gravel throughout the subsoil. Included areas make up about 10 percent of the total acreage.

Permeability of this Pinole soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight.

This unit is used for vineyards, hay and pasture, homesite development, and firewood production.

This unit is suited to vineyards. It is limited mainly by the content of gravel, which interferes with tillage. Coarse fragments on the surface cause wear of tillage equipment. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption. Because of the coarse fragments in the soil, rock deflection shields

should be used on all mowing equipment. Sprinkler or drip irrigation is best suited to this unit.

This unit is suited to hay and pasture. The main limitation is the content of gravel in the surface layer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Oregon white oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are blue oak, interior live oak, California white oak, and ponderosa pine. On the basis of a 50-year site curve, the mean site index for California black oak is 25. This unit can produce about 12 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit.

After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, soap plant, and Pacific madrone.

This unit is suited to homesite development. The main limitation is the content of gravel in the surface layer. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns.

This map unit is in capability unit IVs-1 (14), irrigated and nonirrigated.

182—Pinole very gravelly loam, 2 to 15 percent slopes. This deep, well drained soil is on terraces, some of which are dissected. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 400 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is brown very gravelly loam about 10 inches thick. The subsoil is brown gravelly clay loam over very gravelly sandy clay loam about 50 inches thick. In some areas the surface layer is loam or gravelly loam, and in some areas it is less than 10 inches thick.

Included in this unit are small areas of Pinnobie and Yokayo soils and soils that have slopes of more than 15 percent and are in drainageways and on terrace escarpments. Also included are soils that are at elevations of more than 1,200 feet and soils that have more than 35 percent gravel throughout the subsoil. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinole soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

This unit is used for vineyards, hay and pasture, homesite development, and firewood production.

This unit is suited to vineyards. It is limited mainly by the content of gravel, steepness of slope, and the hazard of erosion. Coarse fragments on the surface cause wear of tillage equipment. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption. Because of the coarse fragments in the soil, rock deflection shields should be used on all mowing equipment. Sprinkler or drip irrigation is best suited to this unit.

This unit is suited to hay and pasture. The main limitations are the steepness of slope and hazard of erosion. Seedbed preparation should be on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the unit from erosion.

Oregon white oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are blue oak, interior oak, California white oak, and ponderosa pine. On the basis of a 50-year site curve, the mean site index for California black oak is 25. This unit can produce about 12 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in this unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily when water is concentrated in unprotected ditches. After cutting, hardwoods can

regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, soap plant, and Pacific madrone.

This unit is suited to homesite development. The main limitations are the steepness of slope, the hazard of erosion, and the content of gravel in the surface layer. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Excavation for roads and buildings increases the risk of erosion. Revegetating disturbed areas around construction sites helps to control erosion.

This map unit is in capability unit IVs-1 (14), irrigated and nonirrigated.

183—Pits and Dumps. This map unit consists of areas from which the upper layers and underlying material have been removed, areas of sand and gravel borrow pits, and areas of refuse disposal sites. Areas of this unit can occur on any position on the landscape. Areas are irregular in shape and are 4 to 35 acres in size. The native vegetation is mainly sparse annual grasses and forbs. Elevation is 600 to 3,000 feet. The average annual precipitation is 30 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

Included in this unit are small areas of Rock outcrop.

Drainage, permeability, surface runoff, thickness of the root zone, available water capacity, and hazard of erosion are variable.

Revegetating areas of this unit is difficult because of the steepness of slope in some areas and the low fertility of the geologic material.

This map unit is in capability subclass VIIIe (5, 14, 15), nonirrigated.

184—Redvine sandy clay loam, 2 to 8 percent slopes. This very deep, well drained soil is on dissected terraces. It formed in old alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly brush and annual grasses. Elevation is 500 to 1,400 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is reddish brown sandy clay loam over yellowish red sandy clay loam about 8 inches thick. The upper 6 inches of the subsoil is yellowish red clay loam, and the lower 48 inches is yellowish red clay over yellowish red and reddish yellow clay. In some areas the surface layer is loam or clay loam, and in some areas very gravelly clay or clay loam is below a depth of 40 inches.

Included in this unit are small areas of Pinole and Yokayo soils. Also included are small areas of Redvine soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this Redvine soil is slow. Available water capacity is high. Effective rooting depth is more than 60 inches. Runoff is medium, and the hazard of erosion is moderate.

Most areas of this unit are used for vineyards. A few areas are used for pasture and homesite development.

This unit is suited to vineyards. It is limited mainly by the slow permeability. Irrigation is needed to establish grapevines. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Because of the slow permeability of the soil in this unit, application of irrigation water should be regulated to control runoff and erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. The main limitation is the slow permeability. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Sprinkler irrigation is the most suitable method of applying water. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. The main limitations are the slow permeability and high shrink-swell potential. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. Buildings and roads can be designed to offset the effects of shrinking and swelling.

This map unit is in capability units IIe-1 (14), irrigated, and IIIe-1 (14), nonirrigated.

185—Redvine sandy clay loam, 8 to 15 percent slopes. This very deep, well drained soil is on dissected terraces. It formed in old alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly brush and annual grasses. Elevation is 500 to 1,400 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is reddish brown sandy clay loam over yellowish red sandy clay loam about 8

inches thick. The upper 6 inches of the subsoil is yellowish red clay loam, and the lower 48 inches is yellowish red clay over yellowish red and reddish yellow clay. In some areas the surface layer is loam or clay loam, and in some areas very gravelly clay or clay loam is below a depth of 40 inches.

Included in this unit are small areas of Pinole and Yokayo soils. Also included are small areas of Redvine soils that have slopes of less than 8 percent or more than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this Redvine soil is slow. Available water capacity is high. Effective rooting depth is more than 60 inches. Runoff is medium, and the hazard of erosion is moderate.

Most areas of this unit are used for vineyards. A few areas are used for homesite development.

This unit is suited to vineyards. It is limited mainly by the slow permeability and the hazard of erosion. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Irrigation is needed to establish grapevines. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Application of irrigation water should be regulated to control runoff and erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to homesite development. The main limitations are the steepness of slope, slow permeability, and high shrink-swell potential. Extensive cutting and filling generally are required for homesite development. Cuts are susceptible to erosion. Revegetating disturbed areas around construction sites helps to control erosion. Intensive runoff control measures are needed. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. Septic tank absorption lines should be installed on the contour. Buildings and roads can be designed to offset the effects of shrinking and swelling.

This map unit is in capability unit IIIe-1 (14), irrigated and nonirrigated.

186—Redvine sandy clay loam, 15 to 30 percent slopes. This very deep, well drained soil is on dissected terraces. It formed in old alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, brush, and scattered trees. Elevation is 500 to 1,400 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is reddish brown sandy clay loam over yellowish red sandy clay loam about 8 inches thick. The upper 6 inches of the subsoil is yellowish red clay loam, and the lower 48 inches is yellowish red clay over yellowish red and reddish yellow clay. In some areas the surface layer is loam or clay loam, and in some areas the profile is underlain by very gravelly clay or clay loam.

Included in this unit are small areas of Pinole and Yokayo soils. Also included are small areas of Redvine soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Redvine soil is slow. Available water capacity is high. Effective rooting depth is more than 60 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used as watershed, for livestock grazing, and as wildlife habitat. A few areas are used for fruit orchards and vineyards.

This unit is poorly suited to orchards and vineyards. It is limited mainly by the hazard of erosion. Application of irrigation water should be regulated to control runoff and erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption. Roads may fail or landslides may occur following deep soil disturbance.

Woody plants are the most extensive species on this unit. The characteristic plant community is mainly chamise, manzanita, ceanothus, and scrub oak. If the trees and shrubs are managed to create open areas, this unit produces a good stand of desirable grasses and forbs. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Grazing should be deferred when the surface layer is saturated.

This map unit is in capability unit IVe-1 (14), irrigated and nonirrigated.

187—Rock outcrop. This map unit consists of exposures of sedimentary rock and greenstone on mountains. Slope is 30 to 90 percent. Rock outcrop supports little if any vegetation. Elevation is 550 to 5,922 feet.

Included in this unit are small areas of Etsel, Snook, Tyson, and Woodin soils. Included areas make up about 5 percent of the total acreage. The percentage varies from one area to another.

Runoff is medium to very rapid, and the hazard of erosion is slight.

This unit has poor potential for most uses. It is limited by steepness of slope and the sparseness of vegetation.

This map unit is in capability subclass VIIIs (5, 15).

188—Russian loam, 0 to 2 percent slopes. This very deep, well drained soil is on flood plains and low stream terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is grayish brown loam about 38 inches thick. The underlying material to a depth of 60 inches or more is stratified, grayish brown loam and very fine sandy loam. In some areas the surface layer is very fine sandy loam or silt loam.

Included in this unit are small areas of Cole and Feliz soils, Xerofluvents, Riverwash, and soils that have a gravelly substratum. Near Hulls Valley in the northern part of the survey area, there are also small areas of Russian soils at an elevation of 2,750 feet. Included areas make up about 15 percent of the total acreage.

Permeability of this Russian soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is protected from flooding by upstream flood control structures.

This unit is used for orchards, vineyards, hay and pasture, and homesite development.

This unit is suited to irrigated orchards and vineyards. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is best suited to this unit. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil and by using minimum tillage. Cover crops help to prevent crusting of the surface and increase the water intake rate.

This unit is suited to hay and pasture. Irrigation is needed in summer for maximum production of forage. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. It has few limitations.

This map unit is in capability class I (14), irrigated, and capability subclass IIIc (14), nonirrigated.

189—Russian loam, flooded, 0 to 2 percent slopes. This very deep, well drained soil is on flood plains. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 400 to 600 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 225 to 250 days.

Typically, the surface layer is grayish brown loam about 38 inches thick. The underlying material to a depth of 60 inches or more is stratified, grayish brown loam, silt loam, and very fine sandy loam.

Included in this unit are small areas of Cole soils and Xerofluvents. Also included are small areas of Feliz and Talmage soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Russian soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. This soil is subject to brief periods of flooding in December to April. Runoff is very slow, and the hazard of erosion is slight.

This unit is used for orchards, vineyards, and hay and pasture.

This unit is suited to irrigated crops, orchards, and vineyards. The main limitation is the brief periods of flooding. Sprinkler irrigation is best suited to this unit. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil and by using minimum tillage. Cover crops help to prevent crusting of the surface and increase the water intake rate.

This unit is well suited to hay and pasture. The main limitation is the brief periods of flooding. Irrigation is needed in summer for maximum production of forage. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This map unit is in capability units IIw-2 (14), irrigated, and IIIw-2 (14), nonirrigated.

190—Russian loam, gravelly substratum, 0 to 2 percent slopes. This very deep, well drained soil is on flood plains and low terraces. It formed in alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is grayish brown loam about 30 inches thick. The substratum to a depth of

more than 60 inches is stratified, pale brown gravelly loamy sand. In some areas the surface layer is gravelly loam or sandy loam.

Included in this unit are small areas of Cole and Feliz soils, Xerofluvents, and Riverwash. Also included are soils in Laytonville Valley that are similar to this Russian soil but are at an elevation of more than 1,500 feet. Included areas make up about 15 percent of the total acreage.

Permeability of this Russian soil is moderate to a depth of 30 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight. This soil is protected from flooding by upstream flood control structures.

This unit is used for orchards, vineyards, hay and pasture, and urban development.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by the rapid permeability and droughtiness of the gravelly substratum. Sprinkler or trickle irrigation is suited to this unit. Water should be applied in amounts large enough to wet the root zone but small enough to minimize leaching of plant nutrients. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil and by using minimum tillage. Cover crops help to prevent crusting of the surface and increase the water intake rate. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. The main limitations are the rapid permeability and droughtiness of the gravelly substratum. Water should be applied in amounts large enough to wet the root zone but small enough to minimize leaching of plant nutrients.

If this unit is used for homesite development, the main limitation is the poor filtering capacity of the underlying material. If the soil in this unit is used for septic tank absorption fields, the fields should be designed to prevent contamination of ground water by effluent.

This map unit is in capability units IIs-0 (14), irrigated, and IIIs-0 (14), nonirrigated.

191—Sanhedrin-Asabean-Speaker gravelly loams, 30 to 50 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly coniferous forest with scattered oak and madrone. Elevation is 2,500 to 3,500 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 45 percent Sanhedrin gravelly loam, 20 percent Asabean gravelly loam, and 20 percent Speaker gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Gudgrey, Kekawaka, Neuns, and Woodin soils. Included areas make up about 15 percent of the total acreage.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Asabean soil is very deep and well drained. It formed in material derived dominantly from sandstone, metasedimentary rock, or chert. Typically, the surface is covered with a mat of decomposed and undecomposed leaves, needles, and twigs about 2 inches thick. The surface layer is brown gravelly loam about 9 inches thick. The upper 28 inches of the subsoil is reddish yellow very gravelly loam over very gravelly sandy clay loam, and the lower 27 inches is very pale brown very gravelly sandy loam. In some areas the subsoil is cobbly.

Permeability of the Asabean soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow

clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber and firewood production and as wildlife habitat.

Douglas fir, ponderosa pine, California black oak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Sanhedrin soil, 122 on the Asabean soil, and 107 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 121 on the Sanhedrin soil, 129 on the Asabean soil, and 106 on the Speaker soil. The potential annual production from a fully stocked stand of ponderosa pine is 585 board feet per acre on the Sanhedrin soil, 685 board feet on the Asabean soil, and 425 board feet on the Speaker soil. Among the trees of limited extent are sugar pine, Oregon white oak, canyon live oak, and white fir.

The main limitations for the harvesting of timber and firewood are the steepness of slope, hazard of erosion, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Plant competition is a concern in the production of timber on this unit. When openings are made in the canopy, invading brush can delay the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are poison oak, reed fescue, gooseberry, and bedstraw.

This map unit is in capability subclass VIe (5), nonirrigated.

192—Sanhedrin-Asabean-Speaker gravelly loams, 50 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly coniferous forest with scattered oak and madrone. Elevation is 2,500 to 3,500 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 45 percent Sanhedrin gravelly loam, 25 percent Asabean gravelly loam, and 15 percent Speaker gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Gudgrey, Kekawaka, and Neuns soils and some shallow soils that have more than 35 percent rock fragments and no increase of clay in the subsoil. Also included are small areas of soils in Trinity County that have base saturation of less than 35 percent in the subsoil. Included areas make up about 15 percent of the total acreage.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Asabean soil is very deep and well drained. It formed in material derived dominantly from sandstone, metasedimentary rock, or chert. Typically, the surface is covered with a mat of decomposed and undecomposed leaves, needles, and twigs about 2 inches thick. The surface layer is brown gravelly loam about 9 inches thick. The upper 28 inches of the subsoil is reddish yellow very gravelly loam over very gravelly sandy clay loam, and the lower 27 inches is very pale brown very gravelly sandy loam. In some areas the subsoil is cobbly.

Permeability of the Asabean soil is moderately slow. Available water capacity is moderate. Effective rooting

depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber and firewood production and as wildlife habitat.

Douglas fir, ponderosa pine, California black oak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Sanhedrin soil, 122 on the Asabean soil, and 107 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 121 on the Sanhedrin soil, 129 on the Asabean soil, and 106 on the Speaker soil. The potential annual production from a fully stocked stand of ponderosa pine is 585 board feet per acre on the Sanhedrin soil, 685 board feet on the Asabean soil, and 425 board feet on the Speaker soil. Among the trees of limited extent are sugar pine, Oregon white oak, canyon live oak, and white fir.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following deep soil disturbance. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Roads on the soils in this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Rock for construction of roads is not readily available in areas of this unit. Rocks and loose soil material may slide onto roads on the Asabean soil, increasing the need for road maintenance.

Plant competition is a concern in the production of timber on this unit. When openings are made in the canopy, invading brush can delay the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently.

Among the common forest understory plants are poison oak, reed fescue, gooseberry, and bedstraw.

This map unit is in capability subclass VIIe (5), nonirrigated.

193—Sanhedrin-Kekawaka-Speaker complex, 2 to 30 percent slopes. This map unit is on rounded ridgetops or toe slopes on hills and mountains. The native vegetation is mainly conifers and oak. Elevation is 1,500 to 3,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 40 percent Sanhedrin gravelly loam, 25 percent Kekawaka loam, and 20 percent Speaker gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Cummiskey and Tyson soils throughout the unit, Hopland and Maymen soils on south-facing slopes and ridgetops, and Neuns and Pardaloe soils surrounding areas of Rock outcrop. Also included are small areas of Sanhedrin, Kekawaka, and Speaker soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick.

The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is clay loam.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used for timber production and as wildlife habitat.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 121 on the Sanhedrin soil, 147 on the Kekawaka soil, and 106 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Sanhedrin soil, 154 on the Kekawaka soil, and 107 on the Speaker soil. The potential annual production from a fully stocked stand of ponderosa pine is 585 board feet per acre on the Sanhedrin soil, 945 board feet on the Kekawaka soil, and 425 board feet on the Speaker soil.

The main limitation for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. The Kekawaka soil is unstable in some areas. Roads may fail and landslides may occur following deep soil disturbance in these areas.

Plant competition is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically, especially on the Sanhedrin and Kekawaka soils. When openings are made in the canopy, invading brush can delay the establishment of seedlings.

Among the common forest understory plants are bedstraw, poison oak, brackenfern, and manzanita.

This map unit is in capability unit IVe-1 (5), nonirrigated.

194—Sanhedrin-Kekawaka-Speaker complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly conifers and oak. Elevation is 1,500 to 3,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 40 percent Sanhedrin gravelly loam, 25 percent Kekawaka loam, and 20 percent Speaker gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Asabean, Cummiskey, Tyson, and Yorktree soils throughout the unit, Hopland and Maymen soils on south-facing slopes and ridgetops, and Neuns and Pardaloe soils surrounding areas of Rock outcrop. Also included are areas of soils that are similar to the Kekawaka, Sanhedrin, and Speaker soils but have more than 35 percent rock fragments in the subsoil and small areas of Sanhedrin, Kekawaka, and Speaker soils that have slopes of less than 30 percent or more than 50 percent. In the northeastern part of the survey area, adjacent to the Mendocino National Forest, there are small areas of soils at elevations of as much as 4,600 feet. Included areas make up about 15 percent of the total acreage.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded hard sandstone and siltstone are at a depth

of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam or the subsoil is more than 35 percent rock fragments.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of needles, leaves, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is clay loam or the depth to soft sandstone is less than 60 inches.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as watershed and wildlife habitat.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 121 on the Sanhedrin soil, 147 on the Kekawaka soil, and 106 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Sanhedrin soil, 154 on the Kekawaka soil, and 107 on the Speaker soil. The potential annual production from a fully stocked stand of ponderosa pine is 585 board feet per acre on the Sanhedrin soil, 945 board feet on the Kekawaka soil, and 425 board feet on the Speaker soil.

The main limitations for the harvesting of timber are the steepness of slope, seasonal wetness, and hazard of erosion. Wheeled and tracked equipment can be used in the less sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. The Kekawaka soil is unstable in some areas. Roads may fail and landslides may occur following deep soil disturbance in these areas.

Plant competition is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically, especially on the Sanhedrin and Kekawaka soils. When openings are made in the canopy, invading brush can delay the establishment of seedlings.

Among the common forest understory plants are bedstraw, poison oak, brackenfern, and manzanita.

This map unit is in capability subclass VIe (5), nonirrigated.

195—Sanhedrin-Kekawaka-Speaker complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly conifers and oak. Elevation is 1,500 to 3,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 40 percent Sanhedrin gravelly loam, 25 percent Kekawaka loam, and 20 percent Speaker gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Asabean, Cummiskey, and Tyson soils throughout the unit, Hopland and Maymen soils on south-facing slopes and ridgetops, Neuns and Pardaloe soils in areas surrounding Rock outcrop, and soils that are similar to these Kekawaka, Sanhedrin, and Speaker soils but have more than 35 percent rock fragments in the subsoil. Also included are small areas of Sanhedrin, Kekawaka, and Speaker soils that have slopes of less than 50 percent or more than 75 percent. Included areas make up about 15 percent of the total acreage.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a

mat of twigs, needles, and decomposed litter about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded hard sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sandedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Kekawaka soil is very deep and well drained. It formed in material derived dominantly from sandstone or siltstone. Typically, the surface is covered with a mat of leaves, needles, and twigs about 1 inch thick. The surface layer is yellowish red loam about 4 inches thick. The upper 31 inches of the subsoil is yellowish red clay loam, and the lower 26 inches is red clay. In some areas the surface layer is clay loam or the depth to soft sandstone is less than 60 inches.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of erosion is very high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as watershed and wildlife habitat.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 121 on the Sanhedrin soil, 147 on the Kekawaka soil, and 106 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Sanhedrin soil, 154 on the Kekawaka soil, and 107 on the Speaker soil. The potential annual production from a fully stocked stand of ponderosa pine is 585 board feet per acre on the Sanhedrin soil, 945 board feet on the Kekawaka soil, and 425 board feet on the Speaker soil.

The main limitations for the harvesting of timber are the steepness of slope and hazard of erosion. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Roads on this unit are dusty when dry. Surface treatment may be desirable during periods of heavy use. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on the soils in this unit. The Kekawaka soil is unstable in some areas. Roads may fail and landslides may occur following deep soil disturbance in these areas.

Plant competition is a concern in the production of timber. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically, especially on the Sanhedrin and Kekawaka soils. When openings are made in the canopy, invading brush can delay the establishment of seedlings.

Among the common forest understory plants are bedstraw, poison oak, brackenfern, and manzanita.

This map unit is in capability subclass VIIe (5), nonirrigated.

196—Shortyork-Tyson-Witherell complex, 30 to 50 percent slopes. This map unit is on south- and west-facing side slopes of hills and mountains. The native vegetation is mainly grass and scattered oak groves. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 40 percent Shortyork gravelly loam, 35 percent Tyson very gravelly loam, and 15 percent Witherell sandy loam. The Shortyork soil is on grass-covered slopes, the Tyson soil is under groves of Oregon white oak, and the Witherell soil is on ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Gudgrey, Neuns, Sanhedrin, Speaker, Snook, Updegraff, and Yorktree soils and Rock outcrop. Also included are small areas of Shortyork, Tyson, and Witherell soils that have slopes of less than 30 percent or more than 50 percent and soils that are similar to the Shortyork soil but have a gravelly or very gravelly clay subsoil. Included areas make up about 10 percent of the total acreage.

The Shortyork soil is moderately deep and well drained. It formed in material weathered from schist, shale, or graywacke. Typically, the surface layer is dark grayish brown over brown gravelly loam about 7 inches thick. The upper 4 inches of the subsoil is brown very gravelly clay loam, and the lower 17 inches is dark grayish brown very gravelly clay loam. Fractured graywacke and schist are at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Shortyork soil is moderately slow. Available water capacity is low. Effective rooting depth is about 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Tyson soil is moderately deep and well drained. It formed in material weathered from shale or sandstone. Typically, the surface is covered with a mat of oak leaves and twigs about 1 inch thick. The surface layer is brown very gravelly loam about 7 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam, and the lower 11 inches is pale brown very gravelly loam. Fractured shale is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Tyson soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown and yellowish brown sandy loam about 7 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for livestock grazing and as watershed and wildlife habitat.

Production of forage is limited by the restricted available water capacity. Seeding and fertilization generally are not practical because of the steepness of slope, the restricted available water capacity, and the shallow rooting depth of the Witherell soil. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Common plants on the Shortyork and Witherell soils are soft chess, wild oat, red fescue, and filaree. The Tyson soil tends to produce woody species such as Brewer oak and Oregon white oak. Among the common understory plants on the Tyson soil are blue wildrye, red fescue, and shootingstar.

This map unit is in capability subclass VIe (15).

197—Shortyork-Witherell-Updegraff complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly annual grasses, Digger pine, and scattered groves of oak and Douglas fir. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 150 to 175 days.

This unit is 30 percent Shortyork gravelly loam, 30 percent Witherell sandy loam, and 25 percent Updegraff loam. The Shortyork and Witherell soils are on south-facing slopes, and the Updegraff soil is on north-facing slopes and in draws. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Maymen, Snook, Speaker, Yorktree, and Yorkville soils and Rock outcrop. Also included are small areas of soils that are more than 40 inches deep or are very gravelly clay; Shortyork, Witherell, and Updegraff soils that have slopes of less than 50 percent or more than 75 percent; soils near the Eel River that are at elevations of less than 1,500 feet; and areas at elevations of more than 2,000 feet that have a smaller percentage of Updegraff soils and as much as 20 percent Tyson soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Shortyork soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or graywacke. Typically, the surface layer is dark grayish brown over brown gravelly loam about 7 inches thick. The upper 4 inches of the subsoil is brown very gravelly clay loam, and the lower 17 inches is dark

grayish brown very gravelly clay loam. Fractured schist and graywacke are at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Shortyork soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is brown over yellowish brown sandy loam about 7 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam and the subsoil is gravelly or very gravelly clay throughout.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for livestock grazing and as recreation areas, watershed, and wildlife habitat.

Production of forage is limited by the restricted available water capacity of the Shortyork and Witherell soils and the shallow rooting depth of the Witherell soil. Woody plants are abundant on the Updegraff soil. Because of the instability of the soil, trees and brush should be retained on this unit. Seeding and fertilization generally are not practical because of the steepness of slope, the restricted available water capacity of the Shortyork and Witherell soils, and the shallow rooting depth of the Witherell soil. Steepness of slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities help to promote uniform distribution of livestock grazing. Because of the steepness of slope, this unit is better suited to grazing by sheep than by cattle. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity. Common plants on the Shortyork and Witherell soils are soft chess, wild oat, red fescue, filaree, and annual clover. Among the common forest understory plants on the Updegraff soil are Geyer oniongrass, blue wildrye, and vetch.

This map unit is in capability subclass VIIe (15), nonirrigated.

198—Shortyork-Yorkville-Witherell complex, 9 to 15 percent slopes. This map unit is on south- and west-facing slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 50 percent Shortyork gravelly loam, 20 percent Yorkville loam, and 15 percent Witherell sandy loam. The Shortyork soil is on convex and concave slopes, the Yorkville soil is in small swales, and the Witherell soil is on ridgetops and spur ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Hopland, Speaker, Squawrock, Updegraff, and Yorktree soils. Also included are small areas of Shortyork, Yorkville, and Witherell soils that have slopes of less than 9 percent or more than 15 percent and soils that are similar to the Shortyork soil but have a gravelly or very gravelly clay subsoil. Included areas make up about 15 percent of the total acreage.

The Shortyork soil is moderately deep and well drained. It formed in material weathered from schist, shale, or graywacke. Typically, the surface layer is dark grayish brown over brown gravelly loam about 7 inches thick. The upper 4 inches of the subsoil is light brownish gray very gravelly clay loam, and the lower 17 inches is dark grayish brown very gravelly clay loam. Fractured schist and graywacke are at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam or sandy loam.

Permeability of the Shortyork soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of erosion is moderate.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the

surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam. In some areas bedrock is at a depth of 50 to 60 inches.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate. The soil is saturated above the clay subsoil during wet periods. It is susceptible to slumping, and the risk increases if it is disturbed.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown and yellowish brown sandy loam about 7 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. In some areas the surface layer is loam. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of erosion is moderate.

This unit is used for livestock grazing and as watershed and wildlife habitat.

Production of forage is limited by the restricted available water capacity of the Shortyork and Witherell soils, the susceptibility of the soils to compaction when moist, and the shallow rooting depth of the Witherell soil. The Shortyork and Yorkville soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. Rangeland seeding on the Witherell soil generally is not practical because of the restricted available water capacity and shallow rooting depth. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. If the rangeland is poorly managed, plants not suitable for grazing dominate the plant community. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly red fescue, California oatgrass, wild oat, soft chess, burclover, and filaree.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

199—Shortyork-Yorkville-Witherell complex, 15 to 30 percent slopes. This map unit is on south- and west-facing, unstable slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 50 percent Shortyork gravelly loam, 20 percent Yorkville loam, and 15 percent Witherell sandy loam. The Shortyork soil is on convex and concave slopes, the Yorkville soil is in small swales, and the Witherell soil is on ridegtops and spur ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Hopland, Speaker, Squawrock, Updegraff, and Yorktree soils. Also included are small areas of Shortyork, Yorkville, and Witherell soils that have slopes of less than 15 percent or more than 30 percent and soils that are similar to the Shortyork soil but have a very gravelly clay subsoil. Included areas make up about 15 percent of the total acreage.

The Shortyork soil is moderately deep and well drained. It formed in material weathered from schist, shale, or graywacke. Typically, the surface layer is dark grayish brown over brown gravelly loam about 7 inches thick. The upper 4 inches of the subsoil is brown very gravelly clay loam, and the lower 17 inches is dark grayish brown very gravelly clay loam. Fractured schist and graywacke are at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Shortyork soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam. In some areas bedrock is at a depth of 50 to 60 inches.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate. The soil is saturated above the clay subsoil during wet periods. This soil is susceptible to slumping, and the risk increases if it is disturbed.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown and yellowish brown sandy loam about 7 inches thick.

The subsoil is reddish yellow sandy loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. In some areas the surface layer is loam. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is moderate.

This unit is used for livestock grazing and as watershed and wildlife habitat.

Production of forage is limited by the restricted available water capacity of the Shortyork and Witherell soils, the susceptibility of the soils to compaction when moist, and the shallow rooting depth of the Witherell soil. The Shortyork and Yorkville soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. Rangeland seeding on the Witherell soil generally is not practical because of the shallow rooting depth and restricted available water capacity. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. If the rangeland is poorly managed, plants not suitable for livestock grazing dominate the plant community. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly red fescue, California oatgrass, wild oat, soft chess, burclover, and filaree.

This map unit is in capability unit IVe-1 (15), nonirrigated.

200—Shortyork-Yorkville-Witherell complex, 30 to 50 percent slopes. This map unit is on south- and west-facing, unstable slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 125 to 175 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit commonly is 50 percent Shortyork gravelly loam, 20 percent Yorkville loam, and 15 percent Witherell sandy loam. In Trinity County the unit is 40 percent Shortyork gravelly loam, 30 percent Yorkville loam, and 15 percent Witherell sandy loam. The percentage varies from one area to another. The Shortyork soil is on convex and concave slopes, the Yorkville soil is in small swales, and the Witherell soil is on spur ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop, stony soils, and Sanhedrin, Speaker, Squawrock, Updegraff, and Yorktree soils. Also included are small areas of Shortyork, Yorkville, and Witherell soils that have slopes of less than 30 percent or more than 50 percent and soils that are similar to the Shortyork soil but have a very gravelly or gravelly clay subsoil. Included areas make up about 15 percent of the total acreage.

The Shortyork soil is moderately deep and well drained. It formed in material weathered from schist, shale, or graywacke. Typically, the surface layer is dark grayish brown over brown gravelly loam about 7 inches thick. The upper 4 inches of the subsoil is light brownish gray very gravelly clay loam, and the lower 17 inches is dark grayish brown very gravelly clay loam. Fractured schist and graywacke are at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Shortyork soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gravelly clay loam. In some areas the profile is gravelly throughout or bedrock is at a depth of 50 to 60 inches.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is saturated above the clay subsoil during wet periods. It is susceptible to slumping, and the risk increases if it is disturbed.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown and yellowish brown sandy loam about 7 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. In some areas the surface layer is loam. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for livestock grazing and as watershed and wildlife habitat.

Production of forage is limited by the restricted

available water capacity of the Shortyork and Witherell soils, the steepness of slope, the susceptibility of the soils to compaction when moist, and the shallow rooting depth of the Witherell soil. The Shortyork and Yorkville soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. Rangeland seeding on the Witherell soil generally is not practical because of the shallow depth and restricted available water capacity. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. If the rangeland is poorly managed, plants not suitable for livestock grazing dominate the plant community. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly red fecue, California oatgrass, wild oat, soft chess, burclover, and filaree.

This map unit is in capability subclass VIe (15).

201—Squawrock-Witherell complex, 15 to 50 percent slopes. This map unit is on side slopes and ridges of hills and mountains. The native vegetation is mainly annual grasses, forbs, and scattered oaks. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 55 percent Squawrock cobbly loam and 35 percent Witherell sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Hopland, Yorktree, and Yorkville soils, Rock outcrop, and stony soils. Also included are small areas of soils that have slopes of less than 15 percent and are on ridgetops or have slopes of more than 50 percent and are in drainageways. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Squawrock soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is sandy loam or gravelly sandy loam.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is brown over yellowish brown sandy loam about 7 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for livestock grazing and as watershed and wildlife habitat. A few areas are used for homesite development.

Production of forage is limited by the restricted available water capacity of the soils in this unit and by the shallow depth of the Witherell soil. The suitability of this unit for rangeland seeding is poor. The main limitations for seeding are the restricted available water capacity, the shallow depth of the Witherell soil, and steepness of slope in some areas. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities help to promote uniform distribution of livestock grazing.

Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the capacity of the unit to produce forage. The potential plant community on this unit is mainly soft chess, wild oat, and filaree.

If this unit is used for homesite development, the main limitations are the steepness of slope, hazard of erosion, and depth to bedrock. Extensive cutting and filling generally are required. Cuts are subject to a greater risk of erosion. Runoff control measures are needed. Preferred building sites are limited to knolls and the less sloping areas. Cuts needed to provide essentially level building sites can expose bedrock. The main limitation of this unit for septic tank absorption fields is the depth to bedrock, which restricts movement and filtration of effluent. Untreated effluent can move along the surface of the bedrock and seep in downslope areas, creating a hazard to health.

This map unit is in capability subclass VIe (15), nonirrigated.

202—Squawrock-Witherell complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly annual grasses and scattered oaks. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 50 percent Squawrock cobbly loam and 35 percent Witherell sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Etsel, Hopland, Maymen, and Yorktree soils and Rock outcrop. Included areas make up about 15 percent of the total acreage.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam or sandy loam.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick over yellowish brown sandy loam about 5 inches thick. The subsoil is reddish yellow loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for livestock grazing and as recreation areas, watershed, and wildlife habitat.

Production of forage is limited by the restricted available water capacity and shallow rooting depth. Slope limits access by livestock. Fencing and properly locating salt and livestock watering facilities promote uniform distribution of livestock grazing. Because of the steepness of slope, this unit is better suited to grazing by sheep than by cattle. The unit should be managed to protect the soil from erosion. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree.

This unit is in capability subclass VIIe (15), nonirrigated.

203—Talmage gravelly sandy loam, 0 to 2 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans and plains. It formed in alluvium derived from various kinds of rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 350 to 1,800 feet. The average annual precipitation is 32 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

Typically, the surface layer is brown gravelly sandy loam about 9 inches thick over brown very gravelly sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sandy loam and very gravelly coarse loamy sand. In some areas the surface layer is gravelly loam.

Included in this unit are small areas of Russian soils, Xerofluvents, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Talmage soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight. This soil is subject to flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used as a source of aggregate and for vineyards, orchards, hay and pasture, rangeland, and homesite development.

The removal of aggregate from this unit can lower the level of streambeds and widen stream channels. This can undermine structures, lower the water table in areas adjacent to stream channels, and erode streambanks, thereby increasing sedimentation downstream. Erosion of streambanks can also result in loss of valuable agricultural land. Areas subject to streambank cutting can be protected by rockwork.

This unit is suited to orchards and vineyards. It is limited mainly by the restricted available water capacity. Sprinkler irrigation is best suited to this unit. Water should be applied in amounts large enough to wet the root zone but small enough to minimize leaching of plant nutrients. Sprinkler or spray systems are needed to provide protection from frost in spring. Coarse fragments on the surface cause wear of tillage equipment. Cover crops should be managed by mowing instead of tilling. Because of the coarse fragments in

the soil, rock deflection shields should be used on all mowing equipment.

If this unit is used for hay and pasture, the main limitation is restricted available water capacity. Sprinkler irrigation is the most suitable method of applying water. Water should be applied in amounts large enough to wet the root zone but small enough to minimize the leaching of plant nutrients.

The production of forage is limited by the restricted available water capacity. The herbaceous plant cover readily deteriorates if it is overgrazed. As the range deteriorates, less desirable plants such as popcornflower and medusahead increase. Common plants are soft chess, filaree, wild oat, and foxtail fescue.

If this unit is suited to homesite development, the main limitations are the hazard of flooding and the risk of seepage of effluent from sewage systems. Buildings should not be located near natural drainageways. Seepage from onsite sewage disposal systems may contaminate water supplies.

This map unit is in capability unit IVs-4 (14), irrigated and nonirrigated.

204—Talmage very gravelly sandy loam, 0 to 2 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans and plains. It formed in alluvium derived from various kinds of rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 350 to 1,800 feet. The average annual precipitation is 32 to 54 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

Typically, the surface layer is brown very gravelly sandy loam about 19 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown very gravelly coarse sandy loam and very gravelly coarse loamy sand. In some areas the surface layer is very gravelly loam.

Included in this unit are small areas of Russian soils, Xerofluvents, and Riverwash. Also included are small areas of soils that are similar to this Talmage soil but are at elevations of as much as 2,700 feet and are along Wilson Creek and Kekawaka Creek, near Haman Ridge, in the southwestern part of Trinity County. Included areas make up about 15 percent of the total acreage.

Permeability of this Talmage soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight. This soil is subject to flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used as a source of aggregate and for orchards and vineyards, hay and pasture, rangeland, and homesite development.

The removal of aggregate from this unit can lower the level of streambeds and widen stream channels. This can undermine structures, lower the water table in areas adjacent to the stream channels, and erode streambanks, thereby increasing sedimentation downstream. Erosion of streambanks can also result in loss of valuable agricultural land. Areas subject to streambank cutting can be protected by rockwork.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by the restricted available water capacity and the coarse fragments in the surface layer. Sprinkler irrigation is best suited to this unit. Water should be applied in amounts large enough to wet the root zone but small enough to minimize leaching of plant nutrients. Sprinkler or spray systems are needed to provide protection from frost in spring. Coarse fragments on the surface cause rapid wear of tillage equipment. Cover crops should be managed by mowing instead of tilling. Because of the coarse fragements in the soil, rock deflectors should be used on all mowing equipment.

This unit is suited to hay and pasture. The main limitation is the restricted available water capacity. Sprinkler irrigation is the most suitable method of applying water. Water should be applied in amounts large enough to wet the root zone but small enough to minimize the leaching of plant nutrients.

The production of forage is limited by the restricted available water capacity. The herbaceous plant cover readily deteriorates if it is overgrazed. As the range deteriorates, less desirable plants such as popcornflower and medusahead increase. Common plants are soft chess, filaree, wild oat, and foxtail fescue.

If this unit is used for homesite development, the main limitations are the hazard of flooding and the risk of seepage of effluent from sewage systems. Buildings should not be located near natural drainageways. Seepage from onsite sewage disposal systems may contaminate water supplies.

This map unit is in capability unit IVs-4 (14), irrigated and nonirrigated.

205—Tyson-Updegraff complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oak. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 47 to 56

degrees F, and the average frost-free period is 125 to 150 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 60 percent Tyson very gravelly loam and 25 percent Updegraff loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Maymen, Neuns, Sanhedrin, Shortyork, Speaker, and Yorkville soils. Also included are small areas of soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

The Tyson soil is moderately deep and well drained. It formed in material derived dominantly from shale or sandstone. Typically, the surface is covered with a mat of oak leaves and twigs about 1 inch thick. The surface layer is brown very gravelly loam about 7 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam, and the lower 11 inches is pale brown very gravelly loam. Fractured shale is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam or depth to bedrock is more than 40 inches.

Permeability of the Tyson soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. In some areas the surface layer is gravelly loam or the subsoil is clay or gravelly clay. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used as watershed, wildlife habitat, and recreation areas and for limited firewood production.

Brewer oak is the main tree species on the Tyson soil. This soil can produce about 11 cords of wood per acre from a stand of trees 50 years old. Oregon white oak, California black oak, California buckeye, and scattered Douglas fir and ponderosa pine are the main tree species on the Updegraff soil. This soil can produce about 23 cords of wood per acre from a stand of trees 50 years old. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

The main limitations for the harvesting of firewood are the steepness of slope and the instability of the Updegraff soil. Roads may fail and landslides may occur following deep soil disturbance. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Tyson soil because of the coarse fragments in the soil.

Among the common forest understory plants are blue wildrye, reed fescue, and shootingstar.

This map unit is in capability subclass VIe (5), nonirrigated.

206—Tyson-Updegraff complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oak. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 50 to 60 inches, the average annual air temperature is 47 to 56 degrees F, and the average frost-free period is 125 to 150 days. There is occasional snowfall at elevations of more than 3,000 feet.

This unit is 60 percent Tyson very gravelly loam and 25 percent Updegraff loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Maymen, Neuns, Sanhedrin, Shortyork, Speaker, and Yorkville soils. Included areas make up about 15 percent of the total acreage.

The Tyson soil is moderately deep and well drained. It formed in material derived dominantly from shale or sandstone. Typically, the surface is covered with a mat of oak leaves and twigs about 1 inch thick. The surface layer is brown very gravelly loam about 7 inches thick. The upper 6 inches of the subsoil is yellowish brown gravelly loam, and the lower 11 inches is pale brown very gravelly loam. Fractured shale is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam or the depth to bedrock is more than 40 inches.

Permeability of the Tyson soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. In some areas the surface layer is gravelly loam or the subsoil is clay or gravelly clay. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used as watershed, wildlife habitat, and recreation areas and for limited firewood production.

Brewer oak is the main tree species on the Tyson soil. This soil can produce about 11 cords of wood per acre from a stand of trees 50 years old. Oregon white oak, California black oak, California buckeye, and scattered Douglas fir and ponderosa pine are the main tree species on the Updegraff soil. This soil can produce about 23 cords of wood per acre from a stand of trees 50 years old. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

Harvesting of firewood on this unit generally is not feasible because of the steepness of slope and the instability of the Updegraff soil. Roads may fail and landslides may occur following deep soil disturbance. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Tyson soil because of the coarse fragments in the soil.

Among the common forest understory plants are blue wildrye, reed fescue, and shootingstar.

This map unit is in capability subclass VIIe (5), nonirrigated.

207—Updegraff-Sanhedrin complex, 15 to 50 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly conifers and oak. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 40 to 65 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 150 to 200 days.

This unit is 35 percent Updegraff loam and 30 percent Sanhedrin gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Casabonne, Kekawaka, Maymen, Nashmead, Wohly, Woodin, Yorktree, and Yorkville soils. Also included are small areas of Updegraff and Sanhedrin soils that have slopes of less than 15 percent or more than 50 percent and soils that are similar to the Yorktree soil but have more than 35 percent rock fragments in the subsoil. Included areas make up about 35 percent of the total acreage.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam or clay loam and the subsoil is clay or gravelly clay.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Sanhedrin soil is deep and well drained. It formed in material derived dominantly from sandstone and siltstone. Typically, the surface is covered with a mat of needles, twigs, and cones about 2 inches thick. The surface layer is brown gravelly loam about 13 inches thick. The upper 10 inches of the subsoil is yellowish brown gravelly loam, and the lower 20 inches is yellowish brown gravelly clay loam. Interbedded sandstone and siltstone are at a depth of 43 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is loam.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for timber and firewood production and as wildlife habitat.

Oregon white oak, Douglas fir, ponderosa pine, and California black oak are the main tree species on this unit. Oregon white oak commonly is the most abundant tree on the Updegraff soil, but it commonly is absent on

the Sanhedrin soil. Among the trees of limited extent are Pacific madrone and sugar pine. On the basis of a 100-year site curve, the mean site index for Douglas fir is 101 on the Updegraff soil and 125 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 121 on the Sanhedrin soil. The potential annual production from a fully stocked stand of ponderosa pine is 585 board feet per acre on the Sanhedrin soil.

The main limitations for the harvesting of timber and firewood are the hazard of mass movement on the Updegraff soil, steepness of slope, and seasonal wetness. The clayey texture of the subsoil in the Updegraff soil limits the use of equipment to dry periods. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following deep soil disturbance.

Seedling survival and plant competition are concerns in the production of timber. Plantings on the Updegraff soil have little chance of survival because of the clay content of the subsoil. Reforestation can be accomplished on the Sanhedrin soil by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. When openings are made in the canopy, invading perennial grasses can prevent the establishment of seedlings.

Among the common forest understory plants are melic, blue wildrye, brackenfern, and manzanita.

This map unit is in capability subclass VIe (5), nonirrigated.

208—Updegraff-Speaker-Neuns complex, 30 to 50 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly oaks, sparse annual grasses, and occasional Douglas fir and ponderosa pine. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 125 to 175 days.

This unit is 25 percent Updegraff loam, 20 percent Speaker gravelly loam, and 15 percent Neuns very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Gudgrey, Sanhedrin, Tyson, Yorktree, and Yorkville soils. Also included are small areas of Updegraff, Speaker, and Neuns soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 40 percent of the total acreage.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the subsoil is light yellowish brown over yellowish brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. In some areas the surface layer is gravelly loam or the subsoil is clay or gravelly clay. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick.

Hard, fractured sandstone is at a depth of 29 inches. In some areas the surface layer is gravelly loam. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for timber production and as watershed and wildlife habitat. A few areas are used for firewood production.

Oregon white oak, California black oak, and scattered Douglas fir are the main tree species on the Updegraff soil. This soil can produce about 23 cords of wood per acre from a stand of trees 50 years old. Conifer stands generally are noncommercial. A mean site index of 101 for Douglas fir has been measured in a few areas. California black oak, Douglas fir, and ponderosa pine are the main tree species on the Speaker and Neuns soils. On the basis of a 100-year site curve, the mean site index for Douglas fir is 107 on the Speaker soil and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker and Neuns soils. The potential annual production from a fully stocked stand of ponderosa pine is 425 board feet per acre on these soils.

The main limitations for the harvesting of timber and firewood are the hazard of mass movement on the Updegraff soil, seasonal wetness, and steepness of slope. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts on the Neuns soil is difficult because of the large amount of coarse fragments and the very low available water capacity. Roads may fail and landslides may occur following deep soil disturbance.

Seedling survival and plant competition are concerns in the production of timber on this unit. Plantings on the Updegraff soil have little chance of survival because of the clay content of the subsoil. Reforestation can be accomplished on the Speaker and Neuns soils by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. When openings are made in the canopy, invading plants can prevent the establishment of seedlings. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done from December to May.

Among the common forest understory plants are melic, blue wildrye, brackenfern, and manzanita.

This map unit is in capability subclass VIe (5), nonirrigated.

209—Updegraff-Speaker-Neuns complex, 50 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly oaks, sparse annual grasses, and occasional Douglas fir and ponderosa pine. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 125 to 175 days.

This unit is 25 percent Updegraff loam, 20 percent Speaker gravelly loam, and 15 percent Neuns very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bluenose, Gudgrey, Sanhedrin, Tyson, and Yorktree soils and Rock outcrop. Also included are small areas of Updegraff, Speaker, and Neuns soils that have slopes of less than 50 percent or more than 75 percent. Included areas make up about 40 percent of the total acreage.

The Updegraff soil is deep and well drained. It formed in material derived dominantly from graywacke and schist. Typically, the surface is covered with a mat of decomposed leaves and twigs about 1 inch thick. The surface layer is grayish brown over brown loam about 12 inches thick. The upper 10 inches of the subsoil is grayish brown over brown clay loam, and the lower 23 inches is grayish brown clay loam. Fractured graywacke and schist are at a depth of 45 inches. In some areas the surface layer is gravelly loam or the subsoil is clay or gravelly clay. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Updegraff soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Speaker soil is moderately deep and well drained. It formed in material derived dominantly from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of pine needles, bark, twigs, and decomposed litter about 1 inch thick. The surface layer is variegated brown and dark grayish brown gravelly loam about 6 inches thick. The subsoil is reddish yellow clay loam about 18 inches thick. Fractured sandstone is at a depth of 24 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Speaker soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Neuns soil is moderately deep and well drained. It formed in material derived dominantly from schist, shale, or sandstone. Typically, the surface layer is grayish brown very gravelly loam about 5 inches thick. The subsoil is light yellowish brown and very pale brown very gravelly sandy loam about 24 inches thick. Hard, fractured sandstone is at a depth of 29 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Neuns soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used for timber production and as watershed and wildlife habitat. A few areas are used for firewood production.

Oregon white oak, California black oak, and scattered Douglas fir are the main tree species on the Updegraff soil. This soil can produce about 23 cords of wood per acre from a stand of trees 50 years old. Conifer stands are generally noncommercial. A mean site index of 101 for Douglas fir has been measured in a few areas. California black oak, Douglas fir, and ponderosa pine are the main tree species on the Speaker and Neuns soils. On the basis of a 100-year site curve, the mean site index for Douglas fir is 107 on the Speaker soil and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker and Neuns soils. The potential annual production from a fully stocked stand of ponderosa pine is 425 board feet per acre on these soils.

The main limitations for the harvesting of timber and firewood are the hazard of mass movement on the Updegraff soil, steepness of slope, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts on the Neuns soil is difficult because of the large amount of coarse fragments and the restricted available water capacity. Roads may fail and landslides may occur following deep soil disturbance. Rocks and loose soil material may slide onto roads on the Neuns soil, increasing the need for road maintenance.

Seedling survival and plant competition are concerns in the production of timber on this unit. Plantings on the Updegraff soil have little chance of survival because of the clay content of the subsoil. Reforestation can be accomplished on the Speaker and Neuns soils by planting large ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. When openings are made in the canopy, invading plants can prevent the establishment of seedlings. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done from December to May.

Among the common forest understory plants are melic, blue wildrye, brackenfern, and manzanita.

This map unit is in capability subclass VIIe (5), nonirrigated.

210—Urban land. This map unit is on terraces and alluvial plains in Ukiah and Little Lake Valleys. Slopes are nearly level to gently sloping. Elevation is 500 to 1,400 feet.

About 60 percent of this unit consists of areas that are covered by concrete, asphalt, buildings, or other impervious surfaces and about 30 percent consists of open areas that have been altered by cutting and filling or grading for housing developments, shopping centers, schools, parks, industrialized areas, and other similar uses.

Included in this unit are small areas of Talmage soils and Xerofluvents near creekbeds and Cole, Feliz, Pinole, Pinnobie, and Yokayo soils in relatively undisturbed areas. Included areas make up about 10 percent of the total acreage.

Drainage, permeability, surface runoff, and available water capacity are all variable.

This map unit has not been assigned a capability classification.

211—Witherell-Hopland-Squawrock complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly annual grasses and oaks. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 35 percent Witherell sandy loam, 25 percent Hopland loam, and 20 percent Squawrock cobbly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Etsel, Maymen, Yorktree, and Yorkville soils and Rock outcrop. Also included are small areas of Witherell and Squawrock soils that have slopes of more than 75 percent and soils that are similar to the Witherell and Hopland soils but have more than 35 percent rock fragments in the subsoil. Included areas make up about 20 percent of the total acreage.

The Witherell soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick over yellowish brown sandy loam 5 inches thick. The subsoil is reddish yellow sandy loam about 5 inches thick. Fractured sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Hopland soil is moderately deep and well drained. It formed in material derived dominantly from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. In some areas the surface layer is gravelly loam. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Squawrock soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used for livestock grazing, recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The characteristic plant community on the Witherell and Squawrock soils is mainly soft chess, wild oat, and filaree. The production of forage is limited by steepness of slope, restricted available water capacity in some areas, and the shallow rooting depth of the Witherell soil. Rangeland seeding and fertilization generally are not practical. Slope limits access by livestock. Fencing and properly locating salt and livestock watering facilities help to promote a more uniform distribution of livestock grazing. Because of the steepness of slope, this unit is better suited to grazing by sheep than by cattle.

Oregon white oak and blue oak are the main tree species on the Hopland soil. Among the trees of limited extent are Douglas fir, California black oak, Pacific madrone, and California laurel. This soil can produce about 35 cords of wood per acre from a stand of trees 50 years old.

Harvesting of firewood generally is not feasible on this unit because of the steepness of slope, hazard of erosion, and seasonal wetness. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Squawrock and Witherell soils because of the restricted available water capacity. Roads may fail and landslides may occur following deep soil disturbance.

This map unit is in capability subclass VIIe (15), nonirrigated.

212—Wohly-Casabonne loams, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir and oaks. Elevation is 500 to 2,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air

temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 55 percent Wohly loam and 25 percent Casabonne loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Kekawaka, Pardaloe, Woodin, and Yorkville soils. Also included are small areas of Wohly and Casabonne soils that have slopes of less than 30 percent or more than 50 percent and soils that have more than 35 percent rock fragments in the subsoil. Included areas make up about 20 percent of the total acreage.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Soft, fractured sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Casabonne soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is reddish yellow loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. In some areas the surface layer is gravelly loam. Depth to soft bedrock ranges from 40 to 60 inches.

Permeability of the Casabonne soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for timber production and as wildlife habitat. A few areas are used for livestock grazing.

Douglas fir, California black oak, tanoak, and Pacific madrone are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 118 on the Wohly soil and 153 on the Casabonne soil. The potential annual production from a fully stocked stand of Douglas fir is 420 board feet per acre on the Wohly soil and 750 board feet on the Casabonne soil. Among the trees of limited extent are knobcone pine in areas of old burns and ponderosa pine.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Seedling establishment and plant competition are concerns in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings or, on south-facing slopes, ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs infrequently. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes of the Wohly soil. When openings are made in the canopy, invading brushy plants can prevent the establishment of seedlings.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial grasses. Desirable forage species such as hardinggrass and soft chess grow well in previously wooded areas that have been cleared and seeded; however, the soils in this unit retain their tendency to produce woody species. Grass is difficult to maintain in most areas.

This map unit is in capability subclass VIe (5), nonirrigated.

213—Wohly-Casabonne-Pardaloe complex, 50 to 75 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly Douglas fir, tanoak, Pacific madrone, and California black oak. Elevation is 700 to 2,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 45 percent Wohly loam, 20 percent Casabonne gravelly loam, and 15 percent Pardaloe gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Kekawaka, Squawrock, and Yorkville soils. Also included are small areas of Wohly, Casabonne, and Pardaloe soils that have slopes of less than 50 percent or more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Wohly soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is yellowish brown over brown loam about 11 inches thick. The upper 6 inches of the subsoil is light reddish brown gravelly clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Fractured, soft sandstone is at a depth of 24 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Wohly soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Casabonne soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is reddish yellow gravelly loam about 15 inches thick. The upper 28 inches of the subsoil is reddish yellow clay loam, and the lower 10 inches is reddish yellow gravelly clay loam. The substratum is reddish yellow gravelly clay loam about 5 inches thick. Soft sandstone is at a depth of 58 inches. In some areas the surface layer is loam. Depth to soft bedrock ranges from 40 to 60 inches.

Permeability of the Casabonne soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Pardaloe soil is deep and well drained. It formed in material weathered from sandstone, siltstone, or shale. Typically, the surface is covered with a mat of conifer needles, oak leaves, and twigs about 0.5 inch thick. The surface layer is dark yellowish brown gravelly loam about 10 inches thick. The upper 17 inches of the subsoil is pale brown very gravelly sandy loam, and the lower part to a depth of 58 inches is light yellowish brown very gravelly loam. Fractured siltstone is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is very gravelly loam or gravelly sandy loam.

Permeability of the Pardaloe soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as watershed and wildlife habitat.

Douglas fir and tanoak are the main tree species on this unit. Among the trees of limited extent are California black oak and Pacific madrone. On the basis of a 100-year site curve, the mean site index for Douglas fir is 118 on the Wohly soil, 144 on the Casabonne soil, and 122 on the Pardaloe soil. The potential annual production from a fully stocked stand of Douglas fir is 420 board feet per acre on the Wohly soil, 665 board feet on the Casabonne soil, and 455 board feet on the Pardaloe soil.

The main limitations for the harvesting of timber are the steepness of slope, hazard of erosion, and seasonal wetness. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Harvesting systems that lift logs entirely off the ground reduce the disturbance of the protective layer of duff. Unsurfaced roads and skid trails on the Wohly and Casabonne soils are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of exposed subsoil material is difficult on the Pardaloe soils because of the content of coarse fragments. Roads may fail and landslides may occur following deep soil disturbance.

Seedling establishment and plant competition are concerns in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings and, on south-facing slopes, ponderosa pine seedlings. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes of the Wohly and Pardaloe soils. When openings are made in the canopy, invading brush can prevent the establishment of seedlings.

Among the common forest understory plants are brackenfern, blue wildrye, rose, and perennial grasses.

This map unit is in capability subclass VIIe (5), nonirrigated.

214—Xerochrepts, 5 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly chaparral and conifers. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 150 to 200 days. There is occasional snowfall at elevations of more than 3,000 feet.

Included in this unit are small areas of Asabean,

Beaughton, Casabonne, Dingman, Neuns, Wohly, and Yorkville soils, stony areas, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Xerochrepts are moderately deep to very deep and are well drained. They formed in material derived dominantly from peridotite and serpentinite. No single profile of these soils is typical, but one commonly observed in the survey area has a mat of decomposed needles and twigs about 2 inches thick on the surface. The surface layer is reddish brown gravelly loam about 4 inches thick. The upper 12 inches of the subsoil is reddish brown very gravelly clay loam, and the lower 14 inches is strong brown extremely cobbly sandy clay loam. Below this to a depth of 35 inches is reddish yellow, soft peridotite rock fragments. Hard, fractured peridotite is at a depth of 35 inches. Depth to bedrock ranges from 20 to 60 inches or more. In some areas the surface layer is loam, stony loam, cobbly loam, or very stony loam. In some areas the subsoil is very cobbly or extremely cobbly throughout, and in some areas it is clay loam or clay that is less than 35 percent rock fragments.

Permeability of the Xerochrepts is moderate to slow. Available water capacity is very low to high. Effective rooting depth is 20 to 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used as watershed, wildlife habitat, and recreation areas. A few areas are used for timber production.

Jeffrey pine, sugar pine, ponderosa pine, Douglas fir, and tanoak are the main tree species on this unit. Conifers commonly are widely spaced and slow growing. Scattered pockets of faster growing trees are present in some areas; however, these areas commonly are small. Localized differences in the parent material are the probable cause. Yield estimates have not been made for the soils in this unit because of their variability. Generally, this unit is not used for commercial timber production.

Among the common forest understory plants are Sargent cypress, manzanita, huckleberry oak, wavyleaf ceanothus, and chloris.

This map unit is in capability subclass VIIe (5), nonirrigated.

215—Xerochrepts-Haploxeralfs-Argixerolls complex, 9 to 30 percent slopes. This map unit is on dissected stream terraces and terrace escarpments. The native vegetation is mainly scattered oaks, ponderosa pine, Douglas fir, and manzanita. Elevation is 600 to 2,600 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 225 days.

This unit is 35 percent Xerochrepts, 30 percent Haploxeralfs, and 25 percent Argixerolls. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Redvine soils on ridgetops; Feliz, Gielow, and Talmage soils along streams; Yorkville soils that are on hills and are underlain by sedimentary rock; and eroded soils. Also included are small areas of soils that have slopes of less than 9 percent or more than 30 percent and are on terrace escarpments and along drainageways. Included areas make up about 10 percent of the total acreage.

Xerochrepts are very deep and well drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in the survey area has a mat of partially decomposed needles and twigs about 0.5 inch thick on the surface. The surface layer is light yellowish brown gravelly loam about 12 inches thick. The upper 24 inches of the subsoil is brownish yellow very gravelly loam, and the lower 36 inches is brownish yellow gravelly sandy clay loam over very gravelly loam. In some areas the surface layer is gravelly sandy loam, very gravelly loam, or very gravelly sandy loam. In some areas the subsoil is stratified loam and sandy loam or gravelly loam and gravelly sandy loam.

Permeability of the Xerochrepts is moderate to moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high.

Haploxeralfs are very deep and well drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in the survey area has a surface layer of brown sandy loam and strong brown loam 9 inches thick. The subsoil is reddish yellow loam about 21 inches thick. The upper 7 inches of the substratum is reddish yellow gravelly sandy loam, and the lower part to a depth of 60 inches or more is yellowish brown very gravelly sandy loam. In some areas the surface layer is gravelly loam.

Permeability of the Haploxeralfs is moderate to moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Argixerolls are very deep and are moderately well drained to well drained. They formed in alluvium derived from various kinds of rock. No single profile of these

soils is typical, but one commonly observed in the survey area has a surface layer of brown gravelly loam 11 inches thick. The upper 11 inches of the subsoil is yellowish brown gravelly clay loam, and the lower 15 inches is reddish yellow gravelly clay loam. The underlying material to a depth of 60 inches or more is light yellowish brown clay. Depth to the dense clay layer ranges from 35 to 55 inches. In some areas the surface layer is loam.

Permeability of the Argixerolls is slow to moderately rapid. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This unit is used mainly for timber and firewood production and as wildlife habitat and watershed. It is also used for homesite development.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 109 on the Xerochrepts and Haploxeralfs and 120 on the Argixerolls. On the basis of a 100-year site curve, the mean site index for Douglas fir is 107 on the Xerochrepts and Haploxeralfs and 110 on the Argixerolls. The potential annual production from a fully stocked stand of ponderosa pine is 455 board feet per acre on the Xerochrepts and Haploxeralfs and 570 board feet on the Argixerolls.

The main limitation for the harvesting of timber and firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are soft when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion.

Seedling survival is a concern in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of Douglas fir seedlings, especially on south- and southwest-facing slopes. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs frequently. Natural Douglas fir seedlings usually do not survive. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings.

Among the common forest understory plants are manzanita, reed fescue, poison oak, and bedstraw.

The production of forage is limited by the tendency of this unit to produce woody species. Where oaks and brush are present, forage production can be increased by managing the harvesting of trees and removing brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. This unit responds well to fertilization, rangeland seeding, and proper grazing use. The main limitation for seeding is the abundance of woody species.

If this unit is used for homesite development, the main limitations are the steepness of slope and the presence of a dense clay subsoil in some areas. Suitable building sites are limited to knolls and to the less sloping areas of included soils. Excavation for roads and buildings increases the risk of erosion. Plans for homesite development should provide for the preservation of as many trees as possible. Access roads should be designed to control surface runoff and help stabilize cuts. The main limitation of this unit for septic tank absorption fields is the depth to the clay layer in the Argixerolls, which restricts the movement and filtration of effluent. Untreated effluent can move along the surface of the clay layer and seep in downslope areas, creating a hazard to health. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass IVe (5), nonirrigated.

216—Xerochrepts-Haploxeralfs-Argixerolls complex, 30 to 50 percent slopes. This map unit is on dissected stream terraces and terrace escarpments. The native vegetation is mainly scattered oaks, ponderosa pine, Douglas fir, and manzanita. Elevation is 600 to 2,600 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 225 days.

This unit is 40 percent Xerochrepts, 30 percent Haploxeralfs, and 20 percent Argixerolls. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Redvine soils on ridgetops, Yorktree soils that are on hills and are underlain by sedimentary rock, and eroded soils. Also included are small areas of soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 10 percent of the total acreage.

Xerochrepts are very deep and well drained. They formed in alluvium derived from various kinds of rock.

No single profile of these soils is typical, but one commonly observed in this survey area has a mat of partially decomposed needles and twigs about 0.5 inch thick on the surface. The surface layer is light yellowish brown gravelly loam about 12 inches thick. The upper 24 inches of the subsoil is brownish yellow very gravelly loam, and the lower 36 inches is brownish yellow gravelly sandy clay loam over very gravelly loam. In some areas the surface layer is gravelly sandy loam, very gravelly loam, or very gravelly sandy loam. In some areas the subsoil is stratified loam and sandy loam or gravelly loam and gravelly sandy loam.

Permeability of the Xerochrepts is moderate to moderately rapid. The available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high to very high.

Haploxeralfs are very deep and well drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in the survey area has a surface layer of brown over strong brown loam about 9 inches thick. The subsoil is reddish yellow loam about 21 inches thick. The upper 7 inches of the substratum is reddish yellow gravelly sandy loam, and the lower part to a depth of 60 inches or more is yellowish brown very gravelly sandy loam. In some areas the surface layer is gravelly loam.

Permeability of the Haploxeralfs is moderate to moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high to very high.

Argixerolls are very deep and are moderately well drained to well drained. They formed in alluvium derived from various kinds of rock. No single profile of these soils is typical, but one commonly observed in this survey area has a surface layer of brown loam or gravelly loam 11 inches thick. The upper 11 inches of the subsoil is yellowish brown gravelly clay loam, and the lower 15 inches is reddish yellow gravelly clay loam. The substratum to a depth of 60 inches or more is light yellowish brown clay. Depth to the dense clay layer ranges from 35 to 55 inches.

Permeability of the Argixerolls is slow to moderately rapid. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high to very high.

This unit is used for timber and firewood production and as wildlife habitat and watershed.

Ponderosa pine, Douglas fir, and California black oak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 109 on the Xerochrepts and Haploxeralfs and 120 on the Argixerolls. On the basis of a 100-year site curve, the mean site index for Douglas fir is 107 on the Xerochrepts and Haploxeralfs and 110 on the Argixerolls. The potential annual production from a fully stocked stand of ponderosa pine is 455 board feet per acre on the Xerochrepts and Haploxeralfs and 570 board feet on the Argixerolls.

The main limitations for the harvesting of firewood or timber are the hazard of erosion, steepness of slope, and seasonal wetness. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and tracked equipment or cable yarding systems. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily when water is concentrated in unprotected ditches.

Seedling survival is a concern in the production of timber on this unit. The high soil temperature and limited soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs frequently. Natural Douglas fir seedlings usually do not survive. When openings are made in the canopy, invading brushy plants can delay the establishment of seedlings.

Among the common forest understory plants are manzanita, reed fescue, poison oak, and bedstraw.

This map unit is in capability subclass VIe (5), nonirrigated.

217—Xerofluvents, 0 to 2 percent slopes. These very deep, well drained soils are on flood plains. They formed in recent mixed alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered groves of trees. Elevation is 400 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 55 to 59 degrees F,

and the average frost-free period is 175 to 250 days.

No single profile of Xerofluvents is typical, but one commonly observed in the survey area has a surface layer of grayish brown sandy loam about 15 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and pale brown, stratified sand and loam.

Included in this unit are small areas of Talmage and Russian soils, Riverwash, and soils that have slopes of 3 to 5 percent. Also included are soils on steep terrace escarpments. Included areas make up about 10 percent of the total acreage.

Permeability of these Xerofluvents is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight. These soils are subject to flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly for vineyards, orchards, and hay and pasture. It is also used for homesite development.

This unit is suited to irrigated orchards and vineyards. It is limited mainly by the coarse texture of the soil. Sprinkler irrigation is best suited to this unit. Water should be applied in amounts large enough to wet the root zone but small enough to minimize leaching of plant nutrients.

This unit is also suited to hay and pasture. Sprinkler irrigation is best suited to the unit.

If this unit is used for homesite development, the main limitations are the hazards of flooding and streambank erosion. Roads and streets should be located above the expected flood level. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclasses IIw (14), irrigated, and IIIw (14), nonirrigated.

218—Xerofluvents-Riverwash complex, 0 to 2 percent slopes. This map unit is on narrow flood plains adjacent to stream channels and in active stream channels. It formed in recent alluvium derived dominantly from sedimentary rock. The native vegetation is mainly sparse annual grasses, forbs, and brush. Elevation is about 350 to 2,500 feet. The average annual precipitation is 30 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 125 to 250 days.

This unit is about 50 percent Xerofluvents and 35 percent Riverwash. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cole, Russian, Feliz, and Talmage soils. Also included are soils on steep terrace escarpments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Xerofluvents are very deep and excessively drained. They formed in alluvium derived dominantly from sedimentary rock. No single profile of these soils is typical, but one commonly observed in survey area has a surface layer of grayish brown very gravelly sandy loam about 5 inches thick. The underlying material to a depth of 64 inches is stratified, light brownish gray very gravelly loamy coarse sand and very gravelly coarse sand.

Permeability of the Xerofluvents is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and there is no hazard of erosion except along streams, where there is severe streambank erosion during high-intensity storms. These soils are subject to frequent periods of flooding in winter and spring.

Areas of Riverwash are inundated during periods of high water and are subject to deposition and removal of material. These areas consist of stratified layers of water-deposited sand, gravel, and cobbles. The thickness of the layers is extremely variable and is dependent upon water velocity and location within the channel.

This unit is used mainly as wildlife habitat and for livestock grazing. It is also used as a source of commercial gravel.

The less sloping areas of this unit are suitable for seeding to native or adapted introduced forage plants. The herbaceous plant cover readily deteriorates if it is overgrazed. Vegetation should be retained to prevent erosion and provide habitat for wildlife. The characteristic plant community on this unit is mainly foxtail fescue, vinegarweed, and filaree.

The removal of aggregate can lower the level of streambeds and widen stream channels. This can undermine structures, lower the water table in areas adjacent to the stream channels, and erode streambanks, thereby increasing sedimentation downstream. Erosion of streambanks can also result in loss of valuable agricultural land. Jetties or other structures can be placed in stream channels to protect banks from erosion. Check dams or buried sills can be

used to control the lowering of streambeds.

This map unit is in capability subclass VIIw (5, 14, 15), nonirrigated.

219—Yellowhound-Kibesillah-Ornbaun complex, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly Douglas fir, redwood, and tanoak. Elevation is 500 to 2,500 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 220 to 270 days.

This unit is 40 percent Yellowhound very gravelly loam, 30 percent Kibesillah gravelly loam, and 15 percent Ornbaun loam. The Yellowhound soil is on side slopes, the Kibesillah soil is on side slopes and spur ridges, and the Ornbaun soil is on concave slopes and toe slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Zeni soils and areas of exposed bedrock along roadcuts. Also included are small areas of soils on ridges and along draws that have slopes of less than 30 percent and soils in gulches that have slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Yellowhound soil is deep and well drained. It formed in material derived dominantly from sandstone conglomerate. Typically, the surface layer is light brown very gravelly loam about 6 inches thick. The upper 9 inches of the subsoil is variegated light brown and reddish yellow loam, and the lower 16 inches is very pale brown and reddish yellow very gravelly loam. The substratum is variegated very pale brown and reddish yellow extremely gravelly sandy clay loam about 27 inches thick. Hard conglomerate is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly sandy loam, sandy loam, or loam.

Permeability of the Yellowhound soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is rapid, and the hazard of erosion is high.

The Kibesillah soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of needles, leaves, and twigs of tanoak and huckleberry about 1 inch thick. The surface layer is very pale brown gravelly loam about 3 inches thick. The upper 3 inches of the subsoil is light gray gravelly loam, and the lower 15 inches is white very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to hard sandstone ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam.

Permeability of the Kibesillah soil is moderate. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is rapid, and the hazard of erosion is high.

The Ornbaun soil is deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of fresh and decomposed redwood and Douglas fir needles and tanoak leaves 1 inch thick. The surface layer is pale brown over light yellowish brown loam about 9 inches thick. The upper 10 inches of the subsoil is very pale brown gravelly clay loam, and the lower 23 inches is reddish yellow gravelly clay loam. Fractured sandstone is at a depth of 42 inches. Depth to sandstone ranges from 40 to 60 inches. In some areas the subsoil has more than 35 percent clay.

Permeability of the Ornbaun soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is rapid, and the hazard of erosion is high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, redwood, and tanoak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 143 on the Yellowhound soil, 109 on the Kibesillah soil, and 155 on the Ornbaun soil. On the basis of a 100-year site curve, the mean site index for redwood is 135 on the Yellowhound soil, 109 on the Kibesillah soil, and 152 on the Ornbaun soil. The potential annual production from a fully stocked stand of redwood is 1,045 board feet per acre on the Yellowhound soil, 465 board feet on the Kibesillah soil, and 1,310 board feet the Ornbaun soil. Among the trees of limited extent are Pacific madrone and canyon live oak.

The main limitation for the harvesting of timber is the steepness of slope. Wheeled and tracked equipment can be used in the less sloping areas. Cable yarding systems generally disturb the soil less in the steeper areas. Rock for construction of roads is available in areas of this unit. Revegetation of exposed subsoil material is difficult on the Yellowhound and Kibesillah soils because of the content of coarse fragments. Establishing plant cover on steep cuts and fills reduces erosion.

Seedling establishment and plant competition are

concerns in the production of timber. When openings are made in the canopy, invading brush can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and redwood seedlings on the Yellowhound and Ornbaun soils and Douglas fir seedlings on the Kibesillah soil. If seed trees are present, natural reforestation of cutover areas by Douglas fir occurs infrequently. After cutting, redwood can regenerate by stump sprouting; however, these sprouts seldom provide optimum stocking. The droughtiness of the surface layer reduces the survival rate of seedlings on the Yellowhound and Kibesillah soils, especially on south- and southwest-facing slopes.

Among the common forest understory plants are evergreen huckleberry, brackenfern, tanoak, buckbrush, and blueblossom.

This map unit is in capability subclass VIe (4), nonirrigated.

220—Yellowhound-Kibesillah complex, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly Douglas fir, redwood, and tanoak. Elevation is 500 to 2,500 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is about 52 to 54 degrees F, and the average frost-free period is 220 to 270 days.

This unit is 45 percent Yellowhound very gravelly loam and 35 percent Kibesillah gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ornbaun and Zeni soils and Rock outcrop along roadcuts. Also included are small areas of soils on ridges and along draws that have slopes of less than 50 percent and small areas of soils in gulches that have slopes of more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Yellowhound soil is deep and well drained. It formed in material derived dominantly from sandstone or conglomerate. Typically, the surface layer is light brown very gravelly loam about 6 inches thick. The upper 9 inches of the subsoil is variegated light brown and reddish yellow loam, and the lower 16 inches is variegated very pale brown and reddish yellow very gravelly loam. The substratum is variegated very pale brown and reddish yellow extremely gravelly sandy clay loam about 27 inches thick. Hard conglomerate is at a depth of 58 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly sandy loam, sandy loam, or loam.

Permeability of the Yellowhound soil is moderate. Available water capacity is low. Effective rooting depth is 40 to 60 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is very rapid, and the hazard of erosion is very high.

The Kibesillah soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of tanoak and huckleberry needles, leaves, and twigs about 1 inch thick. The surface layer is very pale brown gravelly loam about 3 inches thick. The upper 3 inches of the subsoil is light gray gravelly loam, and the lower 15 inches is white very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to hard sandstone ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam.

Permeability of the Kibesillah soil is moderate. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches; however, some roots follow fractures in the bedrock and penetrate to a greater depth. Runoff is very rapid, and the hazard of erosion is very high.

This unit is used for timber production and as wildlife habitat.

Douglas fir, redwood, and tanoak are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index for Douglas fir is 143 on the Yellowhound soil and 109 on the Kibesillah soil. On the basis of a 100-year site curve, the mean site index for redwood is 135 on the Yellowhound soil and 109 on the Kibesillah soil. The potential annual production from a fully stocked stand of redwood is 1,045 board feet per acre on the Yellowhound soil and 465 board feet on the Kibesillah soil. Among the trees of limited extent are Pacific madrone and canyon live oak.

The main limitation for the harvesting of timber is the steepness of slope. Steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Rock for construction of roads is available in areas of this unit. Rocks and loose soil material may slide onto roads, increasing the need for road maintenance. Revegetation of exposed subsoil material is difficult on this unit because of the large amount of coarse fragments in the soils.

Seedling establishment and plant competition are concerns in the production of timber. When openings are made in the canopy, invading brush can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas fir and redwood seedlings on the Yellowhound soil and Douglas fir seedlings on the Kibesillah soil. If seed trees are present, natural reforestation of cutover areas by

Douglas fir occurs infrequently. After cutting, redwood can regenerate by stump sprouting; however, these sprouts seldom provide optimum stocking. The droughtiness of the surface layer reduces the survival rate of seedlings on this unit, especially on south- and southwest-facing slopes. Movement of loose soil material on the surface can reduce seedling survival.

Among the common forest understory plants are buckbrush, blueblossom, tanoak, evergreen huckleberry, and, primarily on south-facing slopes, canyon live oak.

This map unit is capability subclass VIIe (4), nonirrigated.

221—Yokayo sandy loam, 0 to 8 percent slopes. This very deep, well drained soil is on old dissected terraces. It formed in old alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is light brownish gray sandy loam about 8 inches thick. The upper 10 inches of the subsoil is light yellowish brown clay, the next 14 inches is light yellowish brown clay loam, and the lower 16 inches is pale yellow clay loam. The substratum to a depth of 60 inches or more is pale yellow loam. In some areas the surface layer is loam, sandy clay loam, or very gravelly sandy clay loam.

Included in this unit are small areas of Pinnobie, Pinole, and Redvine soils. Also included are small areas of Yokayo soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Yokayo soil is moderately rapid to a depth of 8 inches and very slow below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is slight.

Most areas of this unit are used for vineyards, hay and pasture, and homesite development. A few areas are used for livestock grazing and firewood production.

This unit is suited to vineyards. It is limited mainly by the hazard of erosion and the very slow permeability in the lower part of the soil. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Irrigation is needed to establish grapevines. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. The main limitations are the hazard of erosion and the very slow permeability in the lower part of the soil. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Sprinkler irrigation is the most suitable method of applying water. Because of the very slow permeability of the soil in this unit, application of irrigation water should be regulated to control runoff and erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. The main limitations are the high shrink-swell potential, the very slow permeability in the lower part of the soil, and the hazard of erosion. Buildings and roads can be designed to offset the effects of shrinking and swelling. If this unit is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. Revegetating disturbed areas around construction sites helps to control erosion.

The production of forage on this unit is limited by the susceptibility of the soil to compaction when moist and by periods when the surface layer is saturated. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Grazing should be deferred when the surface layer is saturated. Common plants on this unit are wild oat, soft chess, foxtail fescue, filaree, and purple needlegrass.

Oregon white oak, blue oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are interior live oak and California white oak. On the basis of a 50-year site curve, the mean site index for California black oak is 32. This unit can produce about 18 cords of wood per acre from a stand of trees 50 years old. Because the rooting depth is restricted by the clay subsoil, trees sometimes are subject to windthrow.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily when water is

concentrated in unprotected ditches. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, ripgut brome, and blue wildrye.

This map unit is in capability unit IIIe-3 (14), irrigated and nonirrigated.

222—Yokayo sandy loam, 8 to 15 percent slopes. This very deep, well drained soil is on old dissected terraces. It formed in old alluvium derived dominantly from sedimentary rock. The vegetation in areas not cultivated is mainly oaks and annual grasses. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is light brownish gray sandy loam about 8 inches thick. The upper 10 inches of the subsoil is light yellowish brown clay, the next 14 inches is light yellowish brown clay loam, and the lower 16 inches is pale yellow clay loam. The substratum to a depth of 60 inches or more is pale yellow loam. In some areas the surface layer is loam, sandy clay loam, or very gravelly sandy clay loam.

Included in this unit are small areas of Pinnobie, Pinole, and Redvine soils. Also included are small areas of Yokayo soils that have slopes of less than 8 percent or more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Yokayo soil is moderately rapid to a depth of 8 inches and very slow below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate. This soil is susceptible to slumping when wet.

Most areas of this unit are used for vineyards, hay and pasture, and homesite development. A few areas are used for livestock grazing and firewood production.

This unit is suited to vineyards. It is limited mainly by the hazard of erosion and the very slow permeability in the lower part of the soil. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Irrigation is needed to establish grapevines. Sprinkler irrigation is best suited to this unit, and its use helps to protect crops from frost. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, and limit energy consumption.

This unit is suited to hay and pasture. The main limitations are the hazard of erosion and the very slow permeability in the lower part of the soil. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the unit from erosion. This unit is suited to sprinkler irrigation. Because of the very slow permeability of the soil in this unit, application of irrigation water should be regulated to control runoff and erosion. Fertilizer is needed to ensure optimum growth of grasses and legumes.

This unit is suited to homesite development. The main limitations are the high shrink-swell potential, the very slow permeability in the lower part of the soil, and the hazard of erosion. If this unit is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. Buildings and roads can be designed to offset the effects of shrinking and swelling. Revegetating disturbed areas around construction sites helps to control erosion.

The production of forage is limited by the susceptibility of the soil to compaction when moist and a tendency of this unit to produce woody species. Where oaks and brush are present, forage production can be increased by properly managing the harvesting of trees and by removing brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. This unit responds well to fertilization, to rangeland seeding, and to proper grazing use. The main limitation for seeding is the abundance of woody species. Common plants are wild oat, foxtail fescue, purple needlegrass, soft chess, and filaree.

Oregon white oak, blue oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extend are interior live oak and California white oak. On the basis of a 50-year site curve, the mean site index for California black oak is 32. This unit can produce about 18 cords of wood per acre from a stand of trees 50 years old. Because the rooting depth is restricted by the clay subsoil, trees sometimes are subject to windthrow.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this

unit. Establishing plant cover on steep cuts and fills reduces erosion. Gullies form readily when water is concentrated in unprotected ditches. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, ripgut brome, and blue wildrye.

This map unit is in capability unit IVe-3 (14), irrigated and nonirrigated.

223—Yokayo sandy loam, 15 to 30 percent slopes. This very deep, well drained soil is on old dissected terraces. It formed in old alluvium derived dominantly from sedimentary rock. The vegetation is mainly oaks and annual grasses. Elevation is 500 to 1,200 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

Typically, the surface layer is light brownish gray sandy loam about 8 inches thick. The upper 10 inches of the subsoil is light yellowish brown clay, the next 14 inches is light yellowish brown clay loam, and the lower 16 inches is pale yellow clay loam. The substratum to a depth of 60 inches or more is pale yellow loam. In some areas the surface layer is loam, sandy clay loam, or very gravelly sandy clay loam.

Included in this unit are small areas of Pinnobie, Pinole, and Redvine soils. Also included are small areas of Yokayo soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Yokayo soil is moderately rapid to a depth of 8 inches and very slow below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is susceptible to slumping when wet.

This unit is used for livestock grazing, as recreation areas, watershed, and wildlife habitat, and for firewood production.

The production of forage is limited by the susceptibility of the soil to compaction when moist and a tendency to produce woody species. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Grazing should be deferred when the surface layer is saturated. Common plants on this unit are wild oat, soft chess, foxtail fescue, purple needlegrass, and filaree.

Oregon white oak, blue oak, California black oak, and Pacific madrone are the main tree species in areas where this unit has not been cleared. Among the trees of limited extent are interior live oak and California white oak. On the basis of a 50-year site curve, the mean site index for California black oak is 32. This unit can produce about 18 cords of wood per acre from a stand of trees 50 years old. Because the rooting depth is restricted by the clay subsoil, trees sometimes are subject to windthrow.

The main limitation for the harvesting of firewood is seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion on this unit. Gullies form readily when water is concentrated in unprotected ditches. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

Among the common forest understory plants are manzanita, poison oak, ripgut brome, and blue wildrye.

This map unit is in capability unit IVe-1 (14), irrigated and nonirrigated.

224—Yokayo-Pinole-Pinnobie complex, 0 to 15 percent slopes. This map unit is on old dissected stream terraces. The native vegetation is mainly annual grasses and occasional oaks and chaparral. Elevation is 500 to 1,500 feet. The average annual precipitation is 32 to 44 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 200 to 250 days.

This unit is 35 percent Yokayo sandy loam, 30 percent Pinole gravelly loam, and 20 percent Pinnobie loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Redvine soils on ridgetops, Feliz and Talmage soils along streams, and Yorktree soils that are on hills and are underlain by sedimentary rock. Also included are small areas of Yokayo, Pinole, and Pinnobie soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

The Yokayo soil is very deep and well drained. It formed in old alluvium derived dominantly from sedimentary rock. Typically, the surface layer is light brownish gray sandy loam about 8 inches thick. The upper 10 inches of the subsoil is light yellowish brown

clay, the next 14 inches is light yellowish brown clay loam, and the lower 16 inches is pale yellow clay loam. The substratum to a depth of 60 inches or more is pale yellow loam. In some areas the surface layer is loam, sandy clay loam, or very gravelly sandy clay loam.

Permeability of the Yokayo soil is moderately rapid to a depth of 8 inches and very slow below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate. The steeper areas of this soil are susceptible to slumping when wet.

The Pinole soil is very deep and well drained. It formed in alluvium derived dominantly from sedimentary rock. Typically, the surface layer is brown gravelly loam about 10 inches thick. The upper 27 inches of the subsoil is yellowish brown over variegated brown and yellow clay loam, and the lower 24 inches is strong brown and brownish yellow sandy clay loam. In some areas the surface layer is loam, gravelly sandy clay loam, or very gravelly loam.

Permeability of the Pinole soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

The Pinnobie soil is very deep and well drained. It formed in alluvium derived dominantly from sedimentary rock. Typically, the surface layer is brown loam about 11 inches thick. The subsoil is light yellowish brown loam about 31 inches thick. The upper 6 inches of the substratum is yellowish brown and light yellowish brown loam, and the lower part to a depth of 60 inches or more is yellowish brown and light yellowish brown clay loam.

Permeability of the Pinnobie soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for livestock grazing, hay and pasture, and homesite development. Some areas are used for vineyards.

The production of forage is limited by the tendency of the soils in this unit to produce woody species. Where oaks and brush are present, forage production can be increased by harvesting trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. This unit responds well to fertilization, rangeland seeding, and proper grazing use. The main limitation for seeding is the abundance of woody species. Common plants are soft chess, wild oat, purple needlegrass, and filaree.

This unit is suited to hay and pasture, but special management is needed because of the complexity of the slopes. The unit has a tendency to produce woody species that must be cleared before it is cropped. Clearing drainageways and creeks or combining their flow results in gullying and streambank erosion.

This unit is suited to irrigated vineyards. It is limited mainly by slope, the hazard of erosion, and the susceptibility of the soils to compaction, which can result in reduced permeability and poor tilth. Use of contour farming, grassed waterways, and cover crops helps to control erosion. Cover crops should be managed by mowing instead of tilling to reduce erosion, increase the water intake rate, limit energy costs, and limit wear on tillage implements.

Irrigation is needed for vineyards. Sprinkler irrigation is best suited to this unit because it also provides protection from frost. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Sprinkler systems should be designed to meet the needs of the soil in the field that has the slowest permeability.

This unit is suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the unit from erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Fertilizer is needed for optimum growth of grasses and legumes.

This unit is suited to homesite development. The main limitations are the steepness of slope and the very slow permeability in the lower part of the Yokayo soil. Preferred building sites are limited to knolls and the less sloping areas. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. If the Yokayo soil is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field and using low volume flush toilets. The moderate shrink-swell potential of the Pinole and Pinnobie soils and the high shrink-swell potential of the subsoil in the Yokayo soil should be considered when designing and constructing foundations, concrete structures, and paved areas.

This map unit is in capability unit IVe-1 (14), irrigated and nonirrigated.

225—Yorktree-Hopland-Woodin complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The native vegetation is mainly oaks and annual grasses. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 55 inches, the

average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 30 percent Yorktree loam, 30 percent Hopland loam, and 15 percent Woodin gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Etsel, Maymen, and Yorkville soils; Squawrock and Witherell soils south of Ukiah; and Casabonne, Kekawaka, and Wohly soils north of Willits. Also included are areas of soils that are similar to the Yorktree soil but have more than 35 percent rock fragments and soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 25 percent of the total acreage.

The Yorktree soil is deep and well drained. It formed in material derived dominantly from graywacke, shale, sandstone, or siltstone. Typically, the surface layer is brown loam over yellowish brown gravelly loam about 18 inches thick. The upper 6 inches of the subsoil is brown gravelly clay loam, and the lower 27 inches is brown clay over gravelly clay loam. Fractured graywacke is at a depth of 51 inches. In some areas the surface layer is gravelly loam or clay loam. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Yorktree soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

This unit is used for firewood production and as recreation areas, watershed, and wildlife habitat.

Oregon white oak and blue oak are the main tree species on this unit. Among the trees of limited extent are California black oak, Pacific madrone, and California laurel. This unit can produce 20 to 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 30 on the Yorktree soil and 44 on the Hopland soil.

Harvesting of firewood on this unit generally is not feasible because of the steepness of slope, hazard of erosion, and seasonal wetness. Roads may fail and landslides may occur following soil disturbance, especially on the Yorktree soil. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Woodin soil because of the restricted available water capacity. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done in December to May.

Among the common forest understory plants are melic, blue wildrye, and buttercup. California nutmeg commonly is present on the Woodin soil.

This map unit is in capability subclass VIe (5), nonirrigated.

226—Yorktree-Hopland-Woodin complex, 50 to 75 percent slopes. This map unit is on side slopes of hills and mountains. The native vegetation is mainly oak and annual grasses. Elevation is 500 to 2,500 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 175 to 250 days.

This unit is 30 percent Yorktree loam, 30 percent Hopland loam, and 15 percent Woodin very gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Etsel, Maymen, and Yorkville soils; Squawrock and Witherell soils south of Ukiah; and Casabonne, Kekawaka, and Wohly soils north of Willits. Also included are areas of soils that are similar to the Yorktree soil but are more than 35 percent rock fragments and soils that have slopes of less than 50 percent. Included areas make up about 25 percent of the total acreage.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, shale, sandstone, or siltstone. Typically, the surface layer is brown loam over yellowish brown gravelly loam about 18 inches thick. The upper 6 inches of the subsoil is brown gravelly clay loam, and the lower 27 inches is brown clay over gravelly clay loam. Fractured graywacke is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam or clay loam.

Permeability of the Yorktree soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft, fractured sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

The Woodin soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface is covered with a mat of decomposed needles and twigs about 1.5 inches thick. The surface layer is brown gravelly sandy loam about 7 inches thick. The upper 8 inches of the subsoil is yellowish brown very gravelly sandy loam, and the lower 8 inches is yellowish brown very cobbly sandy loam. Hard, fractured sandstone is at a depth of 23 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. A layer of fine gravel as much as 3 inches thick is in some areas.

Permeability of the Woodin soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of erosion is very high.

Most areas of this unit are used for recreation and as wildlife habitat. A few areas are used for firewood production.

Oregon white oak and blue oak are the main tree species on this unit. Among the trees of limited extent are California black oak, Pacific madrone, and California laurel. This unit can produce 20 to 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 30 on the Yorktree soil and 44 on the Hopland soil.

Harvesting of firewood generally is not feasible on this unit because of the steepness of slope, the hazard of erosion, and seasonal wetness. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Revegetation of cuts and fills is difficult on the Woodin soil because of the restricted available water capacity. Roads may fail and landslides may occur following soil disturbance, especially on the Yorktree soil.

Among the common forest understory plants are melic, blue wildrye, and buttercup. California nutmeg commonly is present on the Woodin soil.

This map unit is in capability subclass VIIe (5), nonirrigated.

227—Yorktree-Yorkville loams, 15 to 30 percent slopes. This map unit is on unstable side slopes of hills and mountains. The native vegetation is mainly oaks and grasses. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 50 percent Yorktree loam and 25 percent Yorkville loam. The Yorktree soil is under oaks on convex and concave slopes, and the Yorkville soil is under grasses on concave slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Bearwallow, Hellman, and Hopland soils on ridgetops and small areas of Witherell and Squawrock soils on spur ridges and surrounding rock outcroppings. Also included are small areas of Yorktree and Yorkville soils that have slopes of more than 30 percent or less than 15 percent and Updegraff soils in some areas

north of Willits. Included areas make up about 25 percent of the total acreage.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, shale, siltstone, or sandstone. Typically, the surface layer is brown loam over yellowish brown gravelly loam about 18 inches thick. The upper 6 inches of the subsoil is brown gravelly clay loam, and the lower 27 inches is brown clay over gravelly clay loam. Fractured graywacke is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Yorktree soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The production of forage is limited by the susceptibility of the soils in this unit to compaction when moist. The Yorkville soil responds well to fertilization, rangeland seeding, and proper grazing use. Springs and seeps are common on this unit. They can be developed for use as watering facilities for wildlife and to achieve better livestock distribution. Livestock grazing should be managed to protect this unit from erosion. Woody plants are the most extensive species on the Yorktree soil. Among the common understory plants are melic, blue wildrye, and vetch. The characteristic plant community on the Yorkville soil is mainly wild oat, soft chess, and burclover.

Blue oak and Oregon white oak are the main tree species on the Yorktree soil. This soil can produce about 17 cords of wood per acre from a stand of trees 50 years old.

Harvesting of firewood is limited mainly by the inherent instability of the Yorkville soil and seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following soil disturbance. After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

This unit is in capability unit IVe-1 (15), nonirrigated.

228—Yorktree-Yorkville loam, 30 to 50 percent slopes. This map unit is on unstable side slopes of hills and mountains. The native vegetation is mainly oaks and grasses. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 50 percent Yorktree loam and 25 percent Yorkville loam. The Yorktree soil is under oaks on convex and concave slopes, and the Yorkville soil is under grasses on concave slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Hellman, and Hopland soils on ridgetops, Witherell and Squawrock soils on spur ridges, and Montara and Henneke soils underlain by serpentinitic rock. Also included are small areas of Yorktree and Yorkville soils that have slopes of more than 50 percent or less than 30 percent and Updegraff soils in some areas north of Willits. Included areas make up about 25 percent of the total acreage.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, shale, siltstone, or sandstone. Typically, the surface layer is brown loam over yellowish brown gravelly loam about 18 inches thick. The upper 6 inches of the subsoil is brown gravelly clay loam, and the lower 27 inches is brown clay over brown gravelly clay loam. Fractured graywacke is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Yorktree soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Yorkville soil is very deep and moderately well

drained. It formed in material weathered from graywacke, shale, or chloritic schist. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping.

This unit is used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The production of forage is limited by slope and the susceptibility of the soil to compaction when moist. The Yorkville soil responds well to fertilizer, rangeland seeding, and proper grazing use. The main limitation for seeding is steepness of slope; seed should be applied aerially. Removal of the plant cover results in erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing. Springs and seeps are common on this unit. They can be developed for use as livestock watering facilities and to achieve better distribution of grazing. Grazing should be deferred when the surface layer is saturated. Woody plants are the most extensive species on the Yorktree soil. Among the common understory plants on this soil are melic, blue wildrye, and vetch. The characteristic plant community on the Yorkville soil is mainly wild oat, soft chess, and burclover.

Harvesting of firewood is limited by steepness of slope, seasonal wetness, and the inherent instability of the Yorkville soil. Blue oak and Oregon white oak are the main tree species on this unit. The Yorktree soil can produce about 17 cords of wood per acre from a stand of trees 50 years old. Steepness of slope limits the use of wheeled and tracked equipment on this unit. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following soil disturbance.

This unit is in capability subclass VIe (15), nonirrigated.

229—Yorkville loam, 15 to 30 percent slopes. This very deep, moderately well drained soil is on unstable side slopes of hills and mountains. It formed in material weathered from graywacke, chloritic schist, or shale. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam. In some areas the surface layer is clay loam or the subsoil is brown or strong brown.

Included in this unit are small areas of Bearwallow, Hellman, Hopland, Maymen, Montara, Shortyork, Squawrock, and Yorktree soils. Also included are small areas of Yorkville soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 25 percent of the total acreage.

Permeability of this Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping, and the risk increases if the soil is disturbed.

This unit is used mainly for livestock grazing and as recreation areas, watershed, and wildlife habitat. It is also used for homesite development.

The production of forage is limited by the susceptibility of the soil to compaction when moist. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Removal of the plant cover results in erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly soft chess, wild oat, and burclover.

This unit provides habitat for game birds and animals.

This unit is poorly suited to homesite development; however, population growth has resulted in increased construction of homes on the unit. The main limitations are the steepness of slope, very slow permeability, and susceptibility to slumping.

This map unit is in capability unit IVe-3 (15), irrigated and nonirrigated.

230—Yorkville loam, 30 to 50 percent slopes. This very deep, moderately well drained soil is on unstable side slopes of hills and mountains. It formed in material weathered from graywacke, chloritic schist, or shale. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam. In some areas the subsoil is brown and strong brown.

Included in this unit are small areas of Bearwallow, Hellman, Hopland, Maymen, Maxwell, Montara, Shortyork, Squawrock, and Yorktree soils. Also included are small areas of Yorkville soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 25 percent of the total acreage.

Permeability of this Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping, and the risk increases if the soil is disturbed.

This unit is used for livestock grazing and as recreation areas, watershed, and wildlife habitat.

The production of forage is limited by the susceptibility of the soil to compaction when moist. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding is steepness of slope. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing. Overgrazing results in erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly soft chess, wild oat, and burclover.

This map unit is in capability subclass VIe (15), nonirrigated.

231—Yorkville-Hopland loams, 30 to 50 percent slopes. This map unit is on spur ridges, ridgetops, and unstable side slopes of hills and mountains. The native vegetation is mainly grasses and oaks. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 35 percent Yorkville loam and 35 percent Hopland loam. The Yorkville soil is under grasses on unstable concave slopes, and the Hopland soil is under oaks on convex slopes, spur ridges, and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Cummiskey, Hellman, Montara, Squawrock, Witherell, and Yorktree soils. Included areas make up about 30 percent of the total acreage.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is yellowish red loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish red loam, and the lower 19 inches is yellowish red clay loam over loam. Soft sandstone and shale are at a depth of 31 inches. Depth to soft bedrock ranges from 20 to 40 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production and homesite development.

Production of forage on the Yorkville soil is limited by the susceptibility of the soil to compaction when moist. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing.

Livestock grazing should be managed to protect the unit from erosion. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on the Yorkville soil is mainly wild oat, soft chess, and burclover. Woody plants are the most extensive species on the Hopland soil.

California black oak, Oregon white oak, and blue oak are the main woodland species on the Hopland soil. This soil can produce about 35 cords of wood per acre from a stand of trees 50 years old. On the basis of a 50-year site curve, the mean site index for California black oak is 44. Among the trees of limited extent are Douglas fir and Pacific madrone.

The main limitations for the harvesting of firewood are the steepness of slope and the inherent instability of the Yorkville soil. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not available in areas of this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur on the Yorkville soil following soil disturbance.

After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May. Among the common forest understory plants are blue wildrye, melic, iris, and brackenfern.

This unit is poorly suited to homesite development. The main limitations are slope, restricted permeability, depth to rock in the Hopland soil, shrink-swell potential, and susceptibility of the Yorkville soil to slumping. Cuts needed to provide essentially level building sites can expose bedrock. Preserving the existing plant cover or revegetating disturbed areas around construction sites helps to control erosion. If the soils in this unit are used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. Buildings and roads should be designed to offset the high shrink-swell potential and the limited ability of the Yorkville soil to support a load.

This map unit is in capability subclass VIe (15), nonirrigated.

232—Yorkville-Squawrock-Witherell complex, 15 to 30 percent slopes. This map unit is on spur ridges, in drainageways, and on side slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 45 percent Yorkville loam, 20 percent Squawrock cobbly loam, and 15 percent Witherell sandy loam. The Yorkville soil is on unstable concave slopes; the Squawrock soil is on convex spur ridges, in areas surrounding rock outcroppings, and in drainageways; and the Witherell soil is on convex slopes and spur ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bearwallow, Cummiskey, Hellman, Hopland, Montara, and Yorktree soils. Also included are small areas of Yorkville, Squawrock, and Witherell soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 20 percent of the total acreage.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam. In some areas the surface layer is gravelly loam or clay loam.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping, and the risk increases if the soil is disturbed.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown sandy loam about 2 inches thick over yellowish brown sandy loam 5 inches thick. The subsoil is reddish yellow sandy loam 5 inches thick. Fractured sandstone is at a

depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is loam.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is moderate.

Most areas of this unit are used for livestock grazing and as recreation areas and wildlife habitat. A few areas are used for homesite development.

Production of forage is limited by the susceptibility of the soils to compaction when moist, the restricted available water capacity of the Squawrock and Witherell soils, and the shallow rooting depth of the Witherell soil. The Yorkville and Squawrock soils respond well to fertilization, to rangeland seeding, and to proper grazing use. The Witherell soil not suited to these practices because of the restricted available water capacity and shallow rooting depth. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly wild oat, soft chess, burclover, and filaree.

This unit is poorly suited to homesite development; however, population growth has resulted in increased construction of homes on the unit. The main limitations are slope; the very slow permeability, high shrink-swell potential, and low soil strength of the Yorkville soil; and the depth to bedrock in the Squawrock and Witherell soils. Buildings and roads should be designed to offset the high shrink-swell potential and limited ability of the Yorkville soil to support a load. Revegetating disturbed areas around construction sites helps to control erosion. The main limitations for septic tank absorption fields are the depth to the clay layer in the Yorkville soil and depth to bedrock in the Squawrock and Witherell soils. These restrictive layers limit the movement and filtration of effluent. Untreated effluent can move along the surface of these restrictive layers and seep in downslope areas, creating a hazard to health. If density of housing is moderate to high, community sewage systems may be needed.

This map unit is in capability unit IVe-3 (15), nonirrigated.

233—Yorkville-Squawrock-Witherell complex, 30 to 50 percent slopes. This map unit is on spur ridges, in drainageways, and on side slopes of hills and mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 55 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 40 percent Yorkville loam, 25 percent Squawrock cobbly loam, and 15 percent Witherell sandy loam. The Yorkville soil is on unstable concave slopes; the Squawrock soil is on convex slopes, on spur ridges, in areas surrounding rock outcroppings, and in drainageways; and the Witherell soil is on convex slopes and spur ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop and Bearwallow, Cummiskey, Hellman, Hopland, Montara, and Yorktree soils. Also included are small areas of Yorkville, Squawrock, and Witherell soils that have slopes of less than 30 percent or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The underlying material to a depth of 60 inches or more is gray gravelly clay loam. In some areas the surface layer is gravelly loam or clay loam or the soil is gravelly throughout the profile.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping, and the risk increases if the soil is disturbed.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Hard, fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Witherell soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is brown

sandy loam about 2 inches thick over yellowish brown sandy loam 5 inches thick. The subsoil is reddish yellow sandy loam 5 inches thick. Fractured sandstone is at a depth of 12 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Witherell soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for homesite development.

The production of forage is limited by the susceptibility of the soils in this unit to compaction when moist, restricted available water capacity of the Squawrock and Witherell soils, and the shallow rooting depth of the Witherell soil. The Yorkville and Squawrock soils respond well to fertilization, rangeland seeding, and proper grazing use. The Witherell soil is not suited to these practices because of the restricted available water capacity and shallow rooting depth. The main limitation for seeding is steepness of slope. Aerial application of seeds should be used. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote a more uniform distribution of livestock grazing. Livestock grazing should be managed to protect the soil from erosion. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly wild oat, soft chess, burclover, and filaree.

This unit is poorly suited to homesite development; however, population growth has resulted in increased construction of homes on the unit. The main limitations are slope; the very slow permeability, high shrink-swell potential, and low soil strength of the Yorkville soil; and the depth to bedrock in the Squawrock and Witherell soils. Buildings and roads should be designed to offset the high shrink-swell potential and limited ability of the Yorkville soil to support a load. Revegetating disturbed areas around construction sites helps to control erosion but does not reduce the risk of slumping near cuts and fills. The main limitations for septic tank absorption fields are the very slow permeability of the Yorkville soil and depth to bedrock in the Squawrock and Witherell soils. These limitations restrict the movement and filtration of the effluent. Untreated effluent can move along the surface of the restrictive layers and seep in downslope areas, creating a hazard of health. If density of housing is moderate to high, community sewage systems may be needed.

This map unit is in capability subclass VIe (15), nonirrigated.

234—Yorkville-Yorktree-Squawrock complex, 15 to 30 percent slopes. This map unit is on spur ridges, in drainageways, and on unstable side slopes of hills and mountains. The native vegetation is mainly annual grasses and oaks. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 45 percent Yorkville loam, 20 percent Yorktree loam, and 15 percent Squawrock cobbly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop, Casabonne and Sanhedrin soils under conifers on north-facing slopes, Bearwallow and Hellman soils under grasses, Hopland soils under oaks on spur ridges and ridgetops, Montara soils under chaparral, and Witherell soils under grasses on ridgetops. Also included are small areas of Yorkville, Yorktree, and Squawrock soils that have slopes of less than 15 percent or more than 30 percent and Updegraff soils north of Willits. Included areas make up about 20 percent of the total acreage.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is moderate. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping, and the risk increases if the soil is disturbed.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, shale, siltstone, or sandstone. Typically, the surface layer is brown loam over yellowish brown gravelly loam about 18 inches thick. The upper 6 inches of the subsoil is brown gravelly clay loam, and the lower 27 inches is brown clay over brown gravelly clay loam. Fractured graywacke is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Yorktree soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is moderate.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is moderate.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The production of forage is limited by the susceptibility of the soil in this unit to compaction when moist and the restricted available water capacity of the Squawrock soil. The Yorkville and Squawrock soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on the Yorkville and Squawrock soils is mainly wild oat, soft chess, filaree, and burclover. Woody plants are the most extensive species on the Yorktree soil. Among the common understory plants are melic, blue wildrye, and vetch.

Blue oak, Oregon white oak, and interior live oak are the main species on the Yorktree soil. Among the trees of limited extent are California laurel and Pacific madrone. The Yorktree soil can produce about 17 cords of wood per acre from a stand of trees 50 years old.

The main limitation for the harvesting of firewood are the inherent instability of the Yorkville soil and seasonal wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the roots of trees. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Roads may fail and landslides may occur following soil disturbance. Establishing plant cover on steep cuts and fills reduces erosion. Planting on the Squawrock soil is not practical because of the restricted available water capacity.

After cutting, hardwoods can regenerate by stump sprouting. Regrowth is best if cutting is done between December and May.

This map unit is in capability unit IVe-3 (15), nonirrigated.

235—Yorkville-Yorktree-Squawrock complex, 30 to 50 percent slopes. This map unit is on spur ridges, in drainageways, and on unstable side slopes of hills and mountains. The native vegetation is mainly annual grasses and oaks. Elevation is 500 to 3,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 150 to 250 days.

This unit is 45 percent Yorkville loam, 20 percent Yorktree loam, and 15 percent Squawrock cobbly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Rock outcrop, Casabonne and Sanhedrin soils under conifers on north-facing slopes, Bearwallow and Hellman soils under grasses, Hopland and Tyson soils under oaks on spur ridges and ridgetops, Montara soils that are under chaparral and are derived from serpentinite, and Witherell soils under grasses on ridgetops. Also included are small areas of Yorkville, Yorktree, and Squawrock soils that have slopes of less than 30 percent or more than 50 percent, Updegraff soils in areas north of Willits, and an area along Highway 101, near Cloverdale, that is mapped at an elevation of 390 feet. Included areas make up about 20 percent of the total acreage.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, chloritic schist, or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 14 inches of the subsoil is light brownish gray clay, and the lower 12 inches is gray clay loam. The substratum to a depth of 60 inches or more is gray gravelly clay loam.

Permeability of the Yorkville soil is very slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of erosion is high. This soil is saturated above the clay subsoil in winter. The soil is susceptible to slumping, and the risk increases if the soil is disturbed.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, shale, siltstone,

or sandstone. Typically, the surface layer is brown loam over yellowish brown gravelly loam about 18 inches thick. The upper 6 inches of the subsoil is brown gravelly clay loam, and the lower 27 inches is brown clay over brown gravelly clay loam. Fractured graywacke is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam.

Permeability of the Yorktree soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of erosion is high.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown cobbly loam about 7 inches thick. The upper 9 inches of the subsoil is yellowish brown extremely cobbly loam, and the lower 5 inches is very pale brown very gravelly loam. Fractured sandstone is at a depth of 21 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of erosion is high.

Most areas of this unit are used for livestock grazing and as recreation areas, watershed, and wildlife habitat. A few areas are used for firewood production.

The production of forage is limited by the susceptibility of the soil in this unit to compaction when moist, steepness of slope, and the restricted available water capacity of the Squawrock soil. Because of the instability of the Yorkville soil, trees and brush should be retained. The Yorkville and Squawrock soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding is steepness of slope. Aerial application of seed should be used. Livestock grazing should be managed to protect the unit from erosion. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on the Yorkville and Squawrock soils is mainly wild oat, soft chess, filaree, and burclover. Woody plants are the most extensive species on the Yorktree soil. Among the common understory plants are melic, blue wildrye, and vetch.

Blue oak, Oregon white oak, and interior live oak are the main tree species on the Yorktree soil. Among the trees of limited extent are California laurel and Pacific madrone. The Yorktree soil can produce about 17 cords of wood per acre from a stand of trees 50 years old.

Harvesting of firewood generally is not feasible on this unit because of the inherent instability of the Yorkville soil and seasonal wetness. Unsurfaced roads and skid trails are slippery when wet, and they may be impassable during rainy periods. Rock for construction of roads is not readily available in areas of this unit. Establishing plant cover on steep cuts and fills reduces erosion. Roads may fail and landslides may occur following soil disturbance.

This map unit is in capability subclass VIe (15), nonirrigated.

Prime Farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in this survey area are listed.

Prime farmland is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, seed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pastureland, or woodland, or they may be in other uses. They either are used for producing food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils commonly get an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and length of growing season are favorable, and level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope ranges mainly from 0 to 9 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 55,000 acres, or nearly 5 percent, of the survey area would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available. These soils are in the major valleys in the eastern part of Mendocino County.

The following map units meet the soil requirements for prime farmland. On all soils included in the list, measures should be used to overcome a hazard or limitation, such as flooding, wetness, or droughtiness. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use. See appendix A for the specific criteria used to determine prime farmland.

112	Clear Lake clay, 0 to 2 percent slopes (where irrigated and drained)
113	Cole loam, drained, 0 to 2 percent slopes (where irrigated)
114	Cole loam, drained, 2 to 5 percent slopes (where irrigated)
115	Cole clay loam, 0 to 2 percent slopes (where irrigated and drained)
123	Feliz loam, 0 to 2 percent slopes (where irrigated)

124 Feliz loam, 2 to 5 percent slopes (where irrigated)
125 Feliz clay loam, gravelly substratum, 0 to 2 percent slopes (where irrigated)
128 Gielow sandy loam, 0 to 5 percent slopes (where irrigated and drained)
175 Pinnobie loam, 0 to 2 percent slopes (where irrigated)
177 Pinole gravelly loam, 0 to 2 percent slopes (where irrigated)
178 Pinole gravelly loam, 2 to 8 percent slopes (where irrigated)
181 Pinole very gravelly loam, 0 to 2 percent slopes (where irrigated)
184 Redvine sandy clay loam, 2 to 8 percent slopes (where irrigated)
188 Russian loam, 0 to 2 percent slopes (where irrigated)
189 Russian loam, flooded, 0 to 2 percent slopes (where irrigated and protected from flooding)
190 Russian loam, gravelly substratum, 0 to 2 percent slopes (where irrigated)

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

By Bryan D. Furman, soil conservationist; Dennis Moore, agronomist; and Roy Bowman, soil scientist; Soil Conservation Service.

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification and the land resource area designations used by the Soil Conservation Service are explained; the estimated yields of the main crops and hay and pasture plants commonly grown are listed for each soil; and the Storie index rating used by the Agricultural Experiment Station is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 90,000 acres, or 8 percent, of the survey area consists of soils on bottom land and terraces. Of this, 45 percent, or about 40,000 acres, is used mainly for crops such as varietal wine grapes, pears, alfalfa, hay, and pasture (fig. 3). Apples, walnuts, peaches, cherries, plums, berries, and wild rice and other field crops are also grown *(12)*.

The cropland is mainly in river valleys and along tributaries of the Russian and Eel Rivers, although varietal grapes are grown on about 500 acres on hillsides that have slopes of 15 to 60 percent. Some hay and pasture are grown in small valleys in Trinity County.

The climate in the survey area has a strong influence on the crops that can be grown. The frosts late in spring in the northern part of the survey area make it difficult to produce grapes and pears. The main crops grown in Little Lake Valley, Round Valley, and the Laytonville area of the Eel River system, in the northern half of the survey area, are hay and pasture, but some pears and walnuts are also grown. All crops are suited to the major producing valleys along the Russian River drainageways, in the southern part of the survey area; these valleys extend from Redwood Valley and Potter Valley south to Hopland, where the growing season is longer.

Irrigation is required in summer to achieve maximum production of most crops. Redwood Valley and Potter Valley have community water systems. Other areas

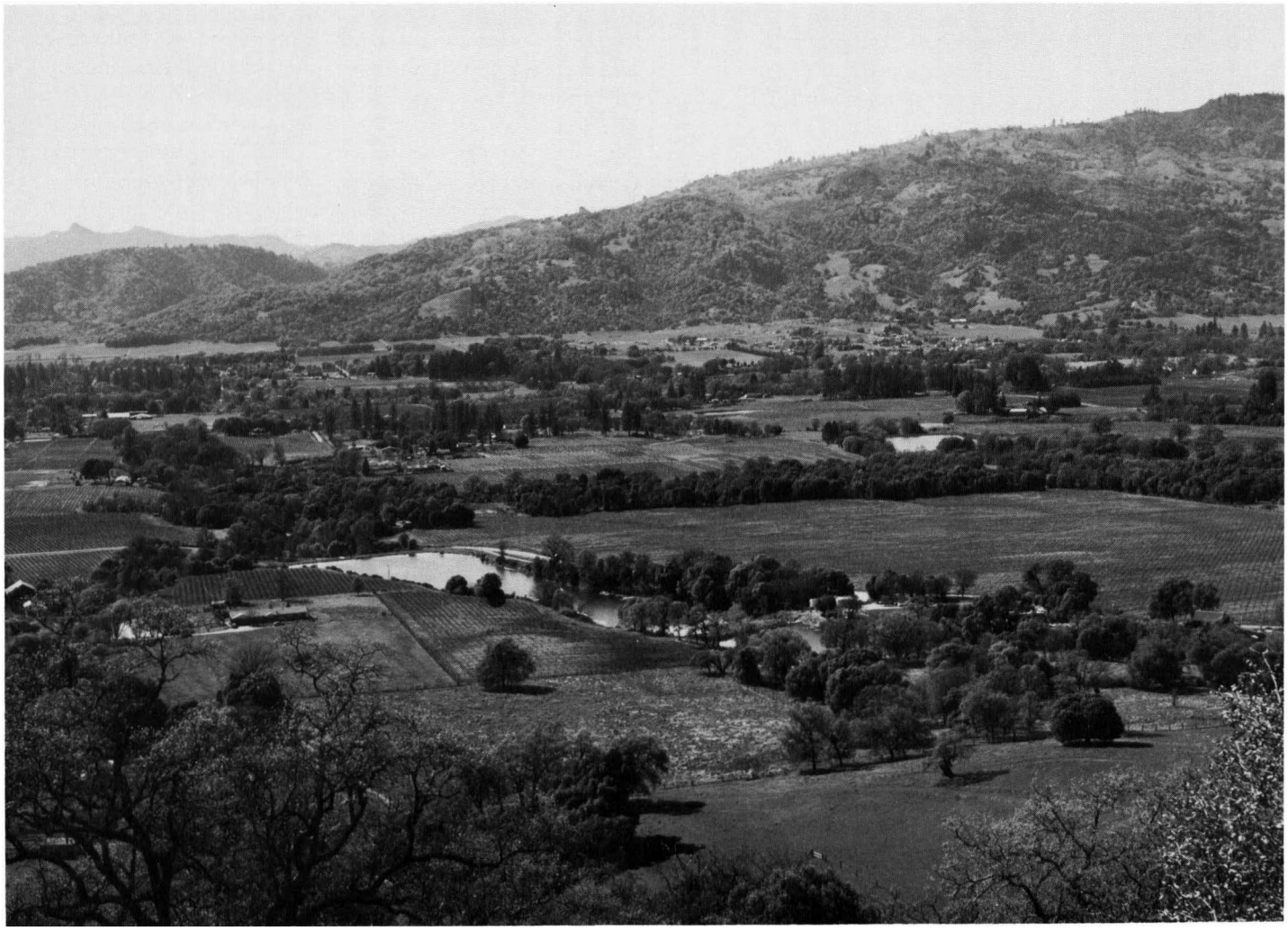

Figure 3.—Vineyards and pastures on Pinole, Redvine, and Yokayo soils in Redwood Valley.

obtain water from wells or streams. Irrigation methods used in the eastern part of Mendocino County are sprinkler and trickle systems for fruit and nuts, sprinkler systems for pastures, and border systems for field crops and some pastures in Potter Valley.

Protection from frost is needed for most vineyards and pear orchards in spring. Although several methods are used to achieve this, the overhead sprinkler method is the main one used. The sprayed water encases young buds in ice and prevents fruit from freezing. Such a frost protection system requires the entire acreage to be sprayed at one time, and it requires use of 50 gallons of water per acre per minute. This large volume of water usually is stored in local reservoirs that are filled by runoff water. Winter runoff to most farms stops in spring or early in summer, after which growers rely on wells and streams for irrigation; they use the same sprinkler system for irrigation or, alternately, a trickle system.

The soils in the survey area have many characteristics that affect their behavior and the type of management practices needed for various uses. Awareness of these characteristics and application of the best management practices for each soil will improve or help to sustain productivity.

The hazard of erosion is a matter of great concern on the more steeply sloping soils in the area. Among the practices that are used to control erosion are conservation tillage; growing cover crops; management and treatment of critical areas such as road cuts and

fills, pond embankments, and stream corridors; irrigation water management; and storm runoff management.

Mendocino County produces grapes that are considered to be premium wine grapes, and they command some of the best prices in the industry. The acreage planted to wine grapes in the survey area is about 11,000 acres and has been steadily increasing. Most of the soils on the terraces and alluvial bottom land are suited to grapes. These are the Cole, Feliz, Gielow, Pinnobie, Pinole, Redvine, and Russian soils.

Cover crops, irrigation water management, protection from frost, and surface runoff management systems commonly are necessary where vineyards are in level to gently sloping areas. Subsurface drains are necessary in some areas of the Cole, Feliz, Gielow, Redvine, and Russian soils. These soils are also susceptible to compaction if equipment is used or livestock is grazed on the soils when they are moist.

Cover crops and surface runoff control systems such as terraces, underground outlets, and grassed waterways commonly are needed on vineyards in gently sloping areas on bottom land and steeper hillsides to prevent rill, sheet, and gully erosion and landslides. Trickle irrigation systems commonly are used to start the vines, and they may or may not be continued depending on grape variety, soil, and aspect. Frost protection systems generally are not necessary in vineyards on hillsides.

Annual and perennial cover crops can be grown in irrigated vineyards. Annual winter cover crops are seeded before October 15. Growth occurs in fall and winter, which protects vineyards from sheet and rill erosion. In spring, prior to April 1, the cover crop can be mowed only to a height of 3 inches or more to reduce possible frost damage to the crop. After the seed has matured, mowing can be performed to any height. The seed from the cuttings will then be available the following fall to start the annual growth cycle again. If properly managed, annual cover crops will reseed each year.

Perennial cover crops grown in irrigated vineyards provide erosion control the same as do annual crops, but they differ in other characteristics important to the manager. Perennial crops are mowed in spring to reduce the risk of frost damage and are mowed in summer and throughout the growing season as necessary. Perennial cover crops can compete for available moisture; however, they may help to dry out wet soils, although they are not a substitute for drainage systems.

With about 3,300 acres in pears, Mendocino County is the third largest producer in California, following Lake and Sacramento Counties. Pear scabbing is a problem that sometimes has resulted in an increased tonnage of pears going from the fresh market to the lower priced canning market.

The deep soils of the terraces and alluvial bottoms are well suited to pears. These soils are those of the Cole, Feliz, Gielow, Pinnobie, Pinole, Redvine, and Russian series. The Clear Lake and Maxwell soils in these areas are too high in content of clay. The Talmage soils and Xerofluvents have restricted available water capacity, and the Yokayo soils have an abrupt textural change to clay. These limitations result in lower yields.

Cover crops, irrigation, frost protection, and surface runoff control systems generally are used in level to gently sloping areas used for orchards. The Cole, Feliz, Gielow, Redvine, and Russian soils are susceptible to compaction if equipment is used when the soils are wet. Because many of the spray operations require early access, and thus compact the soil, subsoiling may be needed every 4 to 6 years to improve the infiltration rate.

Proper management is needed on irrigated pastures to prevent soil compaction, provide maximum production, maintain a desirable plant community, and extend the life of the pasture. Practices necessary in a pasture management program include irrigation water management, rotation grazing, fertilization, harrowing or dragging to scatter droppings, and clipping as necessary to maintain uniform growth. Grazing should begin when plants are 8 to 10 inches high and terminate when 3 to 4 inches of stubble remain.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors and in management.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. If little or no information was available for a particular soil, or if the specified crop was not grown on the soil, yield estimates were made by comparison with similar soils.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of

weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

In table 4, yields given for wine grapes are an average of those for high- and moderate-producing red and white varietal grapes. High-producing white grapes yield about 0.6 ton more than average; moderate-producing white grapes yield about 0.2 ton less. High-producing red grapes yield about 0.2 ton more than average; moderate-producing red grapes produce about 0.6 ton less.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(55)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. The numbers used to designate units within the subclasses are as follows:

0. Indicates limitations caused by stony, cobbly, or gravelly material in the substratum.
1. Indicates limitations caused by slope or by an

actual or potential erosion hazard.

2. Indicates a limitation of wetness caused by poor drainage or flooding.

3. Indicates a limitation of slow or very slow permeability of the subsoil or substratum is caused by a clayey subsoil or by a substratum that is semiconsolidated.

4. Indicates a low available water capacity in sandy or gravelly soils.

5. Indicates limitations caused by a fine-textured or very fine-textured surface layer.

6. Indicates limitations caused by salts or sodium.

7. Indicates limitations caused by rocks, stones, or cobblestones.

8. Indicates that the soil has a very low or low available water capacity because the root zone generally is less than 40 inches deep over massive bedrock.

9. Indicates that a problem or limitation is caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer, lime, or other amendments.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Land Resource Areas

Capability classification is further refined by designating the land resource area in which the soils in a unit occur. A land resource area is a broad geographic area that has a distinct combination of climate, topography, vegetation, land use, and general type of farming *(58)*. Parts of four of these nationally designated areas are in the survey area. These areas and their numbers are: California Coastal Redwood belt (4); Siskiyou-Trinity Area (5); Central California Coastal Valleys (14); and Central California Coast Range (15). The number of the resource area is given in parenthesis after the capability classification in the detailed soil map unit descriptions.

A soil in one resource area may have characteristics similar to those of a soil in another resource area and have the same capability symbol, but the climate, vegetation, crops that are suited, and management practices needed may differ. For example, both capability subclasses VIe (4) and VIe (5) include deep, well drained soils. The soils in capability subclass VIe (4) are suited to growing redwood trees, but those in capability subclass VIe (5) are not.

Land resource area 4.—This resource area includes areas that drain westward directly toward the Pacific Ocean and areas where fog comes in through low gaps in the mountains. Natural vegetation is mainly redwood, Douglas fir, and tanoak. Elevation ranges from 400 to 2,500 feet. The average annual precipitation ranges from 50 to 70 inches. The average annual air temperature is about 53 degrees F, and the average frost-free season is 220 to 270 days.

Most of the soils in this resource area are used for timber production. Small open areas are used as rangeland and as sites for a few homes. Abundant rainfall in winter, many perennial streams, and condensation from coastal fog in summer provide enough water for most year-round uses.

Land resource area 5.—This resource area is in the northern part of the survey area and along the western edge. It is farther inland than land resource area 4 and thus is not influenced by fog. It is mainly in rolling to very steep areas on mountains. The natural vegetation is Douglas fir, ponderosa pine, tanoak, madrone, and California black oak. Elevation ranges from 500 to 5,922 feet. The average annual precipitation ranges from 35 to 65 inches. The average annual air temperature is about 54 degrees F, and the average frost-free season ranges from 125 to 250 days.

Most of this resource area is used for timber production. Open areas are used as rangeland. Most of the rainfall occurs in winter. Summers are hot and dry. There are few perennial streams.

Land resource area 14.—This resource area includes the valleys of the survey area. It comprises Sanel, Ukiah, Redwood, Potter, Little Lake, Round, and Laytonville Valleys. It is dominantly in nearly level to gently rolling areas on bottom land and river terraces. Most of this area is cultivated or has been developed for urban uses. Elevation ranges from about 350 to 1,800 feet. The average annual precipitation ranges from 32 to 55 inches. The average annual air temperature is about 57 degrees F, and the average frost-free season ranges from 150 to 250 days.

This resource area is used for vineyards, orchards, pasture, and hay. Little Lake, Round, and Laytonville Valleys are used mainly for pasture and hay. Most of the rainfall in this resource area falls in winter. Summers are hot and dry, and irrigation is needed for most crops. Redwood and Potter Valleys have community irrigation systems. Other areas obtain water for irrigation from wells or streams.

Land resource area 15.—This resource area includes the hills and mountains of the eastern and southern parts of the survey area. The soils in this area are dominantly rolling to steep. The natural vegetation is annual grasses, live oak, blue oak, Oregon white oak, and madrone. Elevation ranges from 500 to 4,000 feet. The average annual precipitation ranges from 35 to 60

inches, the average annual air temperature is about 56 degrees F, and the average frost-free season ranges from 125 to 250 days.

Most of this resource area is used as rangeland. Wooded areas are used for firewood production. Most of the rainfall occurs in winter. Summers are hot and dry. There are few perennial streams.

Storie Index Rating

By Gordon L. Huntington, lecturer and soil specialist, Department of Land, Air, and Water Resources, University of California, Davis.

The soils in the survey area are rated in table 5 according to the Storie index *(50)*. This index expresses numerically the relative degree of suitability of a soil for general intensive agricultural use as it exists at the time of evaluation. The rating is based on soil characteristics only and is obtained by evaluating factors such as soil depth, surface soil texture, subsoil characteristics, and surface relief. Other factors, such as availability of water for irrigation, local climate, size and accessibility of mapped areas, and distance to markets, that might determine the desirability of growing certain plants in a given locality are not considered. Therefore, in itself, the index should not be used as a direct indicator of land value. However, where the local economic and geographic factors are known to the user, the Storie index provides additional objective information for land tract value comparisons.

Four general factors are used in determining the index rating—*A*, the permeability, water retention capability, and depth of the soil profile; *B*, the texture of the surface soil; *C*, the dominant slope of the soil body; and *X*, other conditions more readily subject to management or modification by the land user. In this survey area the X factor conditions include drainage, flooding, microrelief, and fertility of the soil. For some soils more than one of the X factor conditions are used in rating. All of the factors are evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable, or ideal, condition for general crop production. Lower percentage ratings are assigned for less favorable conditions or characteristics. Factor ratings, in percentages, are selected from tables prepared from data and observations that relate soil properties to plant growth and crop yield *(49)*. In the tables currently used *(50)*, certain soil properties are allowed ranges of percentage values to conform with variations of the properties in relation to their effect on the suitability of the soil for general agricultural purposes; for example, soil depth or proportion of gravel present in a gravelly loam surface soil. When a range of values exists, the modal condition of a soil property, as it is described in a soil map unit, is used to select a value for a factor.

The index rating for a soil is obtained by multiplying the percentage rating values given to its four factors, A, B, C, and X. If more than one condition is recognized for the X factor for a soil, the value for each condition acts as an additional multiplier. Thus, any of the general factors or X factor conditions may dominate or control the final rating. For example, consider a soil such as Russian loam, flooded, 0 to 2 percent slopes. This is a deep, permeable soil that has no serious restriction with respect to root or water movement and has a high available water capacity. This warrants a rating of 100 for factor A. It has a loam surface layer that is easily workable for seedbed preparation, has a favorable water intake rate, and does not require frequent applications of water to maintain a favorable moisture status for plants. This warrants a rating of 100 for factor B. The soil is nearly level, which warrants a rating of 100 for factor C. However, the soil is subject to flooding in winter and spring. This limits the flexibility of use of the soil and restricts the kind of crops that can be grown. This warrants a value of 60 for the X factor. Multiplying the percentage values for the A, B, C, and X factors gives a Storie index of 60 for this soil. If, in time, the flooding can be controlled in part or entirely, the Storie index can be increased by assigning appropriate higher values to the X factor to reflect the changed conditions. For example, the Storie index for areas of Russian loam, 0 to 2 percent slopes, that are not subject to flooding is 100.

Soil complexes or associations in the survey area, such as Dingman-Beaughton complex, 5 to 50 percent slopes, or Etsel-Rock outcrop-Neuns association, 30 to 75 percent slopes, are rated to reflect the proportion of the dominant soils described in the map units. Each of the dominant soils in such complexes is rated separately and the values shown in table 5. The Storie index value rating for each unit is a weighted average for the separate ratings. Miscellaneous area map units, such as Pits and Dumps, Rock outcrop, and Urban land, are not evaluated in terms of factors A, B, C, or X. They have features that preclude common agricultural use; therefore, they have an index rating of zero. In addition, land areas in this survey area to which access was denied cannot be rated.

Soils are placed in grades according to their suitability for general intensive agriculture as shown by their Storie index ratings. The six grades and their range in index ratings are:

Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

In this area, soils in *grade 1* are well suited to intensive use for irrigated crops that are climatically adapted to the region. *Grade 2* soils are good agricultural soils, although they are not so desirable as soils in grade 1 because of moderately fine or gravelly surface textures, a somewhat less permeable subsoil, gentle to moderate slopes, restricted drainage, or a slight to moderate hazard of flooding. *Grade 3* soils are only fairly well suited to general agriculture and are limited in their use because of moderate to steep slopes, moderate soil depth, a less permeable subsoil, moderately fine or gravelly surface textures, poor drainage, hummocky microrelief, or fair to poor soil fertility. *Grade 4* soils are poorly suited. They are severely limited in their agricultural potential because of limitations such as shallower depth, steeper slopes, or more clayey, gravelly, or stony surface textures than for soils in grade 3. *Grade 5* soils are very poorly suited to agriculture and are seldom cultivated. They are more commonly used as rangeland, pastureland, or woodland. *Grade 6* consists of soils and miscellaneous areas that are not suited to agriculture at all because of very severe to extreme limitations with regard to the aforementioned properties. They are better suited to limited use as rangeland, woodland, or watershed. Table 5 lists the grade for each soil in this area.

Rangeland

By Walter K. Cheechov, range conservationist, Soil Conservation Service.

About 37 percent of the survey area is rangeland. Soils that support grassland or oak-grass plant communities suitable for livestock grazing occupy about 250,000 acres, or 22 percent, of the survey area. Soils that support woody shrubs occupy about 165,000 acres, or 15 percent, of the survey area.

Beef cattle and sheep operations are the major users of rangeland. Beef producers conduct both cow-calf and stocker operations throughout the survey area. Cow-calf operators use the rangeland late in winter and in spring, and the rest of the year they provide supplemental hay or irrigated pasture, or both. Stocker operators generally buy young cattle in December and January, use the rangeland forage during the green-feed period, and then sell the heavier cattle in May or June. Sheep operators use the rangeland during the green-feed period, from November to June, following lambing.

Rangeland in the survey area mainly supports annual grasses, clover, and forbs that commonly are interspersed with brush or trees. Annual plants grow from seed each year; they germinate after the rains late in fall and early in winter and grow slowly through the winter. When the weather warms in spring, they grow rapidly and produce seed for the next year's crop. The plants die in May and June, after the seed has set and the soil moisture has been depleted. The characteristic and desirable plant species are soft chess, wild oat, filaree, ripgut brome, and annual clover.

Perennial grass-covered rangeland is relatively uncommon except in the northern part of the survey area, where the climate is more favorable. Perennials such as California oatgrass, Idaho fescue, red fescue, and purple needlegrass are common in undisturbed areas. Some perennials such as blue wildrye, purple needlegrass, and melic grow throughout the survey area, but they most commonly grow in undisturbed areas and under a tree canopy.

Perennial grasses, instead of dying each year, go dormant after the soil moisture has been depleted. During the dormant period, energy is stored in the root system. The plant may be dry above the surface, but it is alive at and below the surface.

Grass-covered rangeland commonly supports a significant amount of legumes, such as clover, and forbs, such as filaree, that are superior forage because of their protein content and that remain in the stand well into the grazing season. Unlike grasses, legumes and forbs do not provide residual mulch that helps to protect the soil from erosion; therefore, management that ensures a mixed stand of grasses, legumes, and forbs provides a balance between plants that provide desirable forage and erosion control.

Forage production is closely tied to the characteristics of the growing season. The growing season varies within the survey area because of differences in local climate, slope, aspect, and elevation. Annual production of forage is related to the amount and distribution of precipitation received during the growing season and the available water capacity of the soil.

Because the desirable plants are selected first by livestock, plants that have little if any value as forage increase on rangeland that is grazed too heavily. The desirable plants often are not allowed to set seed for the next year's crop. At the same time, less desirable plants are permitted to set seed and thus increase. They may eventually dominate the rangeland.

Grassland under good grazing management retains

its productivity and has few negative offsite impacts. Land not managed properly continues to deteriorate until restoration of productivity is difficult.

Soils in the brush-covered areas commonly are shallow and droughty. The vegetation in these areas is dominated by large, unbroken stands of woody shrubs that commonly are impenetrable by man, livestock, and many species of wildlife. Some trees grow as scattered individuals or in small continuous areas of woodland, mainly along waterways and on north- and east-facing slopes. These areas are used primarily as wildlife habitat, watershed, and recreation areas.

Brush-covered areas should be managed to create different successional growth stages in vegetation. Some benefits of managing these areas include fire protection, wildlife habitat improvement, erosion control, water quality improvement, increased water yield, and, in some areas, increased forage production.

Wildfire is a common natural occurrence. Its frequency, however, can be reduced or increased by activities of man. Often, the suppression of fire from brush-covered areas for long periods of time results in areas of tall, overgrown brush and an abundance of old dead plant material. When these areas do burn, the fire is extremely hot; if it is not checked, it can spread into adjacent areas of valuable forest land, rangeland, or urban land. Very hot fires can have a detrimental effect on the physical and chemical properties of the surface soil. They usually consume all vegetation and litter so that the soil surface is left unprotected from erosion by wind and water. Accelerated soil erosion can then result in a loss of productivity and a decrease in offsite water quality as a result of sedimentation. Frequent fires over extensive areas can have similar detrimental effects.

Large areas covered by overage brush are subject to a higher rate of erosion and more surface runoff. They have lower potential for use as wildlife habitat and recreation. Some brush species produce growth inhibitors that discourage the growth of other plants. Thus, when brush grows tall, the ground cover underneath is sparse, exposing essentially bare soil to the impact of water as it falls from the tall brush. Overage brush commonly is out of reach of browsing wildlife and is difficult to travel through, thus reducing availability of wildlife habitat and suitability as recreation areas.

Suitable management of brush-covered areas includes prescribed burning, mechanical crushing, constructing firebreaks and fuelbreaks, developing wildlife watering facilities, and reseeding in selected areas to either reduce erosion during resprouting or to convert to other vegetation types. Where the soils have the potential to be used as grassland or woodland, conversion may be desirable; however, soils, such as those in the Maymen, Etsel, and Snook series, under a natural cover of brush lack the required physical properties to support sustained production of grasses or trees.

Through the implementation of plant management, a mosaic of uneven-aged brush stands can be created. This can reduce the negative effects of wildfire on the survey area's natural resources, increase the amount and diversity of wildlife habitat, and increase the esthetic and recreational value of brushland.

Brush-covered areas in the survey area are mainly in two general soil map units. These units are discussed in the paragraphs that follow.

The most extensive group of brush-covered soils is that in general soil map unit 7. The soils of the Maymen, Etsel, and Snook series are the main soils in this unit. These soils commonly are very shallow to shallow, well drained to somewhat excessively drained, and medium textured. They formed in material weathered from sandstone or shale. The most common brush species on the soils are chamise, manzanita, buckbrush, scrub oak, and Lemmon ceanothus. Grasses such as red brome, foxtail fescue, and bottlebrush squirreltail commonly grow in the understory. Type conversion to grassland has been successful where the Maymen soils occur in small areas and in firebreaks and fuelbreaks. Careful management of the planted species is required, however, because the available water capacity of the soil is limited.

The second group of brush-covered soils is that in general soil map unit 8. The soils of the Dingman, Beaughton, and Henneke series are the main soils in this group. These soils commonly are shallow to moderately deep, well drained, medium textured and fine textured, and formed in material weathered from serpentinitic rock. The common brush species are manzanita, chamise, buckbrush, and scrub oak. Scattered Digger pine and MacNab cypress are also present. These soils are less productive than those that formed in material derived from sandstone and shale because of an imbalance in the ratio of calcium to magnesium induced by the serpentinitic parent material. For this reason, the existing vegetation commonly is stunted and scattered and type conversion to grassland is not practical. Brush management should only be applied to decadent stands of brush to control wildfire.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of

soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, gravel content, and a seasonal water table are also important.

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

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

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

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present plant species composition.

The objective in range management is to control grazing so that the plants growing on a site produce palatable and nutritious forage and so that sufficient plant residue is provided to protect the soil from erosion. Such management generally results in the optimal production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a plant community somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Woodland Management and Productivity

By Donald L. Berry, forester, Soil Conservation Service.

About 52 percent of the survey area, or 574,000 acres, consists of soils that support conifer and hardwood forests. Of this, about 400,000 acres is considered to have potential as commercial woodland. The jobs provided by the wood products industry are of prime importance to the area. Softwood and hardwood lumber, wood chips, hardboard products, and firewood produced from local forests are the major commodities exported from the county. Locally produced redwood siding, outdoor furniture, and other lumber products are marketed throughout the United States.

The information presented in this section, along with that presented in the section "Detailed Soil Map Units," is intended only as a general guide. It will help professional resource managers, landowners, and visitors to the survey area understand the characteristics and proper management of the forested soils in the area. Onsite investigation by resource professionals is needed to obtain site-specific data.

Tables 7 and 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suited to wood crops are listed. Table 7 lists the *ordination symbol* for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The ordination system is a uniform system of labeling individual soils or groups of soils to determine their potential productivity and the main soil properties that influence their use and management as woodland. The ordination system has two levels, class and subclass. The class and subclass symbols are called *ordination symbols*.

The first element in the ordination symbol is the class. It is a number that denotes potential productivity

in cubic meters of wood per hectare per year for an indicator tree species (1 cubic meter per hectare equals 14.3 cubic feet per acre). Potential productivity is based on site index. The growth in cubic meters is calculated at the age of culmination of mean annual increment for fully stocked natural stands (unmanaged except for protection) as given in standard normal yield tables. The species that determines the ordination class is listed next to the symbol in table 7. It is a species that is common in the area and generally is the most productive on the soil. Potential productivity values are based on yield tables for Douglas fir *(35)*, ponderosa pine *(36)*, and redwood *(34)*. Yield is the wood produced in the boles of the trees to the smallest top diameter given in the tables.

The second element in the ordination symbol is the subclass. It is a capital letter that denotes certain soil or physiographic characteristics that contribute to important hazards or limitations in management. The subclasses used in the survey area are discussed in the following paragraphs.

Subclass A. Soils that have no limitations or only slight limitations for forest land use or management.

Subclass C. Soils that have limitations for forest land use or management because of the kind or amount of clay in the upper part of the soil profile.

Subclass D. Soils that have limitations for forest land use or management because of the restricted rooting depth; for example, shallow soils that are underlain by bedrock, a hardpan, or other layers that restrict roots.

Subclass F. Soils that have limitations for forest land use or management because of a high content of rock fragments in the soil profile. Rock fragments are more than 2 millimeters in diameter and less than 10 inches.

Subclass R. Soils that have limitations for forest land use or management because of steepness of slope.

If moderate or severe limitations exist, subclasses are designated according to the definitions listed above. If a soil has more than one limitation, the priority is as follows: R, D, C, and F. If slight limitations are present, the letter "A" is used. For example, 8A means that potential productivity is 8 cubic meters per hectare per year and that there are slight or no soil related limitations. If moderate or severe limitations are present, the subclasses are designated as D, C, F, or R. For example, 7R means that potential productivity is 7 cubic meters per hectare per year and that there are moderate or severe limitations because of the steepness of slope. Plant competition and other special considerations are not used to determine subclass.

The *potential productivity* of merchantable or *commonly grown trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *site index* (average) and *site index range* are listed for each soil in the map unit where adequate data were available. The site indexes for redwood, Douglas fir, and ponderosa pine are from 100-year base age curves *(34, 35, 36)*. Procedures for converting to the 50-year base age curves *(29)* for Douglas fir have been described by Krumland and Wensel *(31)*. White fir site indexes are from the 50-year base age curves by Schumacher *(47)*.

Estimates of the potential productivity for each soil, in board feet per acre per year (Scribner rule) at the culmination of the mean annual increment (CMAI), are given in the detailed soil map unit descriptions. Volumes are given for ponderosa pine *(36)*, for Douglas fir *(35)*, and for redwood *(34)*; fully stocked, unmanaged stands were assumed. Wind can reduce productivity well below estimates for the soil on exposed ridges. Open areas, such as those caused by the presence of rock outcroppings at high elevations, also reduce productivity of soils.

The potential productivity of soils that commonly produce hardwoods is difficult to estimate. Site indexes for soils that support California black oak are from the curves by Powers *(45)*. Hardwood yield estimates are based on local plot measurements and on volume tables by Pillsbury and Stephens *(43)*.

In tables 7 and 8, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Seedling mortality ratings given in table 7 indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition, which may be a significant factor, is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that no problem is expected under normal conditions; *moderate*, that extra precautions are advisable; and *severe*, that precautions are important and that replanting may be necessary.

Trees to plant are those that are suited to the soils and to commercial wood production. Adapted species are named in the detailed soil map unit descriptions. Natural reseeding by conifers is sometimes adequate. Where mineral soil material is exposed during years of

favorable seed production, good regeneration can be expected on all but very gravelly, shallow, or serpentinitic soils. Most of the hardwood species resprout after cutting. Resprouting is best when cutting is done during December through May.

Soil properties that commonly influence seedling mortality include texture, content of rock fragments, temperature, and drainage. Soils that have available water capacity of less than 2.5 inches in the upper 24 inches of the profile are severely limited for planting of seedlings, especially on south-facing slopes below an elevation of 5,000 feet. Restricted available water capacity is less critical at the higher elevations, where the potential use of water by plants is less. Soils at low elevations where the mean annual temperatures are relatively warm can present major problems for survival of seedlings. Soil temperature at a depth of 20 inches commonly is 20 degrees F higher in open areas than in areas under a tree canopy. Surface layer temperature may also be high enough in summer to injure Douglas fir seedlings on south-facing slopes. Species selection, type of planting stock, availability of shade, type of harvest, and available water capacity of the soil need to be considered when reforesting soils in this survey area.

Ratings of *plant competition* given in table 7 indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate*, that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and *severe*, that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants. The species of competing plants and severity of competition vary depending on the kind of soil and past treatment of the site.

Plant competition is related to the available water capacity of the soils. Productive soils have high available water capacity, and plant competition on these soils generally is severe. Perennial and annual grasses, forbs, manzanita, madrone, and black oak can dominate a site for several years after timber is harvested. Conifer seedlings often are slow to regenerate, and their growth can be suppressed by other vegetation because of the competition for moisture and light. Careful selection of the silvicultural and harvesting systems, intensive site preparation, and follow-up treatments may be needed to ensure adequate reforestation. Less productive soils have lower available water capacity, and plant competition on them generally is less intense. In some areas of these soils, unwanted plants have had enough time to establish extensive root systems; however, tree growth is slower and the seedling mortality rate may be high because of the high temperatures and lack of sufficient soil moisture.

Ratings of *limitation for revegetating exposed subsoil* given in table 7 indicate the degree in which the exposed subsoil affects revegetation. Subsoil layers commonly are exposed during forest management activities. This occurs on road cuts and fills and on some skid roads. Revegetation may be desirable for erosion control or for timber production. Separate ratings are given for revegetation with either grasses or trees. Characteristics of the subsoil that influence planting conditions, germination, and subsequent growth rate are considered in the ratings. These are general ratings; they do not preclude the need for onsite investigation of individual projects.

A rating of *slight* indicates that there are few problems with revegetation. If locally adapted grasses are properly seeded, a good stand can be expected to reduce erosion. If trees are planted, good survival and growth can be expected unless compaction or other locally unfavorable conditions prevail. Natural vegetation will grow better in the subsoil material of these soils than in those that have moderate or severe ratings. *Moderate* indicates that additional care is needed in choosing methods or types of plants for erosion control. If trees are planted, some mortality and growth rates below those in undisturbed areas, can be expected. *Severe* indicates that intensive, and expensive, measures would be needed to establish plants to control erosion. Some soils that have a severe rating have little need for erosion control plantings because exposed areas have large amounts of hard rock with only a small amount of erodible soil material. Planting of trees would be very difficult, survival would be low, or growth rates would be very slow or much below those in undisturbed areas. Onsite evaluation is essential when considering revegetation of severely limited sites.

Ratings of *equipment limitations* given in table 8 reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and

severe indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Soil wetness has an influence on the type of equipment that is used and on time of use. Soils usually are too wet for use of ground yarding systems between November 15 and April 1. Soil compaction by wheeled or tracked equipment can be a problem on all soils when they are moist, except for sandy or very gravelly soils. The *State Forest Practice Act* prohibits timber harvesting, except by cable yarding, when the ground is excessively wet. Roads frequently are impassable during the rainy season, except where they have been rocked or where they are in areas of very gravelly or sandy soils. Depth of snowpack limits access and equipment use at elevations of more than 4,500 feet from December 15 through April 15. Some soils, such as those of the Kekawaka, Zeni, Ornbaun, and Gudgrey series, are dusty when dry. Watering, oiling, or other road surface treatments may be desirable on these soils during periods of heavy use.

Steepness of slope is an important consideration when selecting harvesting equipment or harvesting systems. Slope gradients of less than 30 percent present few limitations to wheeled and tracked equipment. Where slopes are 30 to 50 percent, more care is needed in choosing equipment suited to the site. Cable yarding systems generally cause the least soil disturbance in areas where the terrain and road systems are suitable for their use; however, where existing skid and haul roads can be used or where short, steep slopes are intermingled with level areas, tractor yarding equipment can sometimes be used with minimal soil disturbance. Low-ground-pressure, torsion-suspension equipment causes less soil disturbance and compaction on steeper slopes than does conventional tractor equipment *(1, 21)*. Large areas in which slope is more than 50 percent generally are subject to less soil disturbance when cable yarded than when tractor yarded.

Ratings of the *hazard of soil damage from fire* given in table 8 are intended to be used as a general guideline when planning either prescribed burning or revegetation after wildfire. Soil damage can sometimes result from burning; the risk of damage increases with the intensity of heat. The damage is mainly related to the loss of organic matter *(59)*. Some soils have characteristics that enable them to withstand this loss better than other soils. These characteristics are used to rate the soils for their susceptibility to damage from fire. A rating of *slight* indicates that most types of fire will not have an adverse effect on soil characteristics and productivity; *moderate*, that some extra care is needed in planning to maintain favorable soil characteristics; and *severe*, that special attention is needed to maintain the organic matter content of the soil in order to maintain productivity.

Ratings of the *hazard of soil damage from compaction* given in table 8 indicate the tendency of a soil to be adversely affected by the weight of equipment or other traffic. Soil density is increased after compaction. This can affect productivity by increasing resistance to root penetration and reducing the availability of oxygen to plant roots. It may also reduce permeability and the water infiltration rate. Ratings are based on the texture, organic matter content, and rock fragment content of the upper 10 inches of the soil. A rating of *slight* indicates that considerable effort would be required to compact the soil enough to adversely affect plant growth or the water infiltration rate; *moderate*, that less effort is required to cause compaction or that the soil is easily compacted but also recovers rapidly because of the type and amount of clay; and *severe*, that the soil is compacted easily enough to cause adverse effects and that it does not readily recover. Compaction is most likely to occur when the soil is moist. Forest management activities that can cause compaction are site preparation, log skidding, livestock grazing, or any other activity that applies weight *(2)*.

Ratings of the *hazard of sheet and rill erosion* of bare soil surface and when yarded by tractor or skyline systems are given in table 8. The ratings do not account for gully, ditch, or streambank erosion, nor for mass movement caused by geologic conditions, unusual local moisture conditions, ground disturbance, or manipulation of the plant cover. Soils that have an obvious susceptibility to slumping or gullying or that are susceptible to mass movement are identified in the map unit descriptions. Existing slips are shown on the detailed soil maps if they were recognized during mapping. Use of slope stability maps and onsite investigation of these hazards are necessary.

The rating is *slight* if the expected soil loss is small; *moderate,* if measures are needed to control erosion during logging and road construction; and *severe,* if intensive management or special equipment and methods are needed to prevent excessive loss of soil. The ratings are based on observations of approximately 180 transects, which were in recently harvested areas in northern California, to determine common conditions *(17)*. Remaining overstory and understory vegetation, slash, root systems, and water bars reduced the risk of erosion below that of bare soil. The hazard of sheet and rill erosion following timber harvesting generally was

found to be slight, but occasionally moderate, in areas where cable yarding was used. Tractor yarding generally resulted in higher erosion on steep slopes. This is in agreement with research literature on the subject *(33)*.

A rating for the hazard of erosion under bare soil conditions is also given in the detailed soil map unit descriptions. This rating is included as a basis for comparison with all other soils nationwide. The rating is valid only for a soil devoid of vegetation, mulch, or other ground cover. This condition would be expected to occur rarely. An extremely hot fire, tillage for agriculture, or attempted conversions to other land uses could result in bare soil conditions. The rating provides a general guide to the erodibility of exposed soil on skid trails and landings *(30, 60)*. This rating is based on the slope of the land and the inherent erodibility of the soil.

When used together, the ratings of erosion hazard and susceptibility to compaction can help the user decide if a significant reduction in the future growth rate is likely to occur.

Practices that can be used to prevent excessive soil loss and degradation of water quality vary from one area to another. Proper location, design, and installation of roads, culverts, water bars, and stream crossings are critical. Seeding or mulching of cuts and fills, where soil conditions make it needed and feasible, reduces sheet and rill erosion. Buffer strips along streams help to prevent sediment from entering the water, help to control streambank erosion, and may help to maintain favorable water temperatures.

Erosion control and soil characteristics need to be considered when planning site preparation for tree planting. Machinery, chemicals, and fire can all have an adverse effect on the soil characteristics and rate of erosion if they are not properly used or applied. Selection of the proper equipment and a careful, skilled operator are the keys to controlling erosion related to forest management activities.

A few of the forested soils in the survey area have chemical toxicities or imbalances that hinder tree growth. Soils derived from serpentinitic parent material are known to have a calcium-to-magnesium ratio that is not favorable for growth of Douglas fir, ponderosa pine, and redwood. Sargent cypress, McNab cypress, incense cedar, Digger pine, Jeffrey pine, and various species of shrub commonly are dominant on these soils. Typical soils on which this is a concern are those of the Beaughton, Dingman, Henneke, and Montara series. These soils occur in scattered areas throughout the survey area.

Insects and disease problems are common when trees are under stress. Stress can occur where imbalances exist in the soil or where there is either too little or too much moisture. Stress-related disease and insect problems are most likely to occur on the Hopland, Neuns, Pardaloe, Speaker, Tyson, Woodin, and Yorktree soils and the Haploxeralfs and Argixerolls.

Windthrow can be a concern where soil conditions cause shallow rooting of trees. Shallow, compacted, or poorly drained soils can inhibit deep root development. Trees on some of the soils mapped as Argixerolls and Haploxeralfs on terraces around Laytonville and Willits are susceptible to windthrow. Problems can be minimized by modifying harvest boundaries and silvicultural systems and by locating buildings away from trees in these areas.

Dense stands of Douglas fir, tanoak, and Pacific madrone are common on nonskeletal forested soils in the moister parts of the survey area. There is a transition to mixed stands of ponderosa pine, Douglas fir, black oak, and Pacific madrone or to pure oak stands in the drier areas. Tanoak generally is not a part of these stands.

Skeletal forested soils in dry areas support a mixture of live oak, Douglas fir, and nutmeg. Mixed stands of conifers and oaks are common in the mountains north and east of Covelo. Very dense stands of tanoak grow on both skeletal and nonskeletal soils in the extreme northern part of the survey area.

This vegetative mosaic is further complicated by the complexity of the soils. It is not unusual to find the roots of one tree growing in the soils of two different series. Productivity can vary widely depending on which soil is dominant in an area. The application of management practices such as reforestation may require careful onsite investigation to determine which soil is present.

Forest Climatic Zones

The forest vegetation in the survey area grows in three major climatic zones. Plant communities typical of each zone have been identified *(32)*. Key species were used by soil scientists as an aid to identification and mapping of the soils in these zones.

A periodic summer fog zone is along the western boundary of the survey area. This zone extends from the western boundary of the area to the first continuous north-south trending mountain range inland from the coast. Elevation ranges from 800 to 2,000 feet. When fog occurs, it usually forms late at night and dissipates by midmorning. Some moisture is added to the soil in areas where the tree canopy causes water to precipitate from the fog *(6)*. The western part of the Mill Creek

Watershed (Reeves Canyon) and the small drainageways extending from west of Willits to the western boundary of the survey area are the extent of this climatic zone in the survey area.

The presence of redwood is the most reliable indicator of this zone. It commonly comprises as much as 10 percent of the canopy of stands of trees that include mainly Douglas fir, tanoak, and Pacific madrone. The understory indicator species are huckleberry, starflower, tanoak, swordfern, and oxalis.

The second climatic zone is in the southern and eastern parts of the survey area. This zone is characterized by greater extremes of temperature and is drier in summer than the fog zone. Elevation is as much as 5,000 feet. Most of the land that is forested or covered with brush is in this zone. Overstory and understory plant communities in this zone are extremely diverse. Kinds of soil, aspect, elevation, total rainfall, summer temperatures, and past disturbance play a major role in determining the composition of the existing plant community.

A few indicator tree species of this zone are interior live oak, California black oak, nutmeg, Oregon white oak, and ponderosa pine. The understory indicator species are Eastwood manzanita and toyon. Other common plants in the zone are Douglas fir, tanoak, Pacific madrone, canyon live oak, poison oak, and brackenfern.

The third climatic zone is above an elevation of 5,000 feet in the mountains north and east of Covelo. Winter snowpack in this zone is common, the temperature is cooler, and the soils are moist longer. The major plant species in this zone are white fir, red fir, ponderosa pine, Jeffrey pine, sugar pine, huckleberry oak, and mountain white horn. Except for its shrub form, black oak commonly is absent; Douglas fir is confined to the lower elevations within the zone.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive. Much of the oak woodland in the survey area is grazed by livestock and wildlife. The understory generally consists of plant communities similar to those of the annual rangeland in the area. Forage production estimates are given in table 6. Emphasis needs to be placed on livestock distribution practices such as proper fencing, developing livestock watering facilities, and locating salt and minerals in order to achieve proper use of the forage. Stocking rates should be based on the availability of usable forage, which generally decreases as the density of the canopy increases.

If wood production is also an objective in grazed areas, provisions should be made to ensure regeneration of the trees. On soils that are susceptible to compaction, the season of grazing or the stocking rate may need to be modified to avoid major reductions in the growth rate of trees.

Where wood production is not an objective of the landowner, trees are sometimes thinned or removed in an effort to increase the amount of forage available for livestock. In addition, the more nearly level areas are sometimes seeded with desirable forage species. Many of the soils in these areas are well suited to growing woody plants and may require follow-up treatment to eliminate brush or trees. The value of woody plants for wildlife habitat should also be considered.

Vegetation along stream channels provides important habitat for fish and wildlife. Retention of streamside vegetation helps to prevent streambank erosion and gully formation and to prevent sediment from surrounding areas from reaching the streams.

Some soils on steep slopes have a tendency to slip when all the trees are removed. Landslips frequently do not occur during the first year after clearing, but they may occur after the soils have been under a cover of grass for a few years. On soils where this is known to have occurred, instability is mentioned as a problem in the map unit descriptions in the section "Detailed Soil Map Units."

The commercial conifer forest land generally is not grazed by livestock; however, it provides valuable wildlife habitat until the canopy becomes very dense. The vegetation under a full canopy commonly consists of sparse annual forbs, scattered perennial grasses, and shrubs. Total usable forage production under a full canopy commonly is less than 250 pounds per acre. Usable forage production increases for a few years after the canopy cover is removed by timber harvest or fire, but it declines rapidly as new trees begin to develop a canopy cover. These temporary openings are sometimes managed to allow for use by livestock or wildlife.

The major forest cover types *(20)* in the survey area include Pacific Douglas fir, Pacific ponderosa pine-

Douglas fir, Douglas fir-tanoak-Pacific madrone, canyon live oak, and California black oak. Substantial acreages of the Douglas fir-tanoak-Pacific madrone and California black oak types that are now dominated by hardwood species previously had a large number of conifers. It takes many years for Douglas fir and ponderosa pine to become naturally reestablished in these areas. Cover types of limited extent include redwood, Sierra Nevada mixed conifer, blue oak-Digger pine, knobcone pine, Pacific ponderosa pine, black cottonwood-willow, white fir, and Oregon white oak.

Recreation

Recreation, mainly hunting and fishing, is an important land use in this survey area. Most of the area is owned by private ranches, timber companies, and reservations that regulate hunting and other recreational use of the land. The number of recreational and residential subdivisions has increased in the area. This has also increased the risk of erosion, especially in areas where access roads and house pads are constructed on slopes of more than 30 percent. The amount of water available from wells, springs, and diversions for domestic use is severely limited. Use of off-road recreational vehicles should be excluded from soils that are subject to a high hazard of erosion, especially when the soils are wet.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational use by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures. The specific criteria used to determine soil limitations are given in appendix B.

The information in table 9 can be supplemented by other information in this survey; for example, interpretations for dwellings without basements and for local roads and streets in table 10 and interpretations for septic tank absorption fields in table 11.

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

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

By D.W. Patterson, biologist, Soil Conservation Service, and Jack W. Booth, biologist, California Department of Fish and Game.

The topography of the survey area typically is steep and rugged. The main soils in the area support a mixed or continuous plant cover of brush, trees, and annual grasses. Wildlife, primarily deer, is one of the most important products in well managed brush-covered areas. There are only minor amounts of cropland present in the vicinity of Ukiah and in other isolated valleys. The major kinds of wildlife habitat in the area are rangeland habitat consisting of brush and grass and woodland habitat consisting of conifers and broadleaf trees.

Management of brushland to provide quality browse, access for deer, and access and improved visibility for deer hunters is an important wildlife management practice in this survey area.

The kind and abundance of wildlife that populates an area depend largely on the amount, interspersion, and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife may be scarse and some species may be absent. Information on soils is of central importance when planning the management of wildlife habitat. Together with climate, the kinds of soil in an area directly affect the kind and amount of vegetation that is available to wildlife as food and cover and determine feasibility for constructing water impoundments. Spring developments and wildlife watering facilities may also provide water. Soil information cannot be used alone when planning for wildlife. The influence of domestic and feral livestock, public recreational activities, and other uses on rangeland and forest land must also be considered.

Perennial streams such as the Russian and Eel Rivers support important runs of anadromous steelhead, salmon, and occasional coast cutthroat trout and resident trout. A diversity of other game and nongame fish species inhabits the rivers and perennial streams. Streamside vegetation is important to wildlife. Livestock and farm ponds are capable of supporting warmwater game fish such as largemouth black bass, catfish, and sunfish. With proper management, ponds at higher elevations or with adequate cool water supplies can support trout.

Four general types of wildlife habitat—openland, wetland, rangeland, and woodland—are discussed in the following paragraphs.

Openland wildlife habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Typical wildlife attracted to these areas include California valley quail, dove, songbirds, rabbits, raccoon, and gray fox.

Woodland wildlife habitat consists of areas of broadleaf trees and shrubs or coniferous plants, or both, and associated grasses, legumes, and wild herbaceous plants. Typical wildlife attracted to these areas include wild turkey, blue grouse, band-tailed pigeon, songbirds, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland wildlife habitat consists of freshwater marshes. Typical wildlife attracted to these areas are ducks, geese, shore birds, muskrat, mink, and raccoon.

Rangeland wildlife habitat consists of areas of shrubs and wild herbaceous plants and mixtures of both coniferous and broadleaf trees. Typical wildlife attracted to these areas include deer, blue grouse, songbirds, hawks, dove, California valley quail, wild turkey, and coyote.

To facilitate the discussion of wildlife-soil relationships, the soils of the survey area have been placed into four habitat-soil groups. Each group consists of soils that have similar characteristics and produce or have the potential to produce the same general type of habitat, which in turn supports certain species of wildlife. Although soil characteristics alone rarely dictate the presence or absence of a particular wildlife species, the plant component of habitat is strongly influenced by soil characteristics, representative vegetation, elements of wildlife habitat, and important management considerations. The habitat-soil groups correspond with groups of general soil map units and are discussed in the following paragraphs. To find the names of all soils in each group, refer to the section "General Soil Map Units."

Habitat-soil group 1.—This group consists of general soil map units 1, 2, and 3. The soils in this group are on valley bottoms and terraces. The soils typically are very deep, nearly level, well drained to somewhat poorly drained, and medium textured to fine textured. The primary valleys are Redwood and Potter Valleys and those that encompass Ukiah, Laytonville, and Willits.

Wetness of the soil influences the kinds of vegetation that can grow. The wetter sites support cattail, tule, and other water-loving or water-tolerant plants. The drier upland areas or previously wet areas that have been drained support field, vine, and tree crops interspersed with small scattered areas of annual grasses, forbs, and occasional oaks. Streamside vegetation is also included in this group.

Openland and wetland wildlife habitat types dominate these areas. The wildlife habitat elements are primarily agricultural crops, plants in shallow-water areas, wetland plants, and herbaceous plants and smaller areas of shrubs and broadleaf trees.

Important management considerations in these areas include retaining areas of wetlands, maintaining streamside vegetation, maintaining diverse crops and cropping patterns, maintaining or establishing odd areas of herbaceous plants adjacent to cropland, maintaining or establishing blocks or rows of shrubs or trees, or both, and providing a dependable source of drinking water.

Habitat-soil group 2.—This group consists of general soil map units 4, 5, and 6. The soils in this group are on valley rims and foothills. The soils are shallow to very deep, gently rolling to very steep, somewhat excessively drained to moderately well drained, and medium textured. The vegetation is mainly that of open grasslands and is characterized by scattered to continuous overstories of oak and madrone. This group is dissected by both perennial and intermittent streams that are associated with significant areas of riparian woodland.

This group provides significant and diverse rangeland habitat and minor but important amounts of wetland habitat that is associated with waterways, ponds, springs, and seeps. The elements of wildlife habitat are mainly herbaceous plants, broadleaf trees, shrubs, and wetland plants.

Important management considerations for this group include proper grazing use by livestock, providing a dependable supply of drinking water, and retaining native trees, both living and dead.

Habitat-soil group 3.—This group consists of general soil map units 7 and 8. The soils in this group are on hills and mountains. The soils are very shallow to moderately deep, gently rolling to very steep, well drained to somewhat excessively drained, and medium textured.

The vegetation in this group is mainly brush. Oaks grow as scattered individual trees or as continuous woodland, especially on north-facing slopes. Other trees, including Digger pine and knobcone pine, also grow as scattered individuals or in groves. Vast fields of brush that is impenetrable by man, livestock, or wildlife are common. Waterways and north-facing slopes associated with this group commonly have a greater diversity of both trees and shrubs, including California bay and sycamore. Areas dominated by soils that formed in serpentinitic parent material produce very little vegetation and have little potential for improvement.

This group is characterized by large areas of rangeland habitat and by small amounts of important woodland habitat on north-facing slopes and along waterways. These small stands of woodland generally offer the only habitat diversity within fields of brush. The wildlife habitat elements are primarily shrubs, broadleaf trees, herbaceous plants, and coniferous plants. Rock outcrop provides important habitat for some wildlife species, especially some birds of prey, rodents, and reptiles.

Important management considerations for this group include managing brush, including closely growing trees; providing a dependable supply of drinking water; and retaining native trees, both living and dead.

Habitat-soil group 4.—This is the largest habitat-soil group. It consists of general soil map units 9, 10, 11, 12, 13, 14, and 15. The soils in this group are primarily on mountains. The soils are moderately deep to very deep, undulating to very steep, well drained, and coarse, medium, and fine textured.

The vegetation on these soils is primarily mixed conifer forest with varying understories of brush and scattered clumps and strips of brush and broadleaf trees. Areas of this group are dissected by both perennial and intermittent waterways and associated trees and shrubs. The group includes areas of coastal redwood forest lying along the west-central boundary of the survey area; these areas are strongly influenced by fog.

This group consists of large areas of woodland habitat that are fairly well diversified by the presence of rock outcroppings, waterways, and trees that are uneven-aged as a result of past timber harvesting and silvicultural practices. Areas of rangeland and wetland habitat are also in this group. Wildlife habitat elements are primarily coniferous trees, shrubs, herbaceous plants, and broadleaf trees.

Important management considerations for this group include maintaining broadleaf trees and shrubs within commercial timber plantations to increase diversity of wildlife habitat; sustaining yield of woodland harvest to retain even-aged trees both within and between plantations; using proper timber harvesting practices to protect woodland soil and plant resources; properly designing, maintaining, and closing timber access roads to protect the quality of water in streams; and maintaining significant snags and den trees for nesting birds and denning mammals.

The discussions of the habitat-soil groups provide a guide to the habitat types and elements that are best suited to the soils in each group; however, named soils within each group, listed in the "Index to Map Units,"

have varying characteristics that determine the potential and feasibility of managing or improving habitat on the soils. Land planners and managers should consider the characteristics of soils in consultation with biologists, agronomists, range conservationists, and foresters when planning the management or development of wildlife habitat. Water retention structures such as ponds commonly are needed when improving wildlife habitat. Suitability and limitations for both embankments and reservoir areas are provided for each soil in table 13.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section. See appendix B for specific criteria used to determine soil limitations.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; rock fragment

content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments.

The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage because of rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of

more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a *probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable* source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

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

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable

compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding; Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Slope Stability

By Maxine J. Levin, soil scientist, Soil Conservation Service.

This section describes the general types of mass movement of soil material that occur in the survey area. It also identifies the soils that are subject to mineralogical and drainage factors that contribute to landslide potential.

Slope failure, or mass movement of soil material down a hillslope, can have many different causes. The natural weakness of the rock of the Franciscan Formation and the severe faulting and fracturing of the rock are major reasons for the instability of the slopes in the survey area. Bedrock structure and composition, landform features, and climate all affect slope stability in varying degrees in a particular area. Soil characteristics, such as the kind and amount of clay and rock fragments in the soil, and the vegetation on the soil also affect slope stability *(15)*. These features combined with steep upland topography, high rainfall, and intense storms produce widespread slope failures in the area.

Three major forms of slope movement occur in the survey area. They are slump-earthflow, debris flow, and soil creep *(48)*.

Slump-earthflow occurs in areas where the soils are deeply weathered or the slopes are underlain by highly weathered rock *(51)*. A good example is the Squaw Rock slide in an area of Yorkville loam, 30 to 50 percent slopes, near Hopland. Although slumps and earthflows are technically two different kinds of slope failure, they are described as one process because they often occur together (fig. 4). Slumps are deep-seated mass movements where a solid block of soil slips on a broad, curved failure surface. The lower part of the soil block rotates outward, and sometimes upward, from the slope face to form a rounded toe slope. On a flattened bench, a depressional area forms near the top of the failed soil mass, below the main scarp. When the slumping soil moves downslope, the soil block breaks up and mixes with debris of smaller slumps to form an earthflow. Removal of soil material near the bottom of an earthflow, such as by roadbuilding or stream erosion, can reactivate old slumps or increase their rate of movement.

Soil characteristics that encourage slumping and earthflow are high plasticity, high cohesion, and, in some instances, restricted drainage. Plasticity and cohesion commonly are the direct result of the content of clay in a soil. Soils in the survey area that naturally are subject to slumping and subsequent earthflow are the Hellman, Yokayo, Yorktree, and Yorkville soils. All of these soils have a high content of clay in the subsoil. As the clay absorbs water, the resistance to shearing decreases as water films separate the clay particles, thus reducing the soil's cohesive strength and increasing its tendency to slide. Landforms on which these soils are present commonly have hummocky, rolling, grass-covered slopes and poorly formed drainage patterns. Slumps can even occur in gently sloping to moderately sloping areas if there are nearby springs or localized wet areas.

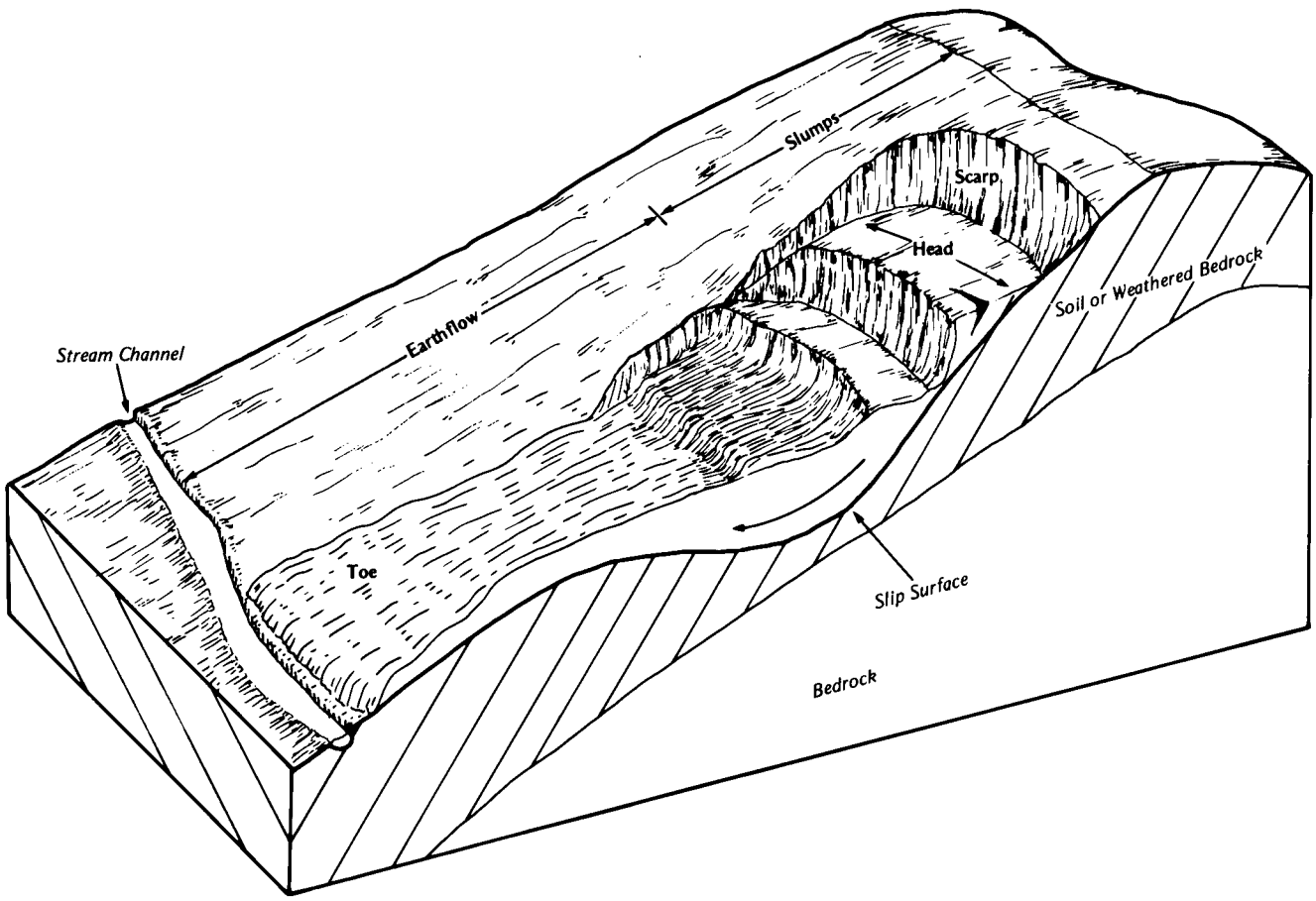

Figure 4.—Pattern of slump-earthflow in an area of clay-rich soils.

The clay minerology of a soil also affects its tendency to slump. Montmorillonite and smectite are clays that become weaker as they absorb large amounts of water. Chlorite and mica, unlike montmorillonite and smectite, are moderate and nonexpanding clays but have soft, platy structure, and the plates easily slide against one another. The Yorkville and Yorkville soils have a high concentration of smectite, chlorite, and mica in their clay particles, which adds to their instability. Soils derived from serpentinite that weathers to smectite *(19)*, such as soils of the Henneke, Montara, Beaughton, and Dingman series, slump in areas where the soils, commonly underlain by shattered bedrock, have been disturbed. Soils that are high in content of clay that does not expand, such as kaolinitic clay, are relatively stable even when saturated with water. Soils of the Kekawaka series are an example. Slumping has been observed in areas of the Kekawaka soils only where there has been deep soil disturbance.

Debris flow occurs in areas of gravelly soils that are less than 60 inches deep and are underlain by an impermeable layer; for example, a layer of hard graywacke, which is common in the survey area. Debris flow frequently occurs along natural channels in steep forested areas and generally is triggered by high rainfall during intense storms in winter (fig. 5). A good example of a large debris flow can be observed on the Casabonne-Wohly-Pardaloe complex, 50 to 75 percent slopes, southwest of the Irvine Rest Area along Highway 101, near Longvale. This mass movement began as a series of small slides along a planar slip surface parallel to the slope face. In such a mass movement, the extra weight of water from rainfall and the buoyant effect of sand grains generally reduce the ability of the soil to resist sliding, and gravity pulls the

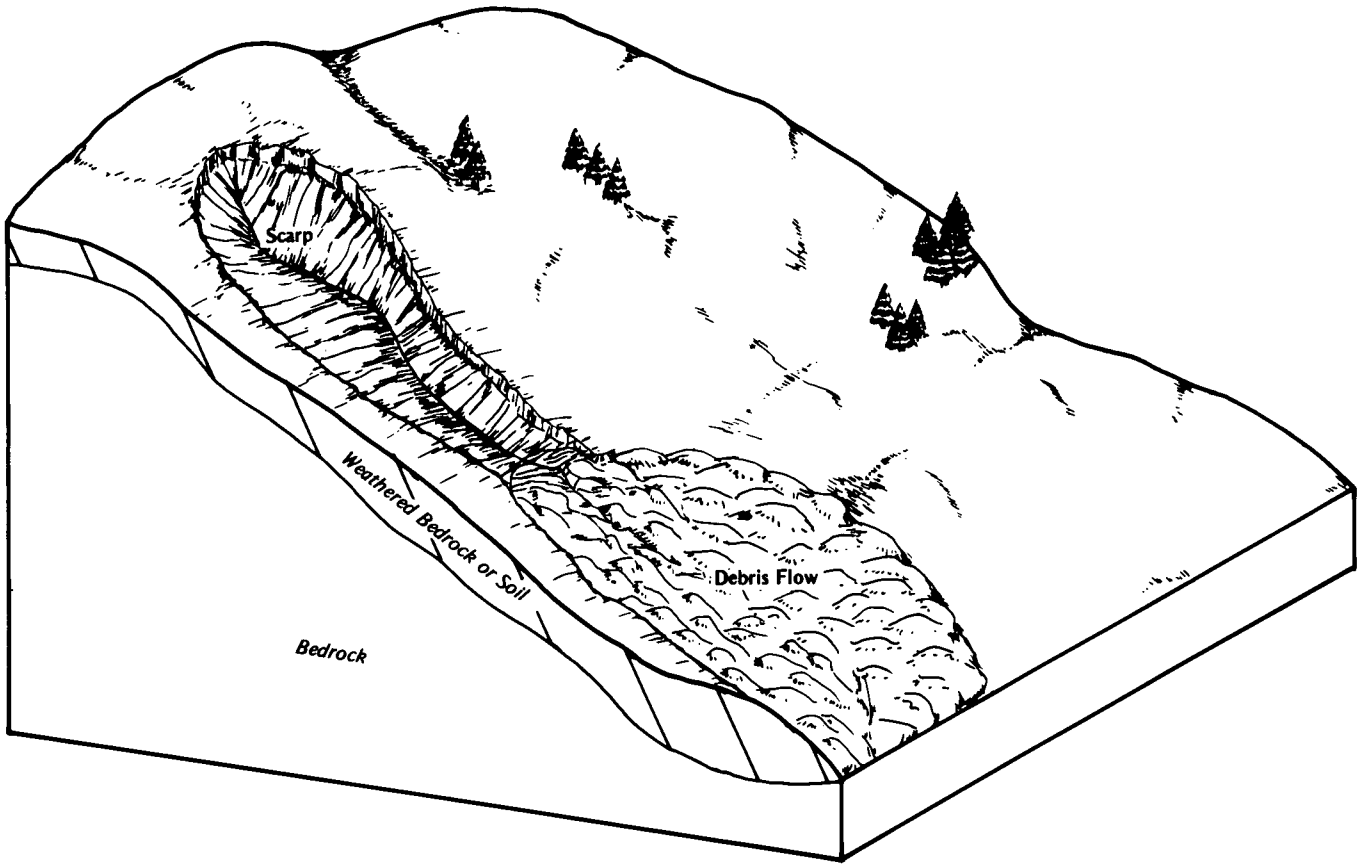

Figure 5.—Pattern of debris flow in an area of clay-rich soils.

soil mass downslope. Internal stresses break the soil block up into a flowing mixture of rock, soil material, and organic debris.

The soils in the eastern part of Mendocino County that are subject to sliding in this manner are those of the Kibesillah, Mayacama, Neuns, Pardaloe, Woodin, and Yellowhound series. These soils tend to be low in clay content, nonplastic, and granular, and coherence generally is low. They are skeletal and have more than 35 percent rock fragments in the subsoil. The soils that are most susceptible to debris flow are those that have slopes of more than 50 percent. Forest vegetation adds stability to steep slopes by anchoring the soil to bedrock with living root systems and by reducing soil water content through transpiration *(61)*. Care should be taken in forest regeneration, roadbuilding, and drainage design to reduce the occurrence of this type of slope failure.

Soil creep is not slope failure, but it precedes a more spectacular mass soil movement. It is the slow, imperceptible movement of soil downslope. The rate commonly is less than 0.25 inch per year. Soil creep is significant because it fills upslope depressional areas with soil material and debris over a period of years. In gravelly, coarse-grained soils this process adds weight and increases the chances for debris flow later. Creep also builds up stress in areas of potential slump-earthflow. Future mass movement can be triggered by events such as earthquakes, especially when the soil is wet. All of the soils in the survey area that are susceptible to debris flow and slump-earthflow are also subject to soil creep.

It is not within the scope of this soil survey to define all the mass erosion processes active in the survey area or to locate all the present, past, and future sites of slope instability; however, the soil maps in the back of this survey do show active landslips that were recognized by soil scientists while mapping the survey area. Onsite investigation and use of slope stability maps are necessary for more detailed information *(11)*.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed *(56)*. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

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

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 to 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

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

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials *(4, 44)* and the Unified soil classification system *(5, 44)*.

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

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074

millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

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

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

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

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

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

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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

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

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

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

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value the

more susceptible the soil is to sheet and rill erosion.

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered to be flooding. Standing water in swamps and marshes or in closed depressional areas is considered to be ponding.

Estimated frequency of flooding is given in table 16. Frequency is expressed as *none, rare, occasional*, and *frequent*. *None* means that flooding is not probable, *rare* that it is unlikely but is possible under unusual weather conditions (chance of flooding in any year is 0 to 5 percent), *occasional* that it occurs infrequently under normal weather conditions (chance of flooding in any year is 5 to 50 percent), and *frequent* that it occurs often under normal weather conditions (chance of flooding in any year is more than 50 percent).

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, *perched, artesian,* or *apparent*; and the months of the year that the water table usually is highest. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or

perched, water table is separated from a lower water table by a dry zone.

The two numbers in the column "High water table" indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(57)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. The adjective *Cumulic* identifies the subgroup of extragrades that have an unusually thick dark surface layer. An example is Cumulic Haplaquolls.

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

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

Taxonomic Units and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each unit. A pedon, a small three-dimensional area of soil, that is typical of the unit in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (54)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (57)*. Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the unit.

The map units of each taxonomic unit are described in the section "Detailed Soil Map Units."

Argixerolls

Argixerolls are very deep, moderately well drained and well drained soils on dissected stream terraces and terrace escarpments. These soils formed in alluvium derived from various kinds of rock. Slope ranges from 0 to 50 percent.

Reference pedon of Argixerolls in an area of Haploxeralfs-Argixerolls complex, 0 to 9 percent slopes, 0.3 mile south of Steele Lane on Highway 101, 300 feet west of highway; 1,800 feet south and 100 feet west of the northeast corner of sec. 25, T. 21 N., R. 15 W., MDBM, Laytonville Quadrangle.

A—0 to 11 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine, fine, medium, and coarse vesicular and tubular pores; 15 percent pebbles 2 to 25 millimeters in diameter; neutral (pH 6.8); gradual wavy boundary.

Bt1—11 to 22 inches; yellowish brown (10YR 5/4) gravelly clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine, fine, and medium tubular pores; common moderately thick clay films on peds and in pores; 15 percent pebbles 2 to 25 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

Bt2—22 to 37 inches; reddish yellow (7.5YR 6/6) gravelly clay loam, strong brown (7.5YR 4/6) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; common very fine and fine roots and few medium roots; many very fine and fine tubular pores and few medium tubular pores; common thin clay films on peds and continuous moderately thick clay films in pores; 15 percent pebbles 2 to 25 millimeters in diameter; strongly acid (pH 5.5); gradual wavy boundary.

2C—37 to 60 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; strong medium prismatic structure; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; continuous moderately thick clay films on peds; very strongly acid (pH 5.0).

Thickness of the solum is 20 to 50 inches. The profile between depths of 7 and 20 inches is dry from June to October and usually is moist the rest of the year. The mean annual soil temperature ranges from 55 to 59 degrees F. The base saturation (ammonium acetate) is more than 50 percent throughout the profile. Gravel content ranges from 10 to 35 percent throughout the solum. Reaction is neutral to very strongly acid.

The A horizon has color of 10YR 5/2 or 5/3 or of 7.5YR 5/2 or 5/3. It has moist color of 10YR 3/2 or 3/3 or of 7.5YR 3/2 or 3/3. It is loam or gravelly loam and is 10 to 20 percent clay.

The Bt horizon has color of 10YR 5/4, 5/6, 6/4, 6/6, or 7/4; 7.5YR 6/6 or 7/6; or 2.5Y 6/4, 6/6, or 7/4. It has moist color of 10YR 3/4, 4/4, 4/6, 5/4, or 5/6; 7.5YR 4/6 or 5/6; or 2.5Y 4/4, 5/4, or 5/6. It is stratified clay loam to very gravelly loam. It averages 20 percent more clay than the A horizon and has clay films throughout.

The C horizon has color of 10YR 6/4, 6/6, 7/3, or 7/4; 7.5YR 6/6 or 7/6; or 2.5Y 6/4, 6/6, or 7/4. It has moist color of 10YR 4/4, 5/3, 5/4, or 5/6; 7.5YR 4/6 or 5/6; or 2.5Y 4/4, 5/4, or 5/6. It is clay or silty clay loam. Mottles, where present, have moist color of 10YR 3/2, 4/6, 5/6, 6/3, or 6/4 and are common and distinct.

Asabean Series

The Asabean series consists of very deep, well drained soils on hills and mountains. These soils formed in material weathered from sedimentary or metasedimentary rock. Slopes range from 15 to 75 percent.

Soils of the Asabean series are loamy-skeletal, mixed, mesic Ultic Haploxeralfs.

Typical pedon of an Asabean gravelly loam in an area of Asabean-Speaker-Neuns complex, 50 to 75 percent slopes, 1,350 feet south and 1,250 feet west of the northeast corner of sec. 5, T. 22 N., R. 13 W., MDBM, Covelo West Quadrangle.

O—2 inches to 0; decomposing leaves, needles, and twigs.

A—0 to 9 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure parting to moderate very fine, fine, and medium subangular blocky; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots and few medium roots; many very fine and fine interstitial pores and few medium tubular pores; 25 percent pebbles 2 to 5 millimeters in diameter; neutral (pH 6.8); gradual smooth boundary.

BAt—9 to 19 inches; reddish yellow (7.5YR 7/6) very gravelly loam, dark brown (7.5YR 4/4) moist; weak

medium and coarse subangular blocky structure parting to moderate very fine, fine, and medium subangular blocky; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine and fine interstitial pores and few medium tubular pores; few thin clay films in pores; 55 percent pebbles; medium acid (pH 5.8); clear wavy boundary.

Bt—19 to 37 inches; reddish yellow (7.5YR 7/6) very gravelly sandy clay loam, brown (7.5YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many fine and medium interstitial pores and few coarse tubular pores; common moderately thick clay films on peds and in pores; 60 percent pebbles; medium acid (pH 5.8); gradual wavy boundary.

BCt—37 to 64 inches; very pale brown (10YR 7/4) very gravelly sandy loam, brown (7.5YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots and common coarse roots; many fine and medium interstitial pores and few coarse tubular pores; many moderately thick clay films on peds and common thick clay films in pores; 35 percent pebbles and 15 percent cobbles 75 to 150 millimeters in diameter; strongly acid (pH 5.5).

Thickness of the solum and depth to bedrock are more than 60 inches. The mean annual soil temperature is 47 to 54 degrees F. The profile between depths of 8 and 22 inches is dry in all parts from June to October and is moist in all parts from December to May. The particle size control section averages 20 to 30 percent clay and 35 to 65 percent rock fragments.

The A horizon has color of 10YR 4/3, 5/2, 5/3, 5/4, or 6/3 or of 7.5YR 7/6. It has moist color of 10YR 3/2, 3/3, 3/4, or 4/3 or of 7.5YR 3/2, 3/3, or 4/4. The horizon commonly is 15 to 25 percent clay, 15 to 35 percent gravel, and 0 to 5 percent cobbles. It is slightly acid or neutral.

The Bt horizon has color of 10YR 6/4, 7/3, or 7/4 or of 7.5YR 6/4, 6/6, 7/3, 7/4, or 7/6. It has moist color of 10YR 4/3, 4/4, or 5/4 or of 7.5YR 3/4, 4/4, 5/4, or 4/6. It is very gravelly clay loam, very gravelly loam, very gravelly sandy loam, or very gravelly sandy clay loam and is 18 to 35 percent clay, 30 to 60 percent gravel, and 5 to 15 percent cobbles. Total rock fragment content ranges from 35 to 65 percent. Base saturation ranges from 35 to 60 percent. The Bt horizon is medium acid or strongly acid.

Bearwallow Series

The Bearwallow series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from soft sandstone or shale. Slopes range from 15 to 50 percent.

Soils of the Bearwallow series are fine-loamy, mixed, thermic Ultic Haploxeralfs.

Typical pedon of a Bearwallow loam in an area of Bearwallow-Hellman-Witherell complex, 30 to 50 percent slopes, 4.2 miles south of the Boonville-Ukiah cutoff on Highway 101, about 3,500 feet west on farm road and 350 feet north of farm road; 1,600 feet south and 3,500 feet east of the northwest corner of sec. 27, T. 14 N., R. 12 W., MDBM, Elledge Peak Quadrangle.

A—0 to 8 inches; reddish yellow (7.5YR 6/6) loam, strong brown (7.5YR 4/6) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and common fine tubular pores; common dark brown (10YR 3/3, moist) silt coatings on peds; medium acid (pH 5.8); clear wavy boundary.

BAt—8 to 15 inches; reddish yellow (7.5YR 6/6) loam, dark brown (7.5YR 4/4) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine and fine tubular pores; few thin clay films in pores; few thin dark yellowish brown (10YR 3/4, moist) silt coatings on peds; medium acid (pH 6.0); clear smooth boundary.

Bt1—15 to 27 inches; reddish yellow (7.5YR 6/6) loam, yellowish red (5YR 5/6) moist; moderate coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine and fine tubular pores; many moderately thick clay films in pores and common thin clay films on peds; 10 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 5.8); gradual wavy boundary.

Bt2—27 to 35 inches; reddish yellow (7.5YR 7/6) loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, firm, sticky and slightly plastic; few fine roots; few fine tubular pores; many moderately thick clay films in pores and common thin clay films on peds; 15 percent pebbles 2 to 15 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

Cr—35 inches; soft, fractured sandstone; silt coatings in fractures.

Thickness of the solum and depth to a paralithic contact are 20 to 40 inches. The soil between depths of 6 and 18 inches is dry from June to October in most years and usually is moist from December to May. The mean annual soil temperature is 59 to 62 degrees F. Rock fragment content ranges from 0 to 15 percent throughout the profile. Base saturation (ammonium acetate) ranges from 50 to 85 percent throughout and is less than 75 percent within the upper 30 inches.

The A horizon has color of 10YR 6/3 or 6/4; 7.5YR 6/4 or 6/6; or 5YR 5/6. It has moist color of 10YR 4/3 or 4/4; 7.5YR 4/2, 4/4, or 4/6; or 5YR 3/4, 4/4, 4/6, or 5/4. It is neutral to medium acid.

The Bt horizon has color of 7.5YR 6/4, 6/6, or 7/6 or of 5YR 6/6, 6/8, or 7/4. It has moist color of 7.5YR 4/4, 4/6, 5/4, or 5/6 or of 5YR 4/6, 4/8, 5/4, or 5/6. The horizon is loam or clay loam and is 20 to 30 percent clay. It is slightly acid or medium acid.

Beaughton Series

The Beaughton series consists of shallow, well drained soils on hills and mountains. These soils formed in material weathered from serpentinitic rock. Slopes range from 5 to 50 percent.

Soils of the Beaughton series are clayey-skeletal, serpentinitic, mesic Lithic Argixerolls.

Typical pedon of a Beaughton gravelly loam in an area of Dingman-Beaughton complex, 5 to 50 percent slopes, 1.25 miles on My Ranch Road from main gate at Inspiration Point, Covelo; 1,450 feet south and 2,375 feet west of the northeast corner of sec. 31, T. 22 N., R. 12 W., MDBM, Jamison Ridge Quadrangle.

A—0 to 4 inches; dark reddish brown (5YR 3/2) gravelly loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 30 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.5); clear wavy boundary.

Bt1—4 to 10 inches; dark reddish brown (5YR 3/2) gravelly clay, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular pores; common thin clay films on peds and in pores; 30 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.5); clear wavy boundary.

Bt2—10 to 16 inches; dark reddish brown (5YR 3/2) very gravelly clay, dark reddish brown (5YR 3/3) moist; strong fine and medium prismatic structure parting to angular blocky; very hard, very firm, very sticky and very plastic; few very fine and medium roots; few very fine and fine tubular pores; many moderately thick clay films on peds and in pores; 45 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 125 millimeters in diameter; mildly alkaline (pH 7.7); clear wavy boundary.

R—16 inches; hard, fractured serpentine; few medium roots in fractures; fractures are 1 to 3 inches apart.

Thickness of the solum and depth to fractured serpentinitic rock are 10 to 20 inches. The profile between a depth of 5 inches and a lithic contact is dry in all parts from July to October and is moist throughout from December to May. The mean annual soil temperature is 54 to 58 degrees F. Base saturation (ammonium acetate and sum) is more than 75 percent throughout the profile. The calcium to magnesium ratio is 1:1 or less. Organic matter content is more than 1 percent throughout.

The A horizon has color of 7.5YR 4/2 or of 5YR 3/2 or 4/2. It has moist color of 7.5YR 3/2 or 5YR 3/2. The horizon is 20 to 27 percent clay and 25 to 35 percent coarse fragments. It is neutral or mildly alkaline.

The Bt horizon has color of 5YR 3/2 when dry and 5YR 3/3 when moist. It is gravelly clay, very gravelly clay loam, or very gravelly clay and averages 35 to 50 percent clay and 40 to 60 percent rock fragments. It is mildly alkaline or moderately alkaline.

Bluenose Series

The Bluenose series consists of very deep, well drained soils on mountains. These soils formed in material weathered from shale, schist, or sandstone. Slopes range from 8 to 75 percent.

Soils of the Bluenose series are loamy-skeletal, mixed, mesic Ultic Argixerolls.

Typical pedon of a Bluenose very gravelly sandy loam in an area of Neuns-Bluenose-Tyson complex, 50 to 75 percent slopes; about 12 miles due north of Covelo, on the main Louisiana-Pacific lumber road, 0.5 mile south of where road crosses Hulls Creek and 100 feet east of that road toward a tributary of Hulls Creek; 200 feet north and 4,800 feet east of the southwest corner of sec. 11, T. 24 N., R. 12 W., MDBM, Bluenose Ridge Quadrangle.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) very

gravelly sandy loam, very dark brown (10YR 2/2) moist; single grain; loose, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine interstitial pores; 50 percent pebbles 2 to 50 millimeters in diameter; neutral (pH 7.0); abrupt smooth boundary.

A2—3 to 15 inches; dark brown (10YR 3/3) very gravelly sandy loam, very dark brown (10YR 2/2) moist; weak fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; common very fine tubular pores; 50 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

Bt—15 to 36 inches; brown (10YR 5/3) very gravelly sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots, common medium roots, and few coarse roots; common very fine tubular pores; few thin clay films bridging sand grains and in pores; 40 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; slightly acid (pH 6.2); clear wavy boundary.

BC—36 to 62 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, slightly sticky and nonplastic; common fine, medium, coarse, and very coarse roots; many very fine interstitial pores; 40 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; slightly acid (pH 6.2).

Thickness of the solum and depth to bedrock are more than 60 inches. The profile between depths of 14 and 38 inches is dry from June to October in most years and usually is moist from December to May. The mean annual soil temperature is 47 to 54 degrees F. Rock fragment content ranges from 35 to 60 percent throughout the profile. Organic matter content to a depth of 10 inches is more than 1 percent.

The A horizon has color of 10YR 3/3, 4/1, 4/2, 5/2, or 5/3 or of 7.5YR 4/2. It has moist color of 10YR 2/1, 2/2, 3/1, 3/2, or 3/3 or of 7.5YR 3/2. It is neutral or slightly acid. Base saturation (ammonium acetate and sum) ranges from 50 to 100 percent.

The Bt horizon has color of 10YR 5/3, 5/4, 6/3, or 6/4 or of 7.5YR 4/4. It has moist color of 10YR 3/3, 3/4, 4/3, 4/4, or 5/4 or of 7.5YR 3/4. It is very gravelly sandy loam, very gravelly loam, or very gravelly sandy clay loam and is 15 to 27 percent clay. It is slightly acid to strongly acid. Base saturation (ammonium acetate and sum) ranges from 50 to 75 percent.

The BC horizon has similar colors and total rock fragment content as those of the Bt horizon. The BC horizon is very gravelly sandy loam or very gravelly loam and is 10 to 20 percent clay. It is slightly acid to strongly acid. Base saturation (ammonium acetate and sum) ranges from 50 to 60 percent.

Casabonne Series

The Casabonne series consists of deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone or shale. Slopes range from 9 to 75 percent.

Soils of the Casabonne series are fine-loamy, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Casabonne loam in an area of Casabonne-Wohly loams, 30 to 50 percent slopes, 1 mile northwest of Mountain House Road on Highway 128 and 600 feet south of highway, near Hopland; 250 feet north and 200 feet west of the southeast corner of sec. 18, T. 12 N., R. 11 W., MDBM, Hopland Quadrangle.

A1—0 to 7 inches; reddish yellow (7.5YR 7/6) loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure parting to granular; slightly hard, very friable, slightly sticky and nonplastic; few medium roots and common very fine and fine roots; common very fine interstitial pores; slightly acid (pH 6.3); clear wavy boundary.

A2—7 to 15 inches; reddish yellow (7.5YR 7/6) loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure parting to granular; slightly hard, friable, sticky and plastic; few very fine, fine, and medium roots; common very fine and fine and many medium tubular pores; slightly acid (pH 6.3); clear wavy boundary.

Bt1—15 to 24 inches; reddish yellow (5YR 7/6) clay loam, yellowish red (5YR 5/6) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots and common fine and medium roots; many very fine, common fine, and few medium tubular pores; common thin clay films in pores; slightly acid (pH 6.3); gradual wavy boundary.

Bt2—24 to 43 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots and common fine,

medium, and coarse roots; common very fine and fine tubular pores; common moderately thick clay films in pores; 10 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

Bt3—43 to 53 inches; reddish yellow (5YR 6/6) gravelly clay loam, yellowish red (5YR 5/6) moist; clay films of yellowish red (5YR 5/8) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots and common fine and medium roots; few very fine and fine tubular pores; many moderately thick clay films on peds and in pores; 20 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

C—53 to 58 inches; reddish yellow (5YR 6/6) gravelly clay loam, yellowish red (5YR 5/6) moist; massive; hard, friable, sticky and plastic; few very fine roots and common fine and medium roots; few very fine and fine tubular pores; common thin clay films in pores; 20 percent pebbles 2 to 75 millimeters in diameter; strongly acid (pH 5.5).

Cr—58 inches; soft, consolidated sandstone.

Depth to soft bedrock is 40 to 60 inches. The profile between depths of 8 and 20 inches is dry in all parts from July through September and is moist from November to May 15. The frost-free season is 175 to 250 days. The particle size control section averages 27 to 35 percent clay.

The A horizon has color of 7.5YR 7/4 or 7/6 or of 5YR 6/3. It has moist color of 7.5YR 3/4, 4/4, 4/6, or 5/6 or of 5YR 3/4, 4/4, or 4/6. It is loam or gravelly loam. It is slightly acid or medium acid.

The Bt horizon has color of 7.5YR 5/4, 5/6, or 6/6 or of 5YR 6/6 or 7/6. It has moist color of 7.5YR 4/4 or 4/6 or of 5YR 4/4, 4/6, or 5/6. It is clay loam or gravelly clay loam and is 27 to 40 percent clay and 5 to 25 percent gravel. It is slightly acid to strongly acid. Base saturation (sum) is 35 to 65 percent.

Some pedons have a BC horizon and do not have a C horizon above the paralithic contact.

Clear Lake Series

The Clear Lake series consists of very deep, poorly drained soils in basins. These soils formed in alluvium derived from sedimentary rock. Slopes range from 0 to 2 percent.

Soils of the Clear Lake series are fine, montmorillonitic, thermic Typic Pelloxererts.

Typical pedon of Clear Lake clay, 0 to 2 percent slopes, 1,500 feet east and 50 feet north of the intersection of Fairbanks Lane and Adobe Lane, in Round Valley, near Covelo; 50 feet north and 200 feet east of the southwest corner of sec. 16, T. 22 N., R. 12 W., MDBM, Covelo East Quadrangle.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) clay, black (10YR 2/1) moist; strong medium and coarse subangular blocky structure; hard, firm, sticky and plastic; many very fine and common fine roots; common very fine and fine tubular pores; cracks 1 centimeter wide and 6 to 8 inches apart; neutral (pH 6.6); clear wavy boundary.

A2—4 to 25 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong coarse prismatic structure parting to strong coarse angular blocky; very hard, very firm, very sticky and very plastic; many very fine and common fine roots; few very fine and fine tubular pores; cracks 1 centimeter wide and 6 to 8 inches apart; many pressure faces and intersecting slickensides; mildly alkaline (pH 7.5); clear wavy boundary.

C1—25 to 49 inches; grayish brown (2.5Y 5/2) clay, very dark gray (10YR 3/1) moist; common medium distinct red (2.5YR 5/6, moist) and yellowish brown (10YR 5/6, moist) mottles; strong medium prismatic structure parting to strong coarse angular blocky; very hard, firm, sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores; many pressure faces; moderately alkaline (pH 8.0); clear wavy boundary.

C2—49 to 65 inches; very dark grayish brown (2.5Y 3/2) clay loam, black (10YR 2/1) moist; common medium distinct reddish yellow (7.5YR 6/8, moist) and weak red (2.5YR 5/2, moist) mottles; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few very fine tubular pores; moderately alkaline (pH 8.0).

The profile is more than 60 inches deep. The particle size control section is silty clay, clay loam, or clay and is 35 to 60 percent clay. Drainage has been altered by stream entrenchment. Depth to the water table is 18 to 36 inches from December to March.

The A horizon has color of 10YR 2/1, 3/1, 4/1, or 4/2 or of 2.5Y 3/1. It has moist color of 10YR 2/1 or 3/1 or of 2.5Y 2/1. Reaction is neutral or mildly alkaline.

The C horizon has color of 10YR 3/1, 3/2, 4/2, or 5/2 or of 2.5Y 3/2, 4/2, 5/2, or 6/2. It has moist color of 10YR 2/1, 3/1, or 3/2 or of 2.5Y 3/2 or 4/2. It is clay loam or clay. Reaction is mildly alkaline or moderately alkaline.

Clear Lake soils in this survey area have higher rainfall and lower air temperatures than are defined in the range for the series as mapped elsewhere. These differences, however, do not significantly affect their use and management.

Cole Series

The Cole series consists of very deep, somewhat poorly drained soils on alluvial plains, fans, and basins. These soils formed in alluvium derived from sedimentary rock. Slopes range from 0 to 5 percent.

Soils of the Cole series are fine, mixed, thermic Pachic Argixerolls.

Typical pedon of Cole clay loam, 0 to 2 percent slopes, about 0.75 mile west-northwest of Potter Valley; 0.65 mile west of the junction of Main Street and Westside Road, then 0.25 mile north in an irrigated field; 1,300 feet north and 3,400 feet west of the southeast corner of sec. 18, T. 17 N., R. 11 W., MDBM, Potter Valley Quadrangle.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; strong very fine and fine granular structure; slightly hard, firm, slightly sticky and plastic; many very fine and fine roots; many very fine, fine, and medium irregular pores and many very fine and fine tubular pores; 5 percent pebbles 2 to 5 millimeters in diameter; neutral (pH 6.8); clear smooth boundary.

Bt1—8 to 15 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to strong very fine and fine subangular blocky; hard, firm, sticky and plastic; common very fine and fine roots; many very fine and fine irregular pores and common very fine and fine tubular pores; few thin clay films on peds and in pores; 10 percent pebbles 2 to 5 millimeters in diameter; neutral (pH 7.0); gradual smooth boundary.

Bt2—15 to 27 inches; dark grayish brown (10YR 4/2) clay, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate very fine and fine subangular blocky; very hard, firm, sticky and very plastic; common very fine and fine roots; common very fine and fine irregular pores and common very fine tubular pores; few thin clay films on peds and in pores; 10 percent pebbles 2 to 5 millimeters in diameter and 5 percent pebbles 5 to 25 millimeters in diameter; neutral (pH 7.2); gradual smooth boundary.

Bt3—27 to 41 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; common fine and medium prominent gray (N 6/0) and reddish yellow (7.5YR 6/6) mottles, dark gray (N 4/0) and strong brown (7.5YR 4/6) moist; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; few very fine and fine roots; common very fine and fine irregular pores and common very fine tubular pores; common thin clay films on peds and in pores and few moderately thick clay films in pores; 15 percent pebbles 2 to 25 millimeters in diameter; mildly alkaline (pH 7.5); clear smooth boundary.

C—41 to 60 inches; grayish brown (10YR 5/2) silty clay loam, brown (10YR 4/3) moist; many fine and medium prominent gray (N 5/0) and strong brown (7.5YR 5/8) mottles, many fine prominent dark gray (N 4/0) and strong brown (7.5YR 4/6) moist; massive; very hard, very firm, slightly sticky and slightly plastic; few very fine roots; few very fine irregular pores; 15 percent pebbles 2 to 5 millimeters in diameter; mildly alkaline (pH 7.8).

Thickness of the solum is 41 to 60 inches, and thickness of the profile is more than 60 inches. The water table has been lowered in many areas by artificial drainage or stream entrenchment. Where not irrigated, the profile between depths of 5 and 17 inches is dry from July 1 to October 1 in most years and is moist in all parts from December 1 to April 30. The mean annual soil temperature is 59 to 62 degrees F. Organic matter content is more than 1 percent to a depth of more than 20 inches, and it decreases regularly with increasing depth. Mollic colors extend to a depth of more than 20 inches. The profile has as much as 15 percent gravel throughout. The particle size control section is 35 to 45 percent clay.

The A horizon has color of 10YR 4/1, 4/2, 5/1, 5/2, or 5/3. It has moist color of 10YR 2/1, 2/2, 3/1, 3/2, or 3/3. It is loam or clay loam. The horizon is slightly acid or neutral.

The Bt horizon has color of 10YR 4/1, 4/2, 5/1, 5/2, or 5/3. It has moist color of 10YR 2/1, 3/1, 3/3, 4/1, or 4/2 or of 2.5Y 4/2. In some pedons the Bt horizon does not have mottles. It is clay loam, silty clay loam, or clay. This horizon averages more than 35 percent clay. It is neutral to moderately alkaline.

The C horizon, where present, has color of 10YR 4/1, 4/2, 5/1, 5/2, or 5/3 or of 2.5Y 6/2. It has moist color of 10YR 3/2, 3/3, 4/3, or 4/4 or of 2.5Y 4/2. It is clay loam, silty clay loam, or clay. It is mildly alkaline or moderately alkaline. In some areas it is underlain by gravel.

Cummiskey Series

The Cummiskey series consists of very deep, well drained soils on hills and mountains. These soils formed in material weathered from metasedimentary rock. Slopes range from 30 to 75 percent.

Soils of the Cummiskey series are loamy-skeletal, oxidic, mesic Pachic Ultic Argixerolls.

Typical pedon of Cummiskey gravelly loam, 30 to 75 percent slopes, about 1.4 miles from Mountain House Road on the jeep trail that starts at the old rodeo grounds, on the left side of the trail and about 150 feet upslope; 1,250 feet south and 1,450 feet west of the northeast corner of sec. 10, T. 12 N., R. 11 W., MDBM, Hopland Quadrangle.

O—1 inch to 0; decomposing leaf and twig litter.

A1—0 to 4 inches; weak red (2.5YR 5/2) gravelly loam, dusky red (2.5YR 3/2) moist; weak medium subangular blocky structure parting to strong granular; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots and common medium roots; common very fine and fine interstitial pores; 30 percent pebbles 2 to 50 millimeters in diameter; slightly acid (pH 6.4); abrupt smooth boundary.

A2—4 to 19 inches; weak red (2.5YR 5/2) gravelly loam, dusky red (10R 3/2) moist; weak medium subangular blocky structure parting to moderate granular; slightly hard, very friable, nonsticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine interstitial and tubular pores and common fine and medium tubular pores; 20 percent pebbles 2 to 50 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

Bt1—19 to 25 inches; weak red (2.5YR 5/2) gravelly clay loam, dusky red (10R 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and fine roots and few medium and coarse roots; common very fine interstitial and tubular pores and many fine and medium tubular pores; few thin clay films in pores; 30 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8); gradual wavy boundary.

Bt2—25 to 32 inches; weak red (2.5YR 5/2) very gravelly clay loam, weak red (2.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; common thin clay films on peds and in pores; 45 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

Bt3—32 to 48 inches; pale red (2.5YR 6/2) very gravelly clay loam, weak red (2.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; common thin clay films on peds and in pores; 50 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8); clear irregular boundary.

Bt4—48 to 64 inches; weak red (2.5YR 5/2) gravelly clay, dusky red (10R 3/2) moist; weak medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine and fine roots; common very fine and fine tubular pores; many moderately thick clay films on peds; 20 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8).

Thickness of the solum is more than 60 inches. The profile between depths of 8 and 24 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature is 54 to 59 degrees F. The mollic epipedon extends to a depth of more than 20 inches. Base saturation (ammonium acetate) is 50 to 90 percent throughout the profile and is less than 75 percent (sum) in some part of the upper 30 inches.

The A horizon has color of 5YR 4/2, 4/3, or 5/2 or of 2.5YR 5/2 or 5/3. It has moist color of 5YR 3/2, 2.5YR 3/2, or 10R 3/2 or 3/3. It is 20 to 35 percent gravel. The horizon is medium acid to neutral.

The Bt horizon has color of 5YR 4/3 or 5/3, 2.5YR 5/2 or 6/2, or 10R 5/2. It has moist color of 5YR 3/2, 3/3, or 4/3, 2.5YR 4/2, or 10R 3/2 or 3/3. It is gravelly clay loam, very gravelly clay loam, gravelly clay, or very gravelly clay. The horizon averages 35 to 50 percent gravel and 27 to 35 percent clay in the particle size control section. It is medium acid or slightly acid.

Dingman Series

The Dingman series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from serpentine and peridotite. Slopes range from 5 to 50 percent.

Soils of the Dingman series are fine, serpentinitic, mesic Pachic Ultic Argixerolls.

Typical pedon of a Dingman cobbly clay loam in an area of Dingman-Beaughton complex, 5 to 50 percent slopes; about 5.5 miles south of Covelo, 1.1 miles along

the My Ranch Road from the main gate of Inspiration Point; 0.4 mile southeast along a dirt road toward Round Mountain, on the north-facing roadcut; 700 feet north and 900 feet west of the southeast corner of sec. 31, T. 22 N., R. 12 W., MDBM, Jamison Ridge Quadrangle.

A—0 to 5 inches; dark reddish gray (5YR 4/2) cobbly clay loam, dark reddish brown (5YR 3/2) moist; weak coarse and very coarse granular structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; 15 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; mildly alkaline (pH 7.5); clear smooth boundary.

Bt1—5 to 14 inches; dark reddish gray (5YR 4/2) cobbly clay loam, dark reddish brown (5YR 3/2) moist; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots and many medium and coarse roots; common very fine and fine tubular pores; few thin clay films on peds and in pores; 15 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; mildly alkaline (pH 7.5); gradual smooth boundary.

Bt2—14 to 26 inches; dark reddish brown (5YR 3/2) gravelly clay, dark reddish brown (5YR 3/3) moist; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; common very fine and fine roots and many medium roots; many very fine and fine tubular pores; many thick clay films on peds and in pores; 35 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.6); clear smooth boundary.

Crt—26 inches; variegated dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) weathered serpentine and peridotite, variegated very dark grayish brown (10YR 3/2) and light yellowish brown (10YR 6/4) moist; weathered material consists of rounded cobbles 75 to 150 millimeters in diameter; roots extending along cracks; common thick clay films on faces of rock.

Thickness of solum and depth to a paralithic contact are 20 to 40 inches. The profile between depths of 7 and 21 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature ranges from 54 to 58 degrees F. Organic matter content is more than 1 percent to a depth of 20 inches or more. Base saturation (ammonium acetate) ranges from 50 to 100 percent throughout the profile and is less than 75 percent (sum) in some part of the upper 30 inches. The calcium to magnesium ratio is 1:1 or less. The profile is neutral or mildly alkaline throughout.

The A horizon has color of 10YR 4/2, 7.5YR 4/2, or 5YR 4/2. It has moist color of 7.5YR 3/2 or 5YR 3/2. It has 27 to 35 percent clay and 20 to 35 percent rock fragments.

The Bt horizon has color of 7.5YR 4/2 or of 5YR 3/2 or 4/2. It has moist color of 10YR 3/3, 7.5YR 3/2, or 5YR 3/2 or 3/3. It is cobbly clay loam, cobbly clay, or gravelly clay and averages 35 to 50 percent clay and 20 to 35 percent rock fragments.

Dunsmuir Series

The Dunsmuir series consists of deep, well drained soils on hills and mountains. These soils formed in material weathered from metasedimentary rock. Slopes range from 5 to 75 percent.

Soils of the Dunsmuir series are fine-loamy, oxidic, mesic Ultic Haploxeralfs.

Typical pedon of a Dunsmuir loam in an area of Dunsmuir-Maymen Variant complex, 15 to 50 percent slopes; about 3.4 miles east along Dos Rios Road from its intersection with Highway 101, in Laytonville; 1 mile north on farm road to intersection with jeep trail and 0.1 mile east of roadcut on south-facing bank of road; 2,700 feet south and 1,100 feet west of the southeast corner of sec. 33, T. 22 N., R. 14 W., MDBM, Laytonville Quadrangle.

O—0.25 inch to 0; duff of partially decomposed and undecomposed leaves and twigs.

A—0 to 5 inches; yellowish red (5YR 5/6) and dark yellowish brown (10YR 3/4) loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; soft, friable, slightly sticky and nonplastic; many very fine and fine roots and common coarse roots; many very fine and fine interstitial pores and common medium and coarse tubular pores; 10 percent pebbles 2 to 25 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

Bt1—5 to 11 inches; yellowish red (5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure parting to moderate very fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; common very fine and fine interstitial and tubular pores and few medium tubular pores; few thin silt films on peds; 10 percent pebbles 2 to 25

millimeters in diameter; neutral (pH 7.0); gradual wavy boundary.

Bt2—11 to 21 inches; red (2.5YR 4/6) gravelly clay loam, dark red (2.5YR 3/6) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; few very fine and fine interstitial pores and common medium and coarse tubular pores; many moderately thick clay films on peds and in pores; 15 percent pebbles 2 to 25 millimeters in diameter; neutral (pH 7.0); gradual wavy boundary.

Bt3—21 to 45 inches; red (2.5YR 4/6) gravelly clay loam, dark red (2.5YR 3/6) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and medium roots; few fine and common medium tubular pores; continuous thick clay films on peds and in pores; 10 percent pebbles 2 to 25 millimeters in diameter and 5 percent cobbles 75 to 100 millimeters in diameter; neutral (pH 6.8); gradual wavy boundary.

Cr—45 inches; weathered saprolite; rock fragments are red (2.5YR 4/6) with very dark gray (N 3/0) centers.

Depth to soft bedrock is 40 to 60 inches. The profile between depths of 6 and 18 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature is 52 to 59 degrees F. The ratio of gibbsite plus extractable iron oxide to clay is 0.2 or more. The upper 20 inches of the Bt horizon averages 30 to 35 percent clay. The profile is slightly acid or neutral throughout.

The A horizon has color of 10YR 3/4, of 7.5YR 4/6, 5/6, or 5/8, or of 5YR 4/4, 4/6, or 5/6. It has moist color of 5YR 3/4 or 4/4 or of 2.5YR 3/6. It is 20 to 27 percent clay and 5 to 10 percent gravel.

The Bt horizon has color of 7.5YR 5/6 or 5/8, 5YR 4/6, or 2.5YR 4/6. It has moist color of 5YR 5/8 or of 2.5YR 3/4, 3/6, 4/6, or 5/6. It is clay loam or gravelly clay loam and is 30 to 40 percent clay, 5 to 20 percent gravel, and 0 to 10 percent cobbles.

In some areas there is a BCt or Ct horizon. Colors and textures of the BCt or Ct horizon are the same as those of the Bt horizon. Variegated moist color of 10YR 4/3 or 7/3 or of 7.5YR 4/4 or 5/8 is present in the A, Bt, or Ct horizon in some areas.

Etsel Series

The Etsel series consists of very shallow, somewhat excessively drained soils on hills and mountains. These soils formed in material weathered from sandstone and shale. Slopes range from 15 to 75 percent.

Soils of the Etsel series are loamy-skeletal, mixed, nonacid, mesic Lithic Xerorthents.

Typical pedon of an Etsel gravelly loam on a south-facing slope in an area of Maymen-Etsel-Snook complex, 30 to 75 percent slopes; about 125 feet southwest of the crest of Horse Pasture Ridge, near Covelo, in Mendocino National Forest; in the NW¼NW¼ of sec. 34 (projected), T. 21 N., R. 11 W., MDBM, Thatcher Ridge Quadrangle.

A1—0 to 3 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine interstitial pores; 30 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.3); clear smooth boundary.

A2—3 to 7 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; 35 percent pebbles 2 to 75 millimeters in diameter and 10 percent cobbles 75 to 150 millimeters in diameter; medium acid (pH 6.0); abrupt wavy boundary.

R—7 inches; fractured, slightly weathered, fine grained sandstone and shale.

The depth to bedrock ranges from 4 to 10 inches. The profile at the lithic contact is dry from June to October and is moist from November to May. The mean annual soil temperature just above the bedrock is 53 to 59 degrees F. Rock fragment content averages 35 to 55 percent and ranges from 20 to 65 percent.

The A horizon has color of 10YR 5/3, 5/4, 6/2, 6/3, or 6/4 or of 7.5YR 6/2 or 6/4. It has moist color of 10YR 3/4, 4/2, 4/3, or 4/4 or of 7.5YR 3/4 or 4/2. It is very gravelly loam, gravelly loam, or very gravelly sandy loam. The horizon averages more than 35 percent rock fragments. It is medium acid or slightly acid.

Feliz Series

The Feliz series consists of very deep, well drained soils on flood plains. It formed in alluvium derived from mixed sedimentary rock. Slopes range from 0 to 8 percent.

Soils of the Feliz series are fine-loamy, mixed, thermic Cumulic Haploxerolls.

Typical pedon of Feliz loam, 0 to 2 percent slopes, on the south side of a vineyard avenue; 700 feet west of Mountain House Road and 1,700 feet south of Feliz Bridge, south of Hopland; 4,850 feet north and 700 feet east of the southwest corner of sec. 30, T. 13 N., R. 11 W., MDBM (projected), Hopland Quadrangle.

Ap—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine interstitial pores; slightly acid (pH 6.1); abrupt smooth boundary.

A2—2 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate coarse and very coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine interstitial pores; 5 percent pebbles 2 to 15 millimeters in diameter; neutral (pH 7.0); abrupt wavy boundary.

A3—7 to 26 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and slightly plastic; common very fine and fine roots; many very fine and common fine interstitial pores and few medium tubular pores; 5 percent pebbles 2 to 20 millimeters in diameter; mildly alkaline (pH 7.5); clear wavy boundary.

C1—26 to 39 inches; dark grayish brown (10YR 4/2) clay loam, very dark gray (10YR 3/1) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine interstitial pores; 3 percent pebbles 2 to 20 millimeters in diameter; mildly alkaline (pH 7.5); clear wavy boundary.

C2—39 to 55 inches; dark grayish brown (10YR 4/2) clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine interstitial pores; 5 percent pebbles 2 to 20 millimeters in diameter; mildly alkaline (pH 7.5); gradual wavy boundary.

C3—55 to 62 inches; dark grayish brown (10YR 4/2) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common fine interstitial pores; 13 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.5).

The thickness of the solum ranges from 20 to 46 inches. The profile is more than 60 inches deep. The profile between depths of 6 and 18 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature ranges from 59 to 62 degrees F. Rock fragment content ranges from 0 to 15 percent in most pedons. Some pedons are 25 to 50 percent rock fragments below a depth of 36 inches.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. It has moist color of 10YR 2/2, 3/2, or 3/3. It is loam or clay and is 18 to 30 percent clay. Base saturation (ammonium acetate and sum) ranges from 75 to 95 percent. Organic carbon content decreases irregularly with increasing depth. Reaction is slightly acid to mildly alkaline.

The C1 horizon has color of 10YR 4/2, 4/3, 5/2, 5/3, or 6/3. It has moist color of 10YR 3/1, 3/2, 3/3, 4/2, or 4/3. It is loam or clay loam and is 20 to 30 percent clay.

The C2 and C3 horizons have the same colors as does the C1 horizon. They are loam, clay loam, or sandy clay loam and are gravelly or very gravelly in some pedons. Reaction is neutral or mildly alkaline.

Fluvaquents

Fluvaquents consist of very deep, very poorly drained or poorly drained soils on flood plains. These soils formed in recent alluvium derived from sedimentary rock. Slopes range from 0 to 1 percent.

Reference pedon of Fluvaquents, 0 to 1 percent slopes, about 2 miles north of Willits and 1,200 feet east of Highway 101; 2,100 feet west and 550 feet south of the northeast corner of sec. 6, T. 18 N., R. 13 W., MDBM, Willits NE Quadrangle.

A1—0 to 2 inches; light gray (10YR 7/2) very fine sandy loam, brown (10YR 4/3) moist; common fine distinct strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) mottles, fine prominent yellowish red (5YR 4/6) moist; strong very fine subangular blocky structure; hard, friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine and common medium irregular pores; slightly acid (pH 6.5); abrupt smooth boundary.

A2—2 to 4 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; common fine distinct reddish yellow (7.5YR 6/6) and grayish brown (2.5Y 5/2) mottles, common fine prominent strong brown

(7.5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine tubular and irregular pores and common medium tubular pores; mildly alkaline (pH 7.5); abrupt smooth boundary.

Bg—4 to 25 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 4/3) moist; common fine prominent yellowish brown (10YR 5/6) and light gray (2.5Y 7/2) mottles, common fine distinct dark grayish brown (10YR 4/2) and grayish brown (2.5Y 5/2) moist; moderate fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine and few medium tubular and irregular pores; mildly alkaline (pH 7.4); abrupt smooth boundary.

C—25 to 30 inches; pale brown (10YR 6/3) loamy sand, dark yellowish brown (10YR 4/4) moist; common fine distinct light gray (10YR 6/1) and brownish yellow (10YR 6/6) mottles, common fine faint grayish brown (10YR 5/2) moist; single grain; loose, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine tubular and irregular pores; neutral (pH 7.2); abrupt smooth boundary.

Ab—30 to 42 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; common fine prominent strong brown (7.5YR 5/8) and light gray (10YR 6/1) mottles, common fine prominent strong brown (7.5YR 4/6) and gray (5Y 5/1) moist; moderate fine subangular blocky structure; hard, friable, nonsticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular and irregular pores; mildly alkaline (pH 7.4); clear wavy boundary.

Cg1—42 to 56 inches; light yellowish brown (10YR 6/4) and light brownish gray (10YR 6/2) alternating layers of sand and loamy sand 1 to 4 inches thick, brown (7.5YR 4/4) and dark grayish brown (10YR 4/2) moist; common fine prominent yellowish brown (10YR 5/8) mottles, gray (5Y 5/1) moist; sand is single grain and is loose, nonsticky and nonplastic; loamy sand is massive and is hard, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine tubular pores; mildly alkaline (pH 7.4); abrupt wavy boundary.

Cg2—56 to 63 inches; light yellowish brown (10YR 6/4) and light gray (10YR 6/1) silt loam, dark yellowish brown (10YR 3/4) and gray (5Y 5/1) moist; common fine prominent yellowish brown (10YR 5/8) mottles, reddish brown (5YR 4/3) and black (10YR 2/1) moist; moderate fine angular blocky structure; hard, friable, slightly sticky and plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular pores and common medium tubular pores; mildly alkaline (pH 7.4).

The profile is more than 60 inches deep. The profile between depths of 6 and 18 inches is moist in all parts from November to June and is saturated from November to March. The mean annual soil temperature is about 57 degrees F. The average clay content in the particle size control section ranges from 15 to 30 percent. Organic matter content decreases irregularly with increasing depth.

The A horizon has color of 10YR 5/2, 5/3, 6/2, 6/3, or 7/2 or of 2.5Y 6/2. Mottles are common or many, fine, and distinct or prominent in color of 7.5YR 5/6, 5/8, or 6/6, 10YR 5/6, or 2.5Y 5/2. Moist matrix colors are 10YR 3/2, 3/3, 4/2, or 4/3 or 2.5Y 4/2. Moist mottle colors are 5YR 4/4 or 4/6, 7.5YR 3/4 or 4/6, or 2.5Y 4/4. Texture is sandy loam, very fine sandy loam, loam, silt loam, or clay loam. The horizon is slightly acid or neutral.

The Ab horizon, where present, has the same colors as the A horizon, but it also has moist mottle color of 5Y 5/1. The Ab horizon is silt loam, loam, or clay loam. It is neutral or mildly alkaline.

The B and C horizons have color of 10YR 5/4, 6/1, 6/2, 6/3, or 6/4. They have common or many, fine, and faint, distinct, or prominent mottles in colors of 10YR 5/6, 5/8, 6/1, or 6/6 or of 2.5Y 5/2 or 7/2. Moist colors are 7.5YR 4/4; 10YR 3/2, 3/3, 3/4, 4/1, 4/2, 4/3, or 4/4; or 2.5Y 3/2. Moist mottle colors are 5YR 4/3, 4/4, 4/6, 5/6, or 6/6; 7.5YR 4/4, 4/6, or 5/6; 10YR 2/1, 4/2, 5/2, or 5/6; 2.5Y 4/2, 5/2, or 5/4; 5Y 4/1, 5/1, or 5/2; or N 6/0. The horizons are stratified sand, loamy sand, sandy loam, silt loam, loam, or silty clay loam. They are neutral or mildly alkaline.

Frenchman Series

The Frenchman series consists of very deep, well drained soils on river terraces. These soils formed in alluvium derived from sandstone. Slopes range from 0 to 9 percent.

Soils of the Frenchman series are loamy-skeletal, mixed, isomesic Ustic Dystropepts.

Typical pedon of a Frenchman gravelly loam in an area of Gschwend-Frenchman complex, 0 to 9 percent slopes, 7 miles west on Highway 20 from Highway 101, in Willits, 4.8 miles northwest on Irmulco Road to a

gravel pit, 0.8 mile northeast on Old McGuire Ranch Road to intersection with Redwood Creek Road, 0.2 mile north on Redwood Creek Road and 100 feet west of that road; 750 feet north and 450 feet west of the southeast corner of sec. 2, T. 18 N., R. 15 W., MDBM, Willits NW Quadrangle.

O—1 inch to 0; slightly decomposed redwood needles and twigs.

A—0 to 10 inches; grayish brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular pores; 25 percent pebbles 2 to 20 millimeters in diameter; neutral (pH 7.0); gradual smooth boundary.

Bw1—10 to 16 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores and few medium tubular pores; 35 percent pebbles 2 to 50 millimeters in diameter; neutral (pH 7.0); clear smooth boundary.

Bw2—16 to 30 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine, fine, and coarse roots and common medium roots; common very fine and fine interstitial pores; 35 percent pebbles 2 to 50 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

2C1—30 to 46 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 4/3) moist; massive; soft, loose, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine interstitial pores; 40 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 6.8); clear wavy boundary.

2C2—46 to 64 inches; pale brown (10YR 6/3) extremely gravelly sand, dark yellowish brown (10YR 4/4) moist; massive; soft, loose, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine interstitial pores; 65 percent pebbles 2 to 75 millimeters in diameter and 5 percent cobbles 75 to 100 millimeters in diameter; neutral (pH 6.8).

The profile is more than 60 inches deep. The thickness of the solum ranges from 28 to 45 inches. The profile between depths of 14 and 110 inches is moist in all parts from November 1 to June 15 and is dry in some or all parts from July 15 to October 1 in most years. The mean annual soil temperature ranges from 52 to 56 degrees F. The difference between the mean summer and mean winter soil temperature ranges from 5 to 9 degrees. The particle size control section ranges from 5 to 25 percent clay and averages 10 to 18 percent clay.

The A horizon has color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, or 6/4 or of 7.5YR 5/2 or 6/4. It has moist color of 10YR 2/2, 3/2, 3/3, 4/3, 4/4, or 5/4 or of 7.5YR 3/2 or 4/4. The horizon is gravelly loam and is 10 to 20 percent clay and 15 to 35 percent gravel. It is neutral to medium acid.

The Bw horizon has color of 10YR 5/3, 5/4, 6/3, 6/4, 7/3, or 7/4 or of 7.5YR 6/4. It has moist color of 10YR 4/3, 4/4, 4/6, 5/4, or 5/6 or of 7.5YR 3/4 or 4/4. The horizon is stratified very gravelly sandy loam and very gravelly loam and is 10 to 25 percent clay and 35 to 50 percent total rock fragments. It is neutral to medium acid.

The C horizon has color of 10YR 5/4, 6/3, 6/4, 6/6, 7/3, or 7/4 or of 2.5Y 6/4. It has moist color of 10YR 4/3, 4/4, 5/4, 5/6, or 6/4. The horizon is stratified sand, loamy sand, sandy loam, or loam and is very gravelly, very cobbly, extremely gravelly, or extremely cobbly. It is 5 to 15 percent clay, 25 to 80 percent gravel, and 10 to 40 percent cobbles. Total coarse fragment content ranges from 35 to 90 percent. Reaction is neutral to strongly acid.

Gielow Series

The Gielow series consists of very deep, somewhat poorly drained soils on alluvial plains and fans. These soils formed in alluvium derived from sedimentary rock. Slopes range from 0 to 5 percent.

Soils of the Gielow series are fine-loamy, mixed, mesic Cumulic Haplaquolls.

Typical pedon of Gielow sandy loam, 0 to 5 percent slopes, 0.3 mile west of Eastside Road and 150 feet south of Gielow Lane, in Talmage; lat. 39°7′7″ N., long. 123°9′57″ W. (nonsectionized Yokayo Rancheria); Elledge Peak Quadrangle.

Ap1—0 to 4 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to moderate very fine and fine subangular blocky; slightly hard, friable, nonsticky and nonplastic; many very fine roots; common very fine and fine and few coarse tubular pores; 5 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

Ap2—4 to 8 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and common fine roots; common fine, medium, and coarse tubular pores; 5 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

A1—8 to 11 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate very coarse subangular blocky structure parting to moderate coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine and coarse roots; common fine, medium, and coarse tubular pores; 5 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

A2—11 to 18 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and coarse roots and few medium roots; common very fine and fine tubular pores and few coarse tubular pores; few thin clay films on peds and in pores; 5 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

BAt—18 to 37 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; common fine distinct brown (10YR 4/3, moist) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots; common very fine and fine and few medium tubular pores; few thin and moderately thick clay films on peds and in pores; 5 percent pebbles 2 to 10 millimeters in diameter; slightly acid (pH 6.2); gradual wavy boundary.

Btg—37 to 48 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; common fine distinct brown (7.5YR 5/4, moist) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine, fine, medium, and coarse tubular pores; common moderately thick clay films in pores; 5 percent pebbles 2 to 10 millimeters in diameter; neutral (pH 6.8); abrupt wavy boundary.

C—48 to 65 inches; light yellowish brown (2.5Y 6/4) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine, fine, medium, and coarse tubular pores; 5 percent pebbles 2 to 10 millimeters in diameter; neutral (pH 7.0).

The profile is more than 60 inches deep. The profile between depths of 8 and 21 inches is dry from July 1 to October 15 and is moist the rest of the year. The mean annual soil temperature is 55 to 59 degrees F. The profile is 0 to 10 percent gravel throughout. Base saturation (ammonium acetate) is more than 50 percent throughout the profile. Organic matter content decreases irregularly with increasing depth. The mollic epipedon is 24 inches thick or more and has mottles in the lower part.

The A horizon has color of 10YR 5/2 or 5/3. It has moist color of 10YR 2/1, 3/1, 3/2, or 3/3. The horizon is stratified sandy loam or loam. It is medium acid or slightly acid.

The Bt and C horizons have color of 10YR 5/2, 5/3, 5/4, 6/3, or 7/4 or of 2.5Y 6/2, 6/3, or 6/4. They have moist color of 10YR 3/2, 4/2, 4/3, 4/4, or 5/3 or of 2.5Y 4/4. The horizons are stratified loam, fine sandy loam, sandy loam, or sandy clay loam and are 15 to 27 percent clay. They are medium acid to neutral. They have common distinct mottles that have moist color of 10YR 5/1, 5/6, 6/2, or 7/4, of 5YR 4/6, 5/6, or 5/8, or of 7.5YR 4/6, 5/4, or 5/6.

Gschwend Series

The Gschwend series consists of very deep, well drained soils on river terraces. These soils formed in alluvium derived from sandstone. Slopes range from 0 to 9 percent.

Soils of the Gschwend series are fine-loamy, mixed, isomesic Ustic Dystropepts.

Typical pedon of a Gschwend loam in an area of Gschwend-Frenchman complex, 0 to 9 percent slopes, 7 miles west on Highway 20 from Highway 101, in Willits; 2.3 miles north on Irmulco Road to bridge crossing Olds Creek, then 1.1 miles west on Irmulco Road, 200 feet south of Irmulco Road and 95 feet north of Olds Creek; 2,500 feet south and 3,900 feet west of the northeast corner of sec. 13, T. 18 N., R. 15 W., MDBM, Willits NW Quadrangle.

O—3 inches to 0; redwood needles and twigs.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; soft, friable, nonsticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; few very fine and fine tubular pores; neutral (pH 7.0); gradual smooth boundary.

Bw1—7 to 22 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots and common medium and coarse roots; common very fine and fine tubular pores; slightly acid (pH 6.5); gradual smooth boundary.

Bw2—22 to 39 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots, common medium roots, and many coarse roots; many very fine and fine tubular pores; few thin clay films bridging sand grains; medium acid (pH 6.0); gradual smooth boundary.

C—39 to 50 inches; yellowish brown (10YR 5/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots, common medium roots, and many coarse roots; many very fine and fine interstitial pores; 20 percent pebbles 2 to 10 millimeters in diameter; strongly acid (pH 5.5); clear smooth boundary.

2C—50 to 61 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; massive; loose, nonsticky and nonplastic; 35 percent pebbles 2 to 75 millimeters in diameter and 10 percent cobbles 75 to 150 millimeters in diameter; strongly acid (pH 5.5).

Depth of the profile is more than 60 inches. Thickness of the solum ranges from 17 to 40 inches. The profile between depths of 7 and 22 inches is moist in all parts from November 1 to June 15 and is dry in some or all parts from July 15 to October 1 in most years. The mean annual soil temperature ranges from 52 to 56 degrees F. The difference between the mean summer and mean winter soil temperature ranges from 5 to 9 degrees. The particle size control section averages 18 to 23 percent clay and is 5 to 35 percent coarse fragments.

The A horizon has color of 10YR 4/2, 4/3, 5/3, or 5/4. It has moist color of 10YR 2/1, 2/2, 3/2, 3/3, or 5/3. The horizon is loam and is 10 to 20 percent clay and 0 to 10 percent gravel. It is neutral to medium acid.

The B horizon has color of 10YR 5/4, 6/3, 6/4, 7/3, or 7/4 or of 7.5YR 5/4. It has moist color of 10YR 3/3, 4/3, 4/4, 4/6, 5/3, 5/4, or 5/6 or of 7.5YR 3/4 or 4/4. It is stratified sandy loam, loam, or sandy clay loam and is 10 to 27 percent clay and 0 to 15 percent gravel. It is neutral to strongly acid.

The C horizon has color of 10YR 5/4, 6/4, 7/3, or 7/4. It has moist color of 10YR 4/3, 4/4, 5/4, 5/6, or 6/4 or of 7.5YR 4/4. It is stratified loamy sand, sandy loam, loam, or sandy clay loam and is nongravelly, gravelly, very gravelly, or extremely gravelly. It is 5 to 27 percent clay, 0 to 90 percent gravel, 0 to 15 percent cobbles, and 0 to 5 percent stones. Coarse fragment content ranges from 0 to 90 percent. The horizon is neutral to very strongly acid.

Gudgrey Series

The Gudgrey series consists of very deep, well drained soils on mountains. These soils formed in material weathered from sandstone, schist, or shale. Slopes range from 8 to 75 percent.

Soils of the Gudgrey series are fine-loamy, mixed, mesic Pachic Xerumbrepts.

Typical pedon of a Gudgrey gravelly sandy clay loam in an area of Gudgrey-Bluenose-Neuns complex, 30 to 50 percent slopes; on Bluenose Ridge along the south side of logging road, in roadcut about 10 miles northeast of Covelo; 1,700 feet north and 2,000 feet west of the southeast corner of Round Valley Indian Reservation Tract 16; 1,600 feet north and 650 feet east of the northwest corner of sec. 4, T. 23 N., R. 12 W., MDBM, Bluenose Ridge Quadrangle.

O—1.5 inches to 0; undecomposed and partially decomposed conifer needles, bark, and twigs.

A1—0 to 12 inches; gray (10YR 5/1) gravelly sandy clay loam, very dark gray (10YR 3/1) moist; moderate very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine, fine, and medium tubular pores; 20 percent pebbles 2 to 15 millimeters in diameter; strongly acid (pH 5.5); gradual wavy boundary.

A2—12 to 28 inches; gray (10YR 5/1) gravelly sandy clay loam, very dark gray (10YR 3/1) moist; moderate very fine, fine, and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many very fine tubular pores and common fine and medium tubular pores; 20 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

Bt1—28 to 39 inches; light brownish gray (10YR 6/2) gravelly clay loam, dark gray (10YR 4/1) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common fine, medium, and coarse roots; common very fine

and fine tubular pores; common thin clay films on peds, as bridges, and in pores; 30 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

2Bt2—39 to 58 inches; variegated light gray (10YR 7/1) and yellowish brown (10YR 5/6) gravelly clay loam, grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 4/6) moist; weak medium prismatic structure parting to moderate fine and medium angular blocky; hard, friable, sticky and plastic; few very fine, fine, and medium roots; few very fine tubular pores; many slickensides; few moderately thick clay films in pores; 30 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8); abrupt wavy boundary.

2Bt3—58 to 70 inches; gray (10YR 5/1) gravelly sandy clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate medium and coarse angular blocky; hard, firm, sticky and plastic; few very fine, fine, and medium roots; few very fine tubular pores; many slickensides; 20 percent pebbles 2 to 50 millimeters in diameter; slightly acid (pH 6.3).

Thickness of the solum and depth to bedrock are more than 60 inches. The profile between depths of 7 and 23 inches is dry from June to October and is moist the rest of the year. The mean annual soil temperature is 47 to 54 degrees F. The umbric epipedon extends to a depth of more than 20 inches. The base saturation (ammonium acetate) ranges from 40 to 90 percent but is less than 50 percent in some part of the profile. Rock fragment content is 15 to 35 percent. The B horizon is variegated with lithochromic colors in some pedons. Organic matter content is 1 to 5 percent in the A horizon, and it decreases regularly with increasing depth.

The A horizon has color of 10YR 4/2, 4/3, 5/1, 5/2, or 5/3. It has moist color of 10YR 2/2, 3/1, 3/2, or 3/3. The horizon is 20 to 30 percent clay. It is strongly acid or medium acid.

The Bt horizon has color of 10YR 4/3, 5/1, 5/4, 5/6, 6/2, 6/3, 7/1, or 7/3. It has moist color of 2.5Y 5/2 or of 10YR 3/1, 3/2, 3/3, 3/4, 4/1, 4/2, 4/3, 4/6, 5/2, or 5/4. It is gravelly clay loam, gravelly sandy clay loam, or cobbly clay loam and is 20 to 35 percent clay. It is medium acid or slightly acid.

Haplaquepts

Haplaquepts are very deep, very poorly drained soils that formed in alluvium derived dominantly from sedimentary rock. These soils are in basins and on flood plains. Slope ranges from 0 to 1 percent.

Reference pedon of Haplaquepts, 0 to 1 percent slopes, about 2 miles north of Willits, and 1,750 feet east of Highway 101; 1,500 feet west and 380 feet south of the northeast corner of sec. 6, T. 18 N., R. 13 W., MDBM, Willits NE Quadrangle.

Ag1—0 to 0.5 inch; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many fine prominent dark yellowish brown (10YR 4/6, moist) mottles; moderate very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine interstitial and tubular pores; medium acid (pH 6.0); abrupt wavy boundary.

Ag2—0.5 inch to 3 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many fine prominent dark yellowish brown (10YR 4/6, moist) mottles; moderate fine granular structure; hard, friable, sticky and plastic; many very fine, fine, and medium roots; many very fine, fine, and medium interstitial pores; medium acid (pH 6.0); clear wavy boundary.

ABg—3 to 8 inches; light olive brown (2.5Y 5/6) clay loam, dark grayish brown (2.5Y 4/2) moist; many medium prominent dark yellowish brown (10YR 4/4, moist) mottles and common fine prominent yellowish red (5YR 4/6, moist) mottles; moderate fine and medium subangular blocky structure parting to moderate very fine and fine subangular blocky; hard, friable, sticky and plastic; many very fine and fine roots; many very fine tubular and interstitial pores and common fine tubular pores; slightly acid (pH 6.5); gradual wavy boundary.

Bg1—8 to 19 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; many medium prominent dark yellowish brown (10YR 4/4, moist) mottles; moderate fine and medium subangular blocky structure parting to moderate very fine and fine subangular blocky; hard, friable, sticky and plastic; common very fine and fine roots concentrated along vertical faces of peds; few fine and medium tubular pores; few black (10YR 2/1) manganese stains 1 to 4 millimeters in diameter on faces of peds; neutral (pH 6.8); gradual wavy boundary.

Bg2—19 to 27 inches; light olive gray (5Y 6/2) silty clay loam, dark gray (5Y 4/1) moist; many medium prominent strong brown (7.5YR 4/6, moist) mottles and common fine prominent yellowish red (5YR 4/6, moist) mottles; moderate medium and coarse

subangular blocky structure; very hard, firm, very sticky and plastic; common very fine and fine roots and few medium roots; many very fine and fine tubular pores; neutral (pH 7.0); gradual wavy boundary.

BCg—27 to 37 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; common thin prominent dark reddish brown (5YR 3/4, moist) mottles; moderate medium and coarse angular blocky structure parting to moderate fine and medium angular blocky; very hard, firm, sticky and plastic; few very fine and fine roots and common medium roots; many very fine and fine tubular pores; disseminated lime; slightly effervescent; neutral (pH 7.2); gradual wavy boundary.

Cg—37 to 72 inches; gray (5Y 5/1) silty clay, very dark gray (N 3/0) moist; common fine distinct dark yellowish brown (10YR 4/4, moist) mottles; dark gray (N 4/0, moist) pressure faces; massive; very hard, firm, sticky and very plastic; common fine roots; common very fine tubular and interstitial pores; disseminated lime; slightly effervescent; moderately alkaline (pH 8.0).

Thickness of the solum is 25 to 55 inches. The profile is more than 60 inches deep. The profile between depths of 6 and 15 inches is moist in some part throughout the year and is saturated for as long as 4 months between November and March. The mean annual soil temperature is about 57 degrees F. The clay content in the particle size control section ranges from 30 to 50 percent. Layers of gravel, loamy sand, and sand are common below a depth of 27 inches.

The A horizon has color of 2.5Y 5/2, 5/6, or 6/2. It has moist color of 10YR 3/2, 3/3, 4/1, or 4/3 or of 2.5Y 4/2 or 4/3. The horizon is clay, clay loam, loam, silty clay loam, or silt loam. It is medium acid or slightly acid.

The B and C horizons have color of 10YR 5/1, 2.5Y 5/6 or 6/2, or 5Y 5/1 or 6/2. They have moist color of 10YR 3/3, 4/1, or 5/1, 2.5Y 4/2, 5Y 3/1 or 4/1, or N 3/0. These horizons are clay, silty clay loam, silty clay, or clay loam. They are neutral to moderately alkaline.

Haploxeralfs

Haploxeralfs are very deep, poorly drained to well drained soils on dissected stream terraces and terrace escarpments. These soils formed in alluvium derived from various kinds of rock. Slopes range from 0 to 50 percent.

Reference pedon of Haploxeralfs in an area of Haploxeralfs-Argixerolls complex, 0 to 9 percent slopes, 0.75 mile west on Branscomb Road from Highway 101 and about 150 feet east of Branscomb Road, near Laytonville; 1,800 feet north and 150 feet east of the southwest corner of sec. 12, T. 21 N., R. 15 W., MDBM, Laytonville Quadrangle.

A1—0 to 3 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and thick platy structure parting to moderate fine and medium subangular blocky; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots and few medium and coarse roots; common very fine and fine tubular pores and few very fine and fine interstitial pores; neutral (pH 6.8); abrupt wavy boundary.

A2—3 to 9 inches; strong brown (7.5YR 5/6) loam, dark brown (7.5YR 3/4) moist; moderate medium and coarse subangular blocky structure parting to moderate fine and medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few very fine and fine roots and common medium roots; common very fine and few fine tubular pores; medium acid (pH 6.0); clear wavy boundary.

Bt1—9 to 20 inches; reddish yellow (7.5YR 7/8) loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots, few fine roots, and common medium roots; many very fine and fine tubular pores and common medium and coarse tubular pores; medium acid (pH 5.8); clear wavy boundary.

Bt2—20 to 30 inches; reddish yellow (7.5YR 7/8) loam, strong brown (7.5YR 5/6) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine and fine, common medium, and few coarse tubular pores; strongly acid (pH 5.5); gradual wavy boundary.

C1—30 to 37 inches; reddish yellow (7.5YR 7/8) gravelly sandy loam, strong brown (7.5YR 5/8) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and few fine and medium roots; many very fine, common fine, and few medium tubular pores; 20 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

C2—37 to 66 inches; yellowish brown (10YR 5/6) very gravelly sandy loam, dark yellowish brown (10YR 3/6) moist; massive; soft, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine, fine, and medium

interstitial pores and common very fine and fine tubular pores; 45 percent pebbles 2 to 40 millimeters in diameter; strongly acid (pH 5.5).

The thickness of the solum is 20 to 60 inches or more. The profile between depths of 6 and 18 inches is dry from July through October and is moist the rest of the year. The mean annual soil temperature is 55 to 59 degrees F. Reaction is strongly acid to mildly alkaline. Mottles, where present, are less than 2 millimeters in diameter and have chroma of more than 2 to a depth of 20 inches. Base saturation (ammonium acetate) is less than 50 percent in some part of the profile.

The A horizon has color of 10YR 4/3, 4/4, 4/6, 5/3, 5/4, 6/3, 6/4, or 6/6; 7.5YR 3/2, 3/4, 5/4, or 5/6; or 2.5Y 6/4. It has moist color of 10YR 3/2, 3/3, 3/4, 3/6, 4/3, or 4/4; 7.5YR 3/2 or 3/4; or 2.5Y 4/4. The horizon is loam, sandy loam, or fine sandy loam and is gravelly in some pedons. It is 7 to 20 percent clay. Where the soils are poorly drained, moist mottles of 10YR 4/6, 5/6, or 6/4 or of 7.5YR 4/6 or 5/6 are common and distinct to the surface.

The Bt horizon has color of 10YR 7/3, 6/4, 6/6, 7/4, 4/6, or 5/6; 7.5YR 5/6, 6/6, or 7/8; or 2.5Y 7/2, 6/4, or 6/6. It has moist color of 10YR 4/3, 3/4, 4/4, 5/4, 3/6, 4/6, 5/6, or 6/6; 7.5YR 3/4, 4/4, 4/6, 5/6, or 4/8; or 2.5Y 4/4, 5/4, 6/4, 5/6, or 6/6. It is stratified and ranges from loam to clay in the poorly drained pedons and from clay loam to very gravelly sandy loam in the well drained pedons; it is 10 to 40 percent clay. Mottles that have moist color of 10YR 5/6 or 6/6 or of 7.5YR 5/8 or 6/8 are prevalent throughout the horizon in the poorly drained pedons.

The C horizon, where present, has color of 10YR 5/6, 6/4, or 6/6; 7.5YR 5/6, 6/4, or 7/8; or 2.5Y 6/4. It has moist color of 10YR 3/6, 4/4, 4/6, 5/4, or 5/6; 7.5YR 4/4, 4/6, or 5/8; or 2.5Y 4/4, 5/4, or 6/4. It is stratified very gravelly loam to extremely gravelly sandy loam and is 35 to 75 percent gravel 2 to 75 millimeters in diameter.

Hellman Series

The Hellman series consists of very deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone or shale. Slopes range from 15 to 50 percent.

Soils of the Hellman series are fine, mixed, thermic Mollic Palexeralfs.

Typical pedon of a Hellman loam in an area of Bearwallow-Hellman-Witherell complex, 30 to 50 percent slopes, 1 mile south on old Yorkville-Hopland Road from Hellman Ranch Road, 1,500 feet west on farm road to a north-facing roadcut, near Hopland; 1,560 feet south and 1,770 feet east of the northwest corner of sec. 26, T. 13 N., R. 12 W., MDBM, Hopland NW Quadrangle.

A—0 to 7 inches; brown (7.5YR 4/4) loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 10 percent pebbles 2 to 15 millimeters in diameter; slightly acid (pH 6.1); clear wavy boundary.

AB—7 to 14 inches; strong brown (7.5YR 5/6) loam, brown (7.5YR 4/4) moist; moderate medium, coarse, and very coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores and common fine and medium tubular pores; 10 percent pebbles 2 to 25 millimeters in diameter; slightly acid (pH 6.3); clear wavy boundary.

Bt1—14 to 26 inches; brown (7.5YR 5/4) gravelly clay loam, yellowish red (5YR 4/6) moist; weak very coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores and common fine and medium tubular pores; few thin clay films on peds and in pores; 15 percent pebbles 2 to 20 millimeters in diameter; slightly acid (pH 6.5); gradual wavy boundary.

Bt2—26 to 40 inches; variegated reddish yellow (5YR 6/6) and yellowish red (5YR 5/8) gravelly clay loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; common moderately thick clay films on peds and in pores; 15 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

Bt3—40 to 51 inches; strong brown (7.5YR 5/6) gravelly clay loam, variegated yellowish red (5YR 5/6) and brown (7.5YR 5/4) moist; massive; hard, friable, sticky and plastic; few very fine roots; few very fine and fine tubular pores; many moderately thick clay films in pores; 15 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.3); gradual wavy boundary.

Bt4—51 to 72 inches; variegated reddish yellow (7.5YR 6/8) and strong brown (7.5YR 5/8) clay, strong brown (7.5YR 5/8) moist; massive; extremely hard, firm, sticky and plastic; few very fine and fine

tubular pores; continuous thick clay films in pores; slickensides; extremely acid.

Cr—72 inches; soft sandstone.

Thickness of the solum is 40 inches or more. The profile is more than 60 inches deep. The profile between depths of 7 and 21 inches is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 59 to 62 degrees F. The profile is 0 to 20 percent gravel throughout. Clay content of the argillic horizon increases with increasing depth and averages more than 35 percent throughout the particle size control section. Base saturation is more than 75 percent in some part of the Bt horizon.

The A horizon has color of 10YR 6/3; 7.5YR 4/4, 5/4, 5/6, or 6/4; or 5YR 5/4 or 6/4. It has moist color of 10YR 3/3 or 3/4, 7.5YR 3/4 or 4/4, or 5YR 3/3 or 3/4. The horizon is 20 to 25 percent clay. It is slightly acid or medium acid. Organic matter content is 1 to 3 percent. Where the A horizon has moist chroma of 3, it is 4 to 10 inches thick.

The Bt horizon has color of 7.5YR 4/4, 5/4, 5/6, 5/8, or 6/8 or of 5YR 5/8 or 6/6. It has moist color of 10YR 4/3, 4/4, 4/6, 5/4, or 5/6; 7.5YR 3/4, 4/4, 4/6, 5/4, 5/6, or 5/8; or 5YR 3/4, 4/4, 4/6, or 5/6. The horizon is clay loam or clay and is gravelly in some pedons. It is 35 to 55 percent clay. It is slightly acid to extremely acid and becomes more acid with increasing depth.

Some pedons have a C horizon that has color of 7.5YR 4/4, 5/4, 5/6, or 6/4. It has moist color of 10YR 4/4, 4/6, 5/4, 5/6, or 6/4 or of 7.5YR 4/4, 4/6, 5/4, or 5/6. The horizon is clay or gravelly clay and is 40 to 55 percent clay and 10 to 20 percent gravel. It is strongly acid or extremely acid.

Henneke Series

The Henneke series consists of shallow, well drained soils on hills and mountains. These soils formed in material weathered from serpentinitic rock. Slopes range from 15 to 75 percent.

The soils of the Henneke series are clayey-skeletal, serpentinitic, thermic Lithic Argixerolls.

Typical pedon of a Henneke gravelly loam in an area of Henneke-Montara complex, 15 to 50 percent slopes, 6.5 miles north of Hopland; 0.3 mile southeast of bridge over Parsons Creek on River Road (also known as East Side Road), then 300 feet east of road; 600 feet south and 4,800 feet west of northeast corner of sec. 31, T. 14 N., R. 11 W., MDBM, Purdys Gardens Quadrangle.

A—0 to 4 inches; dark brown (7.5YR 4/4) gravelly loam, dark brown (7.5YR 3/2) moist; weak coarse subangular blocky structure parting to moderate medium and coarse granular; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine irregular pores and few very fine tubular pores; 20 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.5); clear smooth boundary.

Bt1—4 to 11 inches; dark reddish brown (5YR 3/4) very gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine and fine irregular pores and few very fine, fine, and medium tubular pores; common thin and few moderately thick clay films on ped faces and bridging mineral grains; 30 percent pebbles 2 to 75 millimeters in diameter, 10 percent cobbles 75 to 250 millimeters in diameter, and 10 percent highly weathered, serpentine fragments of pebble size; neutral (pH 7.0); clear wavy boundary.

Bt2—11 to 19 inches; dark reddish brown (5YR 3/4) very gravelly clay loam, dark reddish brown (5YR 3/3) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine tubular and irregular pores; continuous moderately thick clay films bridging mineral grains and common thin clay films in pores; 35 percent pebbles 2 to 75 millimeters in diameter, 15 percent cobbles 75 to 250 millimeters in diameter, and 20 percent highly weathered serpentine fragments of pebble size; moderately alkaline (pH 8.0); abrupt wavy boundary.

R—19 inches; hard, fractured serpentine; fractures are 3 to 7 inches apart; thick continuous clay films on rock faces.

Thickness of the solum and depth to fractured serpentinitic rock are 10 to 20 inches. The profile between a depth of 6 inches and a lithic contact is dry in all parts from June to October and is moist throughout from December to May. The mean annual soil temperature is 59 to 62 degrees F. Base saturation (ammonium acetate and sum) is more than 75 percent throughout the profile. The calcium to magnesium ratio is 1:1 or less. Organic matter content is assumed to be more than 1 percent throughout the profile.

The A horizon has color of 7.5YR 4/2 or 4/4 or of 5YR 3/2 or 4/2. It has moist color of 7.5YR 3/2 or 5YR 3/2. It averages 20 to 27 percent clay and 15 to 35 percent hard rock fragments. It is neutral or mildly alkaline.

The B horizon has color of 5YR 3/2 or 3/4. It has moist color of 7.5YR 3/2 or 5YR 3/3. It is very gravelly clay loam or very gravelly clay that averages 35 to 50 percent clay. It is 35 to 60 percent hard rock fragments and 0 to 20 percent soft rock fragments. It is neutral to moderately alkaline.

Hollowtree Series

The Hollowtree series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone. Slopes range from 9 to 75 percent.

Soils of the Hollowtree series are loamy-skeletal, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Hollowtree gravelly sandy loam in an area of Holohan-Hollowtree complex, 50 to 75 percent slopes, 14.88 miles north on Bell Springs Road from its intersection with Highway 101; 900 feet south and 2,000 feet east of the northwest corner of sec. 3, T. 24 N., R. 16 W., MDBM, Bell Springs Quadrangle.

O—0.5 inch to 0; decomposed leaves and twigs mixed with gravel; gravel is 2 to 35 millimeters in diameter and covers 40 percent of the surface.

A—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; soft, very friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine and few medium tubular and interstitial pores; 15 percent pebbles 2 to 10 millimeters in diameter and 5 percent cobbles 75 to 100 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

BAt—4 to 9 inches; yellowish brown (10YR 5/4) gravelly loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and few medium and coarse tubular and interstitial pores; few thin clay films in pores; 25 percent pebbles 2 to 75 millimeters in diameter and 5 percent cobbles 75 to 125 millimeters in diameter; medium acid (pH 6.0); clear irregular boundary.

Bt—9 to 24 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine and common medium and coarse interstitial and tubular pores; common thin clay films in pores and on peds; 35 percent pebbles 2 to 75 millimeters in diameter, 10 percent cobbles 75 to 250 millimeters in diameter, and 5 percent stones; medium acid (pH 6.0); clear irregular boundary.

Ct—24 to 35 inches; light yellowish brown (10YR 6/4) extremely cobbly sandy loam, dark brown (7.5YR 3/4) moist; massive; slightly hard, friable, sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common very fine and fine interstitial and tubular pores; common thin clay films in pores; 30 percent pebbles 2 to 75 millimeters in diameter, 25 percent cobbles 75 to 250 millimeters in diameter, and 10 percent stones; medium acid (pH 6.0); clear irregular boundary.

R—35 inches; fractured sandstone; fractures are 1 to 3 inches apart; few thin clay films along faces of fractures.

Thickness of the solum and depth to a lithic contact are 20 to 40 inches. The profile between a depth of 14 inches and the lithic contact is dry in all parts from July through October in most years and is moist in all parts from November through June. The mean annual soil temperature ranges from 55 to 59 degrees F. The particle size control section averages 15 to 27 percent clay and 35 to 70 percent rock fragments.

The A horizon has color of 10YR 4/2, 5/2, 5/3, 5/4, 6/2, 6/3, 7/2, 7/3, or 7/4. It has moist color of 10YR 3/2, 3/3, 4/2, 4/3, 4/4, or 5/4 or of 7.5YR 3/2. It is gravelly sandy loam or gravelly loam and is 10 to 20 percent clay and 15 to 35 percent gravel. The A horizon is less than 7 inches thick. It is slightly acid or medium acid. Base saturation (sum) is 40 to 60 percent.

The Bt horizon has color of 10YR 5/4, 5/6, 6/4, 7/3, 7/4, or 7/6 or of 7.5YR 5/4. It has moist color of 10YR 5/4 or 5/6, 7.5YR 3/4 or 5/6, or 5YR 5/4. It is gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam and is 15 to 27 percent clay, 25 to 60 percent gravel, 0 to 10 percent cobbles, and 0 to 5 percent stones. Total rock fragment content ranges from 35 to 60 percent. The horizon is strongly acid or medium acid. Base saturation (sum) ranges from 40 to 60 percent but is less than 50 percent in some part of the horizon.

Colors of the C horizon are the same as those of the Bt horizon. The C horizon is extremely cobbly sandy loam or extremely sandy loam and is 5 to 20 percent clay and 60 to 80 percent rock fragments. It is strongly acid or medium acid.

Holohan Series

The Holohan series consists of very deep, well

drained soils on hills and mountains. These soils formed in material weathered from sandstone. Slopes range from 9 to 75 percent.

Soils of the Holohan series are loamy-skeletal, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Holohan very gravelly sandy loam in an area of Holohan-Hollowtree complex, 50 to 75 percent slopes, 14.8 miles north on Bell Springs Road from its intersection with Highway 101; 1,100 feet south and 2,200 feet east of the northwest corner of sec. 3, T. 24 N., R. 16 W., MDBM, Bell Springs Quadrangle.

O—0.5 inch to 0; partially decomposed Douglas fir needles and tanoak leaves and twigs mixed with gravel; gravel covers 10 percent of surface.

A—0 to 6 inches; brown (10YR 5/3) very gravelly sandy loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots, common medium roots, and few coarse roots; many very fine, fine, and medium interstitial and tubular pores; 30 percent pebbles and 5 percent cobbles; slightly acid (pH 6.5); clear wavy boundary.

BAt—6 to 15 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores and common very fine, fine, and medium tubular pores; 20 percent pebbles and 40 percent cobbles; medium acid (pH 6.0); clear wavy boundary.

Bt1—15 to 28 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores and common very fine tubular pores; common thin clay films on peds and in pores and few moderately thick clay films in pores and on rock faces; 40 percent pebbles and 15 percent cobbles; strongly acid (pH 5.5); gradual wavy boundary.

Bt2—28 to 43 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak very fine and fine subangular blocky structure; hard, very friable, nonsticky and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores and common very fine tubular pores; common thin clay films on peds and in pores and very few moderately thick clay films on peds; 40 percent pebbles and 15 percent cobbles; very strongly acid (pH 5.0); gradual wavy boundary.

Bt3—43 to 55 inches; very pale brown (10YR 7/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine, medium, and coarse roots; many very fine and fine interstitial pores; common thin and very few moderately thick clay films on peds; 35 percent pebbles and 10 percent cobbles; very strongly acid (pH 4.8); abrupt irregular boundary.

Ct—55 to 61 inches; very pale brown (10YR 7/4) extremely gravelly loamy sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; common thin clay films on rock faces; 70 percent pebbles and 10 percent cobbles; very strongly acid (pH 4.5); abrupt irregular boundary.

R—61 inches; hard, fractured sandstone.

Depth to a lithic contact ranges from 60 to 80 inches. The profile between a depth of 16 inches and the lithic contact is dry from July to October in most years and usually is moist in all parts from November through June. The mean annual soil temperature ranges from 55 to 59 degrees F. The particle size control section is 18 to 27 percent clay that is 35 to 70 percent rock fragments.

The A horizon has color of 10YR 5/2, 5/3, 6/2, 6/3, 6/4, 7/2, 7/3, or 7/4. It has moist color of 10YR 2/2, 3/2, 3/3, 4/2, 4/3, 4/4, 5/3, 5/4, or 5/6 or of 7.5YR 3/4. It is very gravelly sandy loam that is 10 to 20 percent clay and 35 to 60 percent rock fragments. It is slightly acid or medium acid. Base saturation (sum) ranges from 40 to 75 percent.

The Bt horizon has color of 10YR 5/3, 5/4, 6/2, 6/4, 7/2, 7/3, or 7/4. It has moist color of 10YR 3/3, 3/4, 4/3, 4/4, 5/3, 5/4, or 5/6 or of 7.5YR 4/4, 5/4, 5/6, or 5/8. The horizon is loam, sandy loam, sandy clay loam, or clay loam and is very cobbly or very gravelly in some pedons. It is 14 to 30 percent clay, 35 to 60 percent gravel, and 0 to 40 percent cobbles. Total rock fragment content is 35 to 60 percent. The horizon is very strongly acid to medium acid. Base saturation (sum) ranges from 35 to 50 percent.

The C horizon, where present, has the same colors as those of the Bt horizon. The C horizon is very

gravelly or extremely gravelly loamy sand or sandy loam. It is 5 to 15 percent clay, 45 to 80 percent gravel, and 0 to 20 percent cobbles. Total rock fragment content ranges from 45 to 90 percent. The horizon is medium acid to very strongly acid.

Hopland Series

The Hopland series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone and shale. Slopes range from 15 to 75 percent.

Soils of the Hopland series are fine-loamy, mixed, mesic Typic Haploxeralfs.

Typical pedon of Hopland loam, 50 to 75 percent slopes, 0.9 mile from Mountain House Road along the Bradford Ranch Road, past the Fountain Ranch Headquarters and old dump, about 50 feet up the hill from the road; 950 feet north and 2,750 feet east of the southwest corner of sec. 33, T. 13 N., R. 11 W., MDBM, Hopland Quadrangle.

A—0 to 5 inches; yellowish red (5YR 5/6) loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and medium tubular pores; neutral (pH 7.0); clear wavy boundary.

BAt—5 to 12 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots and common medium and coarse roots; many fine and medium tubular pores; few thin clay films in pores; medium acid (pH 6.1); clear wavy boundary.

Bt1—12 to 24 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and plastic; common fine, medium, and coarse roots; many very fine, fine, and medium tubular pores; common thin clay films in pores and as bridges between mineral grains; 5 percent pebbles 2 to 50 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

Bt2—24 to 31 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common fine and medium roots; many very fine and fine and common medium tubular pores; many thin clay films in pores and few thin clay films on peds; 12 percent pebbles 2 to 50 millimeters in diameter; slightly acid (pH 6.5); abrupt wavy boundary.

Cr—31 inches; light yellowish brown (10YR 6/4), soft, fractured sandstone and shale; fractures are 1 to 3 inches apart.

Thickness of the solum and depth to soft bedrock range from 20 to 40 inches. The profile between depths of 7 and 19 inches is dry from June to October and is moist in all parts from December to late in April. The mean annual soil temperature is 54 to 59 degrees F. Base saturation (sum) ranges from 75 to 95 percent. Gravel content commonly increases with increasing depth and ranges from 0 to 15 percent. The particle size control section is 25 to 35 percent clay.

The A horizon has color of 10YR 5/4, 6/3, or 6/4, of 7.5YR 5/6, 6/4, or 6/6, or of 5YR 5/6. It has moist color of 10YR 3/4 or 4/4, of 7.5YR 4/4 or 4/6, or of 5YR 3/6, 4/4, or 4/6. The horizon is 15 to 25 percent clay. It is neutral or slightly acid.

The Bt horizon has color of 7.5YR 5/6, 6/4, or 6/6 or of 5YR 5/6 or 6/6. It has moist color of 7.5YR 3/4, 4/4, 5/4, or 5/6 or of 5YR 4/4, 4/6, 5/4, or 5/6. It is loam or clay loam and is 20 to 35 percent clay. It is slightly acid or medium acid.

Kekawaka Series

The Kekawaka series consists of very deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone or siltstone. Slopes range from 2 to 75 percent.

Soils of the Kekawaka series are fine, kaolinitic, mesic Ultic Palexeralfs.

Typical pedon of a Kekawaka loam in an area of Sanhedrin-Kekawaka-Speaker complex, 2 to 30 percent slopes, east of Willits; in Pine Mountain Estates along Ridgewood Drive, 0.2 mile west of road fork at Manzanita Flat, 0.55 mile east of pavement's end near the culvert on the south side of the road; 1,750 feet south and 1,400 feet west of the northeast corner of sec. 26, T. 18 N., R. 13 W., MDBM, Willits NE Quadrangle.

O—1 inch to 0; decomposed leaves, pine needles, and twigs.

A—0 to 4 inches; yellowish red (5YR 5/6) loam, dark reddish brown (5YR 3/4) moist; strong fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine interstitial pores; 5 percent pebbles 2 to 8 millimeters in diameter; slightly acid (pH 6.5); abrupt smooth boundary.

Bt1—4 to 10 inches; yellowish red (5YR 5/6) clay loam, dark reddish brown (5YR 3/4) moist; strong fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine and medium roots; many very fine tubular pores and common fine and medium tubular pores; many moderately thick clay films on peds and in pores; 10 percent pebbles 2 to 10 millimeters in diameter; slightly acid (pH 6.2); clear smooth boundary.

Bt2—10 to 16 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; strong fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine and medium roots; many very fine and few fine tubular pores; many moderately thick clay films on peds and in pores; 7 percent pebbles 2 to 10 millimeters in diameter; slightly acid (pH 6.2); clear smooth boundary.

Bt3—16 to 35 inches; yellowish red (5YR 5/8) clay loam, dark red (2.5YR 3/6) moist; strong fine and medium angular blocky structure; hard, friable, slightly sticky and plastic; many very fine roots and common fine, medium, and coarse roots; many very fine tubular pores and common fine and medium tubular pores; continuous thick clay films on peds and in pores; 8 percent pebbles 2 to 7 millimeters in diameter; slightly acid (pH 6.2); gradual wavy boundary.

Bt4—35 to 61 inches; red (2.5YR 4/8) clay, red (2.5YR 4/6) moist; strong fine, medium, and coarse angular blocky structure; hard, firm, slightly sticky and plastic; common fine, medium, and coarse roots; many very fine and fine tubular pores; continuous thick clay films on peds and in pores; 12 percent pebbles 2 to 7 millimeters in diameter; slightly acid (pH 6.2).

The thickness of the solum is more than 60 inches. The profile between depths of 6 and 17 inches is dry from July to October in most years and is moist from December 15 to May 15. The mean annual soil temperature is 54 to 58 degrees F. Rock fragment content ranges from 5 to 15 percent. Clay content averages more than 35 percent in the particle size control section, and it increases with increasing depth. Base saturation (sum) ranges from 35 to 70 percent throughout the profile.

The A horizon has color of 10YR 5/4 or 6/4, 7.5YR 5/4 or 6/4, or 5YR 5/6 or 6/6. It has moist color of 10YR 3/3, 3/4, or 4/4; 7.5YR 3/2, 3/4, 4/4, or 4/6; or 5YR 3/4 or 4/4. The horizon is loam and is 20 to 27 percent clay. It is slightly acid or medium acid.

The Bt horizon has color of 7.5YR 5/6 or 7/6; 5YR 4/6, 4/8, 5/6, or 5/8; or 2.5YR 4/6 or 4/8. It has moist colors of 7.5YR 4/4, 4/6, 5/6, or 5/8; 5YR 3/4, 4/4, 4/6, or 5/8; or 2.5YR 3/6, 4/6, or 5/8. It is slightly acid to strongly acid. The upper part of the argillic horizon is clay loam, and the lower part is clay.

Kibesillah Series

The Kibesillah series consists of moderately deep, well drained soils on mountains. These soils formed in material weathered from sandstone. Slopes range from 30 to 75 percent.

Soils of the Kibesillah series are loamy-skeletal, mixed, isomesic Ultic Haplustalfs.

Typical pedon of a Kibesillah gravelly loam in an area of Yellowhound-Kibesillah complex, 50 to 75 percent slopes, 1.2 miles northwest on Threechop Road from intersection with Highway 20, 1,000 feet northeast on dirt road to roadcut on northeast-facing slope; 1,250 feet south and 2,950 feet east of the northwest corner of sec. 24, T. 18 N., R. 15 N., MDBM, Willits NW Quadrangle.

O—1 inch to 0; root mat and duff of needles, leaves, and twigs of tanoak and huckleberry.

A—0 to 3 inches; very pale brown (10YR 7/4) gravelly loam, dark brown (10YR 4/3) moist; moderate very fine, fine, and medium subangular blocky structure; soft, friable, sticky and slightly plastic; many very fine and common fine roots; common very fine and fine tubular pores; 16 percent pebbles 2 to 25 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

BAt—3 to 6 inches; light gray (10YR 7/2) gravelly loam, brown (10YR 5/3) moist; moderate fine, medium, and coarse subangular blocky structure; slightly hard, friable, sticky and nonplastic; few fine and medium roots; common very fine and fine tubular pores; few thin clay films in pores; 25 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 7.0); abrupt wavy boundary.

Bt—6 to 21 inches; white (10YR 8/2) very gravelly loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and nonplastic; common very fine roots and few fine and medium roots; many very fine interstitial pores and few very fine and fine tubular pores; common moderately thick and thick clay films on rock faces; 40 percent pebbles 2 to 75 millimeters in diameter and 20 percent cobbles 75

to 200 millimeters in diameter; slightly acid (pH 6.5); abrupt wavy boundary.

R—21 inches; fractured, hard sandstone; more than 90 percent fractured coarse fragments; roots and clay films follow fracture cracks in rock.

Depth to a lithic contact and thickness of the solum are 20 to 40 inches. The profile between depths of 11 and 34 inches (or to the lithic contract if less than 34 inches) is moist in all parts from November to June in most years and is dry in some or all parts from July to October in most years. The mean annual soil temperature is 50 to 56 degrees F. The difference between the mean summer and mean winter temperature ranges from 5 to 9 degrees.

The A horizon has color of 10YR 7/4 or 6/3. It has moist color of 10YR 4/3 or of 7.5YR 3/4 or 4/6. The horizon is gravelly loam and is 15 to 35 percent gravel and 15 to 20 percent clay. It is slightly acid or neutral.

The Bt horizon has color of 10YR 7/2 or 8/2. It has moist color of 10YR 5/3, 6/4, 4/6, or 4/4 or of 7.5YR 4/6. It is very gravelly loam or very gravelly clay loam and is 20 to 30 percent clay, 35 to 60 percent gravel, and 0 to 20 percent cobbles. Total rock fragment content is 35 to 60 percent. Base saturation (sum) is 35 to 60 percent. The horizon is medium acid or slightly acid.

Maxwell Series

The Maxwell series consists of very deep, somewhat poorly drained soils in basins and on alluvial fans. These soils formed in alluvium derived mainly from serpentinitic rock. Slope ranges from 0 to 9 percent.

Soils of the Maxwell series are fine, montmorillonitic, thermic Typic Pelloxererts.

Typical pedon of Maxwell clay, 0 to 9 percent slopes, 1.55 miles on My Ranch Road from the main gate of Inspiration Point, in Covelo; 250 feet south and 2,100 feet west of the northeast corner of sec. 31, T. 22 N., R. 12 W., MDBM, Jamison Ridge Quadrangle.

O—2 inches to 0; very dark grayish brown (10YR 3/2) duff consisting of decomposing roots, very dark brown (10YR 2/2) moist.

A1—0 to 5 inches; very dark gray (N 3/0) clay, black (N 2/0) moist; strong coarse granular structure; hard, firm, sticky and very plastic; many very fine and fine roots; many very fine and fine tubular pores; moderately alkaline (pH 8.0); clear smooth boundary.

A2—5 to 17 inches; very dark gray (N 3/0) clay, black (N 2/0) moist; strong coarse prismatic structure parting to strong medium granular; hard, firm, sticky and very plastic; many very fine, fine, and medium roots; common very fine and fine tubular pores; many pressure faces on peds; slickensides; moderately alkaline (pH 8.0); clear wavy boundary.

AC—17 to 37 inches; very dark gray (N 3/0) clay, black (N 2/0) moist; strong coarse prismatic structure parting to strong coarse angular blocky; very hard, very firm, sticky and very plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; many intersecting slickensides; 5 percent pebbles 2 to 20 millimeters in diameter; slightly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

C1—37 to 56 inches; very dark gray (N 3/0) clay, black (N 2/0) moist; strong medium prismatic structure parting to strong coarse angular blocky; very hard, very firm, sticky and very plastic; common very fine roots and few fine and medium roots; many very fine and few medium tubular pores; continuous thick intersecting slickensides; 10 percent pebbles 2 to 20 millimeters in diameter; slightly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

C2—56 to 62 inches; dark gray (5Y 4/1) clay, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and very plastic; few very fine roots; few very fine and medium and common coarse tubular pores; slickensides; 12 percent pebbles 2 to 20 millimeters in diameter; slightly effervescent; moderately alkaline (pH 8.0).

The profile is more than 60 inches deep. The profile between depths of 7 and 21 inches is dry in all parts from June to October and is moist the rest of the year. The mean annual soil temperature is 59 to 62 degrees F. Cracks open once from July to October. The profile has a calcium-to-magnesium ratio of less than 2:l. It is neutral to moderately alkaline throughout.

The A horizon has color of 10YR 4/1 or of N 3/0 or 4/0. It has moist color of 10YR 2/1 or 3/1 or of N 2/0 or 3/0. It is clay or clay loam. Slickensides are present and range from few to many with intersections.

The C horizon has color of 10YR 4/1 or 5/1, 5Y 4/1 or 5/1, or N 3/0 or 4/0. It has moist color of 10YR 4/1, 2.5Y 3/2, 5Y 4/1, or N 2/0. It is clay and is 40 to 55 percent clay and 0 to 12 percent gravel. Slickensides are present and are intersecting in all pedons.

Mayacama Series

The Mayacama series consists of moderately deep,

somewhat excessively drained soils on hills and mountains. These soils formed in material weathered from sedimentary or metasedimentary rock. Slopes range from 30 to 75 percent.

Soils of the Mayacama series are loamy-skeletal, mixed, mesic Dystric Xerochrepts.

Typical pedon of a Mayacama gravelly loam in an area of Mayacama-Hopland-Etsel complex, 30 to 75 percent slopes, in a roadcut on Pine Mountain Road, 0.4 mile south of intersection with Adobe Creek Road; 200 feet south and 1,600 feet east of the northwest corner of sec. 20, T. 12 N., R. 9 W., MDBM, Highland Springs Quadrangle.

A—0 to 4 inches; brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) moist; weak medium subangular blocky structure parting to moderate fine subangular blocky; soft, friable, slightly sticky and nonplastic; few medium and common fine roots; many very fine and few fine tubular pores; 30 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.6); clear wavy boundary.

Bt1—4 to 13 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine and fine roots and few medium roots; common fine tubular pores; few thin clay films in pores; 40 percent pebbles 2 to 75 millimeters in diameter and 5 percent cobbles 75 to 150 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

Bt2—13 to 24 inches; light brown (7.5YR 6/4) very gravelly loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine and few fine roots; common very fine and fine tubular pores; few thin clay films in pores; 45 percent pebbles 2 to 75 millimeters in diameter and 5 percent cobbles 75 to 150 millimeters in diameter; slightly acid (pH 6.5); abrupt irregular boundary.

R—24 inches; slightly metamorphosed, fractured sandstone; few very fine, fine, and medium roots along fractures; few pockets of soil material between some fractures.

Thickness of the solum is 20 to 40 inches. The profile between depths of 15 and 31 inches is dry in all parts for about 135 days from June 15 to October 30 and is moist in all parts for about 120 days from December 15 to April 15. The mean annual soil temperature is 54 to 59 degrees F. Base saturation (ammonium acetate) is 35 to 60 percent throughout the profile.

The A horizon has color of 10YR 5/3, 6/3, or 6/4 or of 7.5YR 4/4, 5/4, or 5/6. It has moist color of 10YR 4/3 or of 7.5YR 3/2 or 3/4. The horizon is 15 to 35 percent gravel. It is slightly acid or medium acid.

The B horizon has color of 10YR 4/3, 4/4, 5/3, or 6/3 or of 7.5YR 5/4, 5/6, or 6/4. It has moist color of 10YR 4/3 or of 7.5YR 3/4, 4/4, or 4/6. It is very gravelly loam, very gravelly sandy loam, or very gravelly sandy clay loam and is 35 to 60 percent rock fragments and 15 to 25 percent clay in the particle size control section. The horizon is 30 to 50 percent gravel and 5 to 20 percent cobbles. It is slightly acid or medium acid.

Maymen Series

The Maymen series consists of shallow, somewhat excessively drained soils on mountains. These soils formed in material weathered from sandstone or shale. Slopes range from 15 to 75 percent.

Soils of the Maymen series are loamy, mixed, mesic Dystric Lithic Xerochrepts.

Typical pedon of a Maymen sandy loam in an area of Maymen-Etsel-Snook complex, 30 to 75 percent slopes, 200 feet northwest of Mill Creek Road, about 1.2 miles north of Red Mountain Camp, near Ukiah; 900 feet south and 2,100 feet east of northwest corner of sec. 8, T. 14 N., R. 11 W., MDBM, Purdys Gardens Quadrangle.

A—0 to 5 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine and common fine tubular pores; slightly acid (pH 6.2); gradual wavy boundary.

Bt—5 to 11 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine roots and few fine and coarse roots; many very fine and common fine tubular pores; few thin clay films bridging sand grains; 15 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 6.0); abrupt irregular boundary.

R—11 inches; pale brown (10YR 6/3), hard, fractured sandstone that becomes harder and less fractured as depth increases.

The thickness of the solum and depth to bedrock are 10 to 20 inches. The profile between a depth of 8 inches and a lithic contact is dry in all parts from June

to October and is moist in all parts from December to May. The mean annual soil temperature is 54 to 59 degrees F. Base saturation (ammonium acetate) is 40 to 60 percent throughout the profile.

The A horizon has color of 10YR 6/3 or 6/4 or of 7.5YR 5/4 or 6/6. It has moist color of 10YR 3/4, 4/3, or 4/4 or of 7.5YR 3/4, 4/6, or 5/8. It is slightly acid or medium acid.

The B horizon has color of 10YR 6/3 or 6/4 or of 7.5YR 5/4 or 6/6. It has moist color of 10YR 4/3 or 4/4 or of 7.5YR 4/4 or 4/6. The horizon is sandy loam, loam, gravelly sandy loam, or gravelly loam. It is slightly acid or medium acid.

Maymen Variant

The Maymen Variant consists of shallow, well drained soils on hills and mountains. These soils formed in material weathered from metasedimentary rock. Slopes range from 5 to 75 percent.

Soils of the Maymen Variant are clayey, mixed, mesic, shallow Typic Haploxerults.

Typical pedon of a Maymen Variant clay loam in an area of Dunsmuir-Maymen Variant complex, 15 to 50 percent slopes, 0.9 mile east on Hearst Road from intersection with Tomki Road, near Willits; 4.9 miles north from Hearst Road on dirt road to fork 2 miles east, and 10 feet east of road in a pit; 1,100 feet south and 4,900 feet east of the northwest corner of sec. 8, T. 19 N., R. 12 W. (projected), MDBM, Brush Mountain Quadrangle.

A—0 to 2 inches; yellowish red (5YR 5/6) clay loam, dark red (2.5YR 3/6) moist; weak fine granular structure; soft, friable, slightly sticky and plastic; many very fine and fine roots and few medium and coarse roots; many very fine and fine interstitial pores and few fine tubular pores; 10 percent pebbles 2 to 25 millimeters in diameter; strongly acid (pH 5.5); abrupt wavy boundary.

Bt1—2 to 6 inches; yellowish red (5YR 5/6) clay, dark red (2.5YR 3/6) moist; strong medium subangular blocky structure parting to strong fine subangular blocky; slightly hard, very firm, sticky and plastic; many very fine, fine, and medium roots and few coarse roots; common fine tubular pores; continuous moderately thick clay films on peds and in pores and few thick clay films on peds; 5 percent pebbles 2 to 25 millimeters in diameter and 10 percent soft rock fragments 10 to 50 millimeters in diameter; strongly acid (pH 5.5); gradual wavy boundary.

Bt2—6 to 13 inches; yellowish red (5YR 5/6) clay loam, dark red (2.5YR 3/6) moist; strong fine subangular blocky structure; slightly hard, very firm, slightly sticky and plastic; few fine, medium, and coarse roots; few fine tubular pores; continuous moderately thick clay films on peds and in pores and few thick clay films on peds and rock faces; 5 percent pebbles 2 to 25 millimeters in diameter and 25 percent soft rock fragments 10 to 75 millimeters in diameter; very strongly acid (pH 5.0); gradual wavy boundary.

Cr—13 inches; soft, fractured metasedimentary sandstone; fractures 0.25 to 2.0 inches apart; few fine, medium, and coarse roots along fractures; continuous thick clay films on rock faces.

Thickness of the solum and depth to soft bedrock are 10 to 20 inches. The profile between a depth of 9 inches and a paralithic contact is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature is 52 to 59 degrees F. Base saturation ranges from 5 to 35 percent throughout the profile.

The A horizon has color of 5YR 4/6, 5/4, or 5/6. It has moist color of 7.5YR 3/4; 5YR 3/3, 3/4, or 3/6; or 2.5YR 3/6 or 4/6. The horizon is clay loam and is 27 to 35 percent clay and 0 to 15 percent gravel. It is slightly acid to strongly acid.

The Bt horizon has color of 5YR 4/6 or 5/6 or of 2.5YR 4/6. It has moist color of 5YR 3/3, 3/4, or 4/6 or of 2.5YR 3/6 or 4/6. The horizon is clay loam or clay and is gravelly in some pedons. It is 35 to 60 percent clay and 0 to 30 percent gravel. It is strongly acid or very strongly acid.

Montara Series

The Montara series consists of shallow, well drained soils on hills and mountains. These soils formed in material weathered from serpentinitic rock. Slopes range from 15 to 75 percent.

Soils of the Montara series are loamy, serpentinitic, thermic Lithic Haploxerolls.

Typical pedon of a Montara loam in an area of Henneke-Montara complex, 15 to 50 percent slopes; 5.45 miles west of the first Feliz Creek Bridge on the Old Hopland-Yorkville Road, near Hopland, and 40 feet downhill and north of the road; 2,500 feet south and 600 feet east of the northwest corner of sec. 33, T. 13 N., R. 12 W., MDBM, Hopland NW Quadrangle.

O—2 inches to 0; decayed cypress needles and twigs.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine interstitial pores; neutral (pH 7.0); clear smooth boundary.

A2—3 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; few very fine and fine tubular pores; 15 percent pebbles 2 to 10 millimeters in diameter; mildly alkaline (pH 7.5); clear wavy boundary.

A3—10 to 13 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular pores; 15 percent pebbles 2 to 10 millimeters in diameter; mildly alkaline (pH 7.8); gradual wavy boundary.

R—13 inches; fractured serpentine with cracks 3 to 6 inches apart.

The depth to fractured serpentinitic rock is 10 to 20 inches. The profile between a depth of about 4 inches and a lithic contact is dry in all parts from June to October and is moist in all parts from December to April. The mean annual soil temperature is 59 to 62 degrees F. The calcium to magnesium ratio is 1:1 or less. Base saturation (ammonium acetate and sum) is more than 50 percent throughout the profile.

The A horizon has color of 10YR 3/1, 3/2, 4/1, 4/2, or 4/3. It has moist color of 10YR 2/1, 2/2, 3/1, or 3/2. The horizon is loam or clay loam and is 20 to 30 percent clay. It is neutral to moderately alkaline.

Nashmead Series

The Nashmead series consists of deep, well drained soils on mountains. These soils formed in material weathered from sandstone or shale. Slopes range from 30 to 75 percent.

Soils of the Nashmead series are loamy-skeletal, mixed, mesic Ultic Argixerolls.

Typical pedon of a Nashmead gravelly sandy loam in an area of Nashmead-Woodin gravelly sandy loams, 30 to 50 percent slopes, 3 miles north on private road from end of Spyrock Road, to a roadcut on a north-facing roadbank; about 25 miles north of Laytonville; 2,800 feet north and 2,500 feet west of southeast corner of sec. 30, T. 24 N., R. 14 W., MDBM, Updegraff Ridge Quadrangle.

O—1 inch to 0; decomposed roots, leaves, and twigs mixed with gravel.

A—0 to 11 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; common very fine tubular pores; 17 percent pebbles 2 to 50 millimeters in diameter and 3 percent cobbles 75 to 150 millimeters in diameter; neutral (pH 6.7); gradual wavy boundary.

Bt1—11 to 24 inches; pale brown (10YR 6/3) very gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular pores; common thin clay films in pores; 30 percent pebbles 2 to 75 millimeters in diameter and 10 percent cobbles 75 to 150 millimeters in diameter; neutral (pH 7.2); gradual wavy boundary.

Bt2—24 to 34 inches; light yellowish brown (2.5Y 6/4) very cobbly loam, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular pores and few medium tubular pores; common thin clay films in pores; 25 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; neutral; gradual wavy boundary.

BC—34 to 51 inches; light yellowish brown (2.5Y 6/4) very cobbly sandy clay loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; few very fine and fine interstitial pores; 30 percent pebbles 2 to 75 millimeters in diameter and 30 percent cobbles 75 to 150 millimeters in diameter; neutral (pH 6.7); clear wavy boundary.

R—51 inches; hard, fractured sandstone; fractures are 1 to 4 inches apart.

Depth to a lithic contact is 40 to 60 inches. The profile between depths of 10 and 30 inches is dry in all parts from June to October and is moist in all parts from

December to May. The mean annual soil temperature is 54 to 59 degrees F. Organic matter content to a depth of 10 inches is assumed to be more than 1 percent. Base saturation (ammonium acetate) is 50 to 90 percent throughout the profile and is less than 75 percent (sum) in some part of the upper 30 inches. Reaction is neutral or slightly acid throughout the profile.

The A horizon has color of 10YR 5/2 or 5/3 or of 2.5Y 4/2 or 5/2. It has moist color of 10YR 3/1, 3/2, or 3/3 or of 2.5Y 3/2. It is gravelly sandy loam and is 10 to 20 percent clay, 15 to 30 percent gravel, and 5 to 10 percent cobbles.

The Bt horizon has color of 10YR 6/3 or 6/4 or of 2.5Y 6/2 or 6/4. It has moist color of 10YR 4/3, 4/4, or 5/4 or of 2.5Y 4/2, 4/4, or 5/4. It is very gravelly loam, very gravelly sandy loam, very gravelly sandy clay loam, very cobbly loam, or very cobbly sandy clay loam and is 15 to 27 percent clay, 10 to 30 percent gravel, and 10 to 35 percent cobbles. Total rock fragment content ranges from 35 to 60 percent.

The BC or C horizon, where present, is similar to the Bt horizon in color, texture, and total rock fragment content. The BC or C horizon has weaker structure and fewer clay films.

Neuns Series

The Neuns series consists of moderately deep, well drained soils on mountains. These soils formed in material weathered from schist, shale, or sandstone. Slopes range from 8 to 75 percent.

Soils of the Neuns series are loamy-skeletal, mixed, mesic Dystric Xerochrepts.

Typical pedon of a Neuns very gravelly loam in an area of Bluenose-Neuns-Gudgrey complex, 30 to 50 percent slopes; 3.4 miles north of Eel River bridge at Hearst, on road to Eden Valley, about 500 feet past corrals and 40 feet uphill from road; 200 feet north and 300 feet east of the southwest corner of sec. 3, T. 19 N., R. 12 W., MDBM, Brush Mountain Quadrangle.

A—0 to 5 inches; grayish brown (10YR 5/2) very gravelly loam, very dark brown (10YR 2/2) moist; moderate very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and common coarse roots; many very fine and fine interstitial pores; 50 percent pebbles 2 to 40 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

Bw1—5 to 14 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine interstitial pores; 60 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.2); gradual wavy boundary.

Bw2—14 to 29 inches; very pale brown (10YR 7/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; 55 percent pebbles 2 to 75 millimeters in diameter and 5 percent cobbles 75 to 250 millimeters in diameter; medium acid (pH 6.0); gradual irregular boundary.

R—29 inches; fractured, hard sandstone.

The depth to a lithic contact ranges from 20 to 40 inches. The profile between depths of 10 and 28 inches or to a lithic contact is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 47 to 54 degrees F. Base saturation (ammonium acetate) is less than 60 percent below a depth of 10 inches. Rock fragment content ranges from 35 to 60 percent and averages more than 35 percent in the particle size control section. Reaction is slightly acid to strongly acid throughout the profile.

The A horizon has color of 2.5Y 6/2; 10YR 4/2, 5/2, 5/3, or 6/3; or 7.5YR 5/2, 5/4, or 6/2. It has moist color of 2.5Y 3/2; 10YR 2/2, 3/2, 3/3, or 4/3; or 7.5YR 3/2 or 3/4.

The Bw horizon has color of 2.5Y 6/2 or 7/4; 10YR 5/3, 5/4, 6/3, 6/4, or 7/3; or 7.5YR 4/4, 5/4, or 6/4. It has moist color of 2.5Y 4/2 or 5/4; 10YR 4/3, 4/4, 5/3, or 5/4; or 7.5YR 3/4, 4/4, or 5/4. It is very gravelly loam or very gravelly sandy loam.

Ornbaun Series

The Ornbaun series consists of deep, well drained soils on mountains. These soils formed in material weathered from sandstone. Slopes range from 9 to 75 percent.

Soils of the Ornbaun series are fine-loamy, mixed, isomesic Ultic Haplustalfs.

Typical pedon of an Ornbaun loam in an area of Ornbaun-Zeni loams, 30 to 50 percent slopes, 1.6 miles north on Irmulco Road from intersection with Highway 20 and 100 yards southwest on logging road, on

roadcut; 1,300 feet south and 150 feet west of northeast corner of sec. 24, T. 18 N., R. 15 W., MDBM, Willits NW Quadrangle.

O—1 inch to 0; fresh and decomposed litter of redwood and Douglas fir needles and tanoak leaves.

A1—0 to 4 inches; pale brown (10YR 6/3) loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots, common fine roots, and few medium roots; few very fine tubular and interstitial pores; 10 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.8); gradual wavy boundary.

A2—4 to 9 inches; light yellowish brown (10YR 6/4) loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and many fine roots; few very fine tubular and interstitial pores; 10 percent pebbles 2 to 75 millimeters in diameter; strongly acid (pH 5.4); gradual wavy boundary.

Bt1—9 to 19 inches; very pale brown (10YR 7/3) gravelly clay loam, light yellowish brown (10YR 6/4) moist; weak coarse angular and subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots and common coarse roots; few very fine interstitial pores and few fine tubular pores; few thin clay films on peds and in pores; 15 percent pebbles 2 to 75 millimeters in diameter; strongly acid (pH 5.2); gradual wavy boundary.

Bt2—19 to 31 inches; reddish yellow (7.5YR 6/6) gravelly clay loam, strong brown (7.5YR 5/6) moist; moderate medium and coarse angular blocky structure; hard, very firm, sticky and plastic; few fine and medium roots and common coarse roots; few very fine interstitial pores and few fine tubular pores; common moderately thick clay films on peds; 25 percent pebbles 2 to 75 millimeters in diameter; strongly acid (pH 5.2); gradual wavy boundary.

Bt3—31 to 42 inches; reddish yellow (7.5YR 6/6) gravelly clay loam, strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and many coarse roots; few very fine interstitial pores; many thin and moderately thick clay films on peds; 35 percent pebbles 2 to 75 millimeters in diameter; very strongly acid (pH 5.0); clear wavy boundary.

Cr—42 inches; fractured sandstone; cracks 1 to 2 millimeters wide; few fine roots and many moderately thick clay films in fractures; rock slakes in water.

Depth of a paralithic contact and thickness of the solum range from 40 to 60 inches. The profile between depths of 6 and 17 inches is moist in all parts from November to June and is dry in some parts the rest of the year. The mean annual soil temperature is 50 to 56 degrees F. The difference between the mean summer and mean winter temperature is less than 9 degrees. The particle size control section averages from 27 to 35 percent clay. Base saturation (sum) ranges from 40 to 75 percent throughout the soil.

The A horizon has color of 10YR 5/4, 6/2, 6/3, or 6/4. It has moist color of 10YR 3/3, 3/4, 4/3, 4/4, 5/3, or 5/4 or of 7.5YR 3/2. The horizon is loam and is 15 to 25 percent clay and 0 to 10 percent gravel. It is slightly acid to strongly acid.

The Bt horizon has color of 10YR 6/4, 6/6, 7/3, or 7/4 or of 7.5YR 6/4, 6/6, 7/4, or 7/6. It has moist color of 10YR 4/6 or 6/4 or of 7.5YR 4/4, 4/6, 5/6, 6/4, 6/6, or 7/6. The horizon is 27 to 40 percent clay and 5 to 35 percent soft rock fragments. It is medium acid to very strongly acid.

Pardaloe Series

The Pardaloe series consists of deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone, siltstone, or shale. Slopes range from 30 to 75 percent.

Soils of the Pardaloe series are loamy-skeletal, mixed, mesic Typic Xerochrepts.

Typical pedon of a Pardaloe gravelly loam in an area of Casabonne-Wohly-Pardaloe complex, 50 to 75 percent slopes, 3,300 feet south and 1,500 feet west of the northeast corner of sec. 25, T. 15 N., R. 14 W., MDBM, Boonville NE Quadrangle.

O—0.5 inch to 0; conifer needles, tanoak leaves, and twigs.

A—0 to 10 inches; dark yellowish brown (10YR 3/4) gravelly loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine tubular pores and common fine and medium tubular pores; few thin silt coatings in pores and on peds; 16 percent pebbles 2 to 20 millimeters in diameter; slightly acid (pH 6.5); gradual wavy boundary.

Bw1—10 to 27 inches; pale brown (10YR 6/3) very

gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine and fine tubular pores and many very fine and fine interstitial pores; 60 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

2Bw2—27 to 47 inches; light yellowish brown (2.5Y 6/4) very gravelly loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores and many very fine and fine interstitial pores; common thin silt coatings in pores; 55 percent pebbles 2 to 75 millimeters in diameter and 3 percent cobbles 75 to 150 millimeters in diameter; medium acid (pH 5.6); gradual wavy boundary.

2Bw3—47 to 58 inches; light yellowish brown (2.5Y 6/4) very gravelly loam, light olive brown (2.5Y 5/4) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine, fine, and coarse roots and common medium roots; many very fine and common fine tubular pores; 40 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 5.6); clear wavy boundary.

R—58 inches; siltstone; fractures are 0.5 inch to 2.0 inches apart; few silt coatings on fractures.

Depth to a lithic contact is 40 to 60 inches. The profile between depths of 10 and 38 inches is dry from July to October in most years and usually is moist the rest of the year. The mean annual soil temperature ranges from 54 to 59 degrees F. The particle size control section is 15 to 27 percent clay and 35 to 60 percent rock fragments. Reaction is medium acid or slightly acid. Organic matter content is assumed to be less than 1 percent within 10 inches of the surface.

The A horizon has color of 10YR 3/4, 4/4, or 5/4 or of 7.5YR 3/4 or 4/4. It has moist color of 10YR 3/2 or 3/3 or of 7.5YR 3/2, 3/3, or 4/2. It is gravelly loam and is 15 to 25 percent clay and 15 to 35 percent gravel. Base saturation (ammonium acetate) is 40 to 60 percent.

The Bw horizon has color of 10YR 6/3, 6/4, or 7/4 or of 2.5Y 6/4. It has moist color of 10YR 3/3, 4/3, 4/4, or 5/4; 7.5YR 5/6, 5/4, or 4/4; or 2.5Y 4/4 or 5/4. The horizon is very gravelly loam, very gravelly sandy loam, or very gravelly sandy clay loam. It is 35 to 60 percent gravel and 0 to 20 percent cobbles. Total coarse fragment content is 35 to 60 percent. Base saturation (ammonium acetate) is 50 to 90 percent below a depth of 10 inches.

Pinnobie Series

The Pinnobie series consists of very deep, well drained soils on terraces. These soils formed in alluvium derived from sedimentary rock. Slopes range from 0 to 15 percent.

Soils of the Pinnobie series are fine-loamy, mixed, thermic Ultic Haploxerolls.

Typical pedon of Pinnobie loam, 0 to 2 percent slopes; 0.4 mile west on Parducci Road from State Street, in Ukiah, and 350 feet north of road; 2,550 feet south and 3,700 feet west of the northeast corner of sec. 31, T. 16 N., R. 12 W., MDBM, Ukiah Quadrangle.

Ap—0 to 11 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots and few coarse roots; common very fine and fine and few medium interstitial and tubular pores; 5 percent pebbles 2 to 25 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

BA—11 to 26 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/6) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and common fine tubular pores; few granular gray coatings on peds; 5 percent rounded pebbles 2 to 25 millimeters in diameter; slightly acid (pH 6.5); gradual wavy boundary.

Bw—26 to 42 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/6) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.8); clear wavy boundary.

C1—42 to 48 inches; variegated light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/6) loam, dark yellowish brown (10YR 4/6) and grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores; few thin clay films on peds; few granular gray coatings on peds; slightly acid (pH 6.5); gradual wavy boundary.

C2—48 to 60 inches; variegated light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/8) clay loam, dark yellowish brown (10YR 4/6) and grayish brown (10YR 5/2) moist; massive; hard, firm, slightly sticky and plastic; few fine roots; few very fine, fine, and medium tubular pores; neutral (pH 7.0).

Thickness of the solum is 40 to 60 inches. Thickness of the profile is more than 60 inches. Where not irrigated, the profile between depths of 5 and 18 inches is dry in all parts from June to October and is moist in all parts from December through May. The mean annual soil temperature is 59 to 61 degrees F. Base saturation (sum) is 50 to 75 percent in the upper 30 inches and is more than 50 percent (ammonium acetate) below a depth of 30 inches. Organic matter content to a depth 10 inches is 1 to 2 percent. Reaction is slightly acid or neutral throughout the profile.

The A horizon has color of 10YR 5/3 or 7.5YR 5/3. It has moist color of 10YR 3/3 or 7.5YR 3/3. It is 18 to 27 percent clay and 5 to 10 percent gravel.

The B horizon has color of 10YR 5/4 or 6/4 or of 7.5YR 6/4. It has moist color of 10YR 3/4, 4/4, or 4/6 or of 7.5YR 4/4 or 4/6. It is loam or sandy clay loam and is gravelly in some pedons. It is 18 to 30 percent clay and 5 to 20 percent gravel.

The C horizon is variegated and has color of 10YR 4/6, 5/3, 5/4, 5/6, 5/8, or 6/4. It has moist color of 10YR 4/4, 4/6, or 5/2 or of 7.5YR 3/3. It is loam, sandy clay loam, or clay loam and is gravelly in some pedons. It is 18 to 30 percent clay and 5 to 25 percent gravel.

Pinole Series

The Pinole series consists of very deep, well drained soils on terraces. These soils formed in alluvium derived from sedimentary rock. Slopes range from 0 to 30 percent.

Soils of the Pinole series are fine-loamy, mixed, thermic Ultic Argixerolls.

Typical pedon of Pinole gravelly loam, 2 to 8 percent slopes, 1 mile north on Tomki Road from the Eastside-Westside Road intersection, 0.4 mile northwest on dirt farm road, 0.3 mile east on side road to vineyards, and 150 feet east of vineyard road, in Redwood Valley; 1,650 feet south and 750 feet west of the northeast corner of sec. 18, T. 17 N., R. 12 W., MDBM, Redwood Valley Quadrangle.

O—0.5 inch to 0; roots and decomposed grass material.

A—0 to 10 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; common very fine, fine, medium, and coarse tubular and interstitial pores; 15 percent pebbles 2 to 25 millimeters in diameter; neutral (pH 6.8); clear wavy boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine and common fine, medium, and coarse tubular and interstitial pores; few thin clay films on peds and in pores; 10 percent pebbles 2 to 25 millimeters in diameter; neutral (pH 6.8); gradual wavy boundary.

Bt2—15 to 37 inches; variegated strong brown (7.5YR 5/6) and yellow (10YR 7/6) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure parting to strong fine subangular blocky; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and common fine and medium interstitial and tubular pores; many moderately thick clay films on peds and in pores; 10 percent pebbles 2 to 25 millimeters in diameter; slightly acid (pH 6.5); gradual wavy boundary.

Bt3—37 to 61 inches; variegated strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) sandy clay loam, variegated dark brown (7.5YR 3/4) and brown (7.5YR 4/4) moist; strong fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular and interstitial pores; common moderately thick clay films on peds and in pores; 5 percent pebbles 2 to 25 millimeters in diameter; few black (N 2/0) manganese stains; slightly acid (pH 6.2).

Thickness of the solum is more than 60 inches. Where not irrigated, the profile between depths of 8 and 23 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature varies from 59 to 61 degrees F. Organic matter content to a depth of 10 inches is 1 to 3 percent. Coarse fragment content in the particle size control section is 5 to 35 percent.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3 or of 7.5YR 4/3, 5/2, or 5/3. It has moist color of 10YR 3/2 or 3/3 or of 7.5YR 3/2 or 3/3. It is gravelly loam or very gravelly loam and is 18 to 25 percent clay and 15 to 40 percent gravel. It is 10 to 16 inches thick. Base saturation (ammonium acetate) ranges from 50 to 70 percent. It is neutral or slightly acid.

The Bt horizon has color of 10YR 4/4, 5/4, 6/4, 6/6, or 7/6 or of 7.5YR 4/4, 5/4, 5/6, or 5/8. It has moist color of 10YR 3/4, 4/3, or 4/4 or of 7.5YR 3/4, 4/3, 4/4, or 4/6. It is sandy clay loam or clay loam and is gravelly

or very gravelly in some pedons. It is 20 to 35 percent clay and 5 to 50 percent gravel. Gravel commonly occurs in lenses 3 to 6 inches thick below a depth of 30 inches. The Bt horizon is medium acid to neutral.

Redvine Series

The Redvine series consists of very deep, well drained soils on dissected terraces. These soils formed in old alluvium derived from sedimentary rock. Slopes range from 2 to 30 percent.

Soils of the Redvine series are fine, mixed, thermic Ultic Palexeralfs.

Typical pedon of Redvine sandy clay loam, 15 to 30 percent slopes, on a north-facing convex slope of 20 percent; in a roadcut on the south side of Road A, 0.15 mile northwest of intersection of Roads A and B; 2,850 feet north and 5,700 feet east of the southwest corner of sec. 14, T. 16 N. R. 12 W., MDBM, Ukiah Quadrangle.

A—0 to 3 inches; reddish brown (5YR 5/3) sandy clay loam, dark reddish brown (5YR 3/2) moist; strong fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; many very fine roots and few fine and medium roots; common very fine tubular pores and many very fine interstitial pores; 7 percent pebbles 2 to 5 millimeters in diameter; slightly acid (pH 6.5); abrupt wavy boundary.

ABt—3 to 8 inches; variegated yellowish red (5YR 5/6) and light gray (10YR 7/2) sandy clay loam, reddish brown (5YR 4/4) and pale brown (10YR 6/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine, common medium, and few coarse tubular pores; few thin clay films in pores and on peds; 5 percent pebbles 2 to 5 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

Bt1—8 to 14 inches; yellowish red (5YR 4/6) clay loam, dark reddish brown (2.5YR 3/4) moist; strong fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine and common medium tubular pores; common moderately thick clay films in pores and on peds; 5 percent pebbles 2 to 5 millimeters in diameter; slightly acid (pH 6.5); abrupt wavy boundary.

Bt2—14 to 30 inches; yellowish red (5YR 5/8) clay, dark red (2.5YR 3/6) moist; strong coarse prismatic structure parting to strong medium and coarse angular blocky; very hard, firm, sticky and plastic; common very fine and coarse roots and many fine and medium roots; many very fine and fine and few medium tubular pores; continuous thick clay films in pores and on peds; 7 percent pebbles 2 to 25 millimeters in diameter; strongly acid (pH 5.5); gradual wavy boundary.

Bt3—30 to 50 inches; yellowish red (5YR 5/8) clay, red (2.5YR 4/6) moist; strong fine and medium angular blocky structure; very hard, firm, sticky and plastic; common very fine, medium, and coarse roots; common very fine and fine tubular pores; continuous thick clay films in pores and on peds; 7 percent pebbles 2 to 25 millimeters in diameter; very strongly acid (pH 4.5); gradual smooth boundary.

Bt4—50 to 62 inches; variegated yellowish red (5YR 5/8) and reddish yellow (5YR 6/6) clay, variegated yellowish red (5YR 5/8) and red (2.5YR 4/6) moist; moderate fine and medium angular blocky structure; very hard, firm, sticky and plastic; common very fine and few fine roots; many very fine and common fine tubular pores; many thick clay films in pores and on peds; 7 percent pebbles 2 to 25 millimeters in diameter and highly weathered, soft rock fragments; very strongly acid (pH 4.5).

Thickness of the solum and the depth to old alluvium are more than 60 inches. The profile between depths of 7 and 20 inches is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 59 to 61 degrees F. The particle size control section averages 35 to 50 percent clay and 0 to 10 percent coarse fragments. Base saturation (sum) ranges from 35 to 45 percent at a depth of 1.25 meters below the top of the Bt horizon.

The A horizon has color of 5YR 5/3, 5/4, 5/6, or 6/4 or of 7.5YR 5/4. It has moist color of 5YR 3/2, 3/4, 4/4, 4/6, or 5/6 or of 7.5YR 3/2 or 4/4. It is strongly acid to slightly acid.

The Bt horizon has color of 2.5YR 3/6 or 4/6; 5YR 3/6, 4/6, 5/4, 5/6, 5/8, 6/4, or 6/6; or 7.5YR 5/4 or 6/6. It has moist color of 2.5YR 3/4, 3/6, 4/6, or 4/8; 5YR 3/4, 4/4, 4/6, 5/6, or 5/8; or 7.5YR 3/4, 4/4, 4/6, 5/4, 5/6, or 5/8. The horizon is clay loam or clay and is 30 to 60 percent clay. It is very strongly acid to slightly acid.

Russian Series

The Russian series consists of very deep, well

drained soils on flood plains and low stream terraces. These soils formed in alluvium derived from sedimentary rock. Slopes range from 0 to 2 percent.

Soils of the Russian series are coarse-loamy, mixed, thermic Cumulic Haploxerolls.

Typical pedon of Russian loam, 0 to 2 percent slopes, on a protected flood plain 1,000 feet west of the Russian River and 700 feet north of Vichy Springs Road, 0.25 mile east of bridge near Ukiah; lat. 39°9'20" N., long. 123°11'13" W. (nonsectionized); Ukiah Quadrangle.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and few fine and medium tubular pores; neutral (pH 6.8); clear smooth boundary.

A2—8 to 25 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and coarse roots and common fine roots; common very fine and few fine and medium tubular pores; silt coatings on peds and in pores; neutral (pH 7.0); clear smooth boundary.

A3—25 to 38 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine, medium, and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and few fine and medium tubular pores; silt coatings on peds and in pores; neutral (pH 7.0); abrupt smooth boundary.

C—38 to 60 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and slightly plastic; few very fine and coarse roots and common fine and medium roots; common very fine and fine and few medium tubular pores; neutral (pH 7.0).

The profile is more than 60 inches deep. Where not irrigated, the profile between depths of 6 and 18 inches is dry from June through October and usually is moist from December through April. The mean annual soil temperature is 59 to 62 degrees F. Organic matter content is 1 to 4 percent to a depth of 21 to 38 inches, and it decreases irregularly with increasing depth. Base saturation (ammonium acetate) ranges from 60 to 100 percent throughout the profile but is more than 75 percent (sum) throughout the upper 30 inches. Reaction is slightly acid to mildly alkaline throughout the profile.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. It has moist color of 10YR 3/2 or 3/3.

The C horizon has color of 10YR 4/3, 5/2, 5/3, or 6/3. It has moist color of 10YR 3/2, 3/3, 4/2, or 4/3. The horizon dominantly is stratified loam, silt loam, or very fine sandy loam and is 10 to 18 percent clay. In some pedons it is stratified gravelly sandy loam and very gravelly sand below a depth of 30 inches.

Sanhedrin Series

The Sanhedrin series consists of deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone and siltstone. Slopes range from 2 to 75 percent.

Soils of the Sanhedrin series are fine-loamy, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Sanhedrin gravelly loam in an area of Sanhedrin-Kekawaka-Speaker complex, 2 to 30 percent slopes; 500 feet north and 2,500 feet east of the southwest corner of sec. 4, T. 22 N., R. 11 W., MDBM, Newhouse Ridge Quadrangle.

O—2 inches to 0; decomposing pine needles, twigs, and cones.

A—0 to 13 inches; brown (10YR 4/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure and moderate fine and medium granular; soft, very friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine and few medium tubular pores; 15 percent pebbles 2 to 20 millimeters in diameter; medium acid (pH 6.0); clear smooth boundary.

Bt1—13 to 23 inches; yellowish brown (10YR 5/4) gravelly loam, brown (10YR 4/3) moist; strong very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and common fine tubular pores; common thin clay films on peds; 20 percent pebbles 2 to 20 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

Bt2—23 to 32 inches; yellowish brown (10YR 5/6) gravelly clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine, common fine, and

few medium tubular pores; many thin clay films on peds and common moderately thick clay films in pores; 25 percent pebbles 2 to 20 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

Bt3—32 to 43 inches; yellowish brown (10YR 5/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and many fine and medium roots; many very fine and fine and few medium tubular pores; many thin clay films on peds and in pores; 20 percent pebbles 2 to 50 millimeters in diameter and 8 percent cobbles 75 to 150 millimeters in diameter; strongly acid (pH 5.5); gradual wavy boundary.

R—43 inches; hard, interbedded sandstone and siltstone; fractures are 0.5 to 2.0 inches apart; pockets of clay are present in some fractures.

The thickness of the solum and depth to bedrock are 40 to 60 inches. The profile between depths of 8 and 24 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature is 52 to 58 degrees F. Rock fragment content ranges from 15 to 35 percent throughout the profile.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3 or of 7.5YR 5/2 or 5/4. It has moist color of 10YR 3/2 or 3/3 or of 7.5YR 3/3. The horizon is slightly acid or medium acid. It is 18 to 25 percent clay.

The Bt horizon has color of 10YR 5/4, 5/6, or 6/4; 7.5YR 5/4, 5/6, or 6/4; or 5YR 4/6 or 5/6. It has moist color of 10YR 4/3 or 5/4; 7.5YR 3/4, 4/4, 4/6, or 5/6; or 5YR 4/4 or 4/6. Base saturation (ammonium acetate) is 35 to 50 percent. The horizon is gravelly loam or gravelly clay loam and is 25 to 35 percent clay. It is slightly acid to strongly acid.

Shortyork Series

The Shortyork series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from schist, shale, or graywacke. Slopes range from 9 to 75 percent.

Soils of the Shortyork series are loamy-skeletal, mixed, thermic Ultic Argixerolls.

Typical pedon of a Shortyork gravelly loam in an area of Shortyork-Yorkville-Witherell complex, 15 to 30 percent slopes, on the north edge of Simmerly Flat, east of Covelo; 150 feet south and 2,150 feet east of the northwest corner of sec. 2, T. 22 N., R. 12 W., MDBM, Covelo East Quadrangle.

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and interstitial pores; 15 percent pebbles 2 to 8 millimeters in diameter; slightly acid (pH 6.0); abrupt wavy boundary.

Ap2—4 to 7 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 15 percent pebbles 2 to 8 millimeters in diameter; slightly acid (pH 6.0); abrupt wavy boundary.

BA—7 to 11 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; strong very fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine and fine interstitial pores; 50 percent pebbles 2 to 25 millimeters in diameter and 10 percent cobbles 75 to 150 millimeters in diameter; strongly acid (pH 6.0); clear smooth boundary.

Bt—11 to 28 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, dark yellowish brown (10YR 3/4) moist; weak fine prismatic structure parting to strong fine angular blocky; hard, firm, sticky and plastic; many very fine and few fine roots; many very fine and fine tubular pores; continuous moderately thick clay films on peds and in pores; 40 percent pebbles 2 to 50 millimeters in diameter; slightly acid (pH 6.1); gradual wavy boundary.

R—28 inches; fractured graywacke and schist; fractures are 0.25 inch apart.

Thickness of the solum and depth to a lithic contact are 20 to 40 inches. The profile between the depths of 8 and 22 inches is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 59 to 61 degrees F. The mollic epipedon is 7 to 19 inches thick. Organic matter content is 1 to 3 percent. The particle size control section averages 27 to 35 percent clay.

The A horizon has color of 10YR 4/2, 5/1, 5/2, or 5/3 or of 2.5Y 5/2. It has moist color of 10YR 2/2, 3/1, 3/2, or 3/3 or of 2.5Y 3/2. It is medium acid to neutral. Rock fragment content ranges from 15 to 35 percent. Base

saturation (ammonium acetate and sum) ranges from 50 to 70 percent.

The Bt horizon has color of 10YR 4/2, 5/1, 5/2, 5/3, 6/2, 6/3, or 6/4 or of 2.5Y 5/2 or 6/2. It has moist color of 10YR 3/1, 3/2, 3/3, 3/4, 4/2, 4/3, or 4/4 or of 2.5Y 2/2, 3/2, or 4/2. The horizon is 27 to 35 percent clay and 35 to 60 percent rock fragments. It ranges from strongly acid to slightly acid. Base saturation (ammonium acetate and sum) ranges from 50 to 90 percent.

Snook Series

The Snook series consists of very shallow, somewhat excessively drained soils on hills and mountains. These soils formed in material weathered from sandstone or shale. Slopes range from 30 to 75 percent.

Soils of the Snook series are loamy, mixed, nonacid, thermic Lithic Xerorthents.

Typical pedon of a Snook gravelly loam in an area of Maymen-Etsel-Snook complex, 30 to 75 percent slopes; 300 feet northwest off Mill Creek Road, about 1.2 miles north of Red Mountain Camp, near Ukiah; 800 feet south and 2,100 feet east of the northwest corner of sec. 8, T. 14 N., R. 11 W., MDBM, Purdys Gardens Quadrangle.

A—0 to 5 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots and few medium roots; many very fine interstitial pores; 20 percent pebbles 2 to 20 millimeters in diameter; 80 percent of the surface is covered with pebbles 2 to 20 millimeters in diameter; medium acid (pH 5.6); abrupt wavy boundary.

R—5 inches; fractured sandstone; fractures 0.5 to 5.0 inches apart; roots penetrate some fractures.

Depth to bedrock ranges from 4 to 10 inches. The profile at the lithic contact is dry from May to October and is moist the rest of the year. The mean annual soil temperature ranges from 59 to 61 degrees F. Gravel content ranges from 15 to 25 percent, and clay content ranges from 10 to 25 percent. Reaction is medium acid or slightly acid throughout the profile.

The A horizon has color of 10YR 6/2, 6/3, or 6/4 or of 7.5YR 6/2, 6/3, or 6/4. It has moist color of 10YR 3/3, 4/3, or 4/4 or of 7.5YR 4/3 or 4/4.

Speaker Series

The Speaker series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone, shale, or siltstone. Slopes range from 2 to 75 percent.

Soils of the Speaker series are fine-loamy, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Speaker gravelly loam in an area of Sanhedrin-Kekawaka-Speaker complex, 2 to 30 percent slopes; 30 feet northwest of Mexico Ridge Road, 150 feet northeast of its intersection with Etsel Ridge Road, 8.5 miles (by air) east of Covelo; 1,000 feet south and 1,500 feet east of the northwest corner of sec. 9, T. 22 N., R. 11 W., MDBM, Newhouse Ridge Quadrangle.

O—1 inch to 0; pine needles, bark, twigs, and decomposed litter.

A—0 to 6 inches; variegated brown (7.5YR 5/4) and dark grayish brown (10YR 4/2) gravelly loam, dark brown (10YR 3/3) moist; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and common fine tubular pores; 20 percent pebbles 2 to 20 millimeters in diameter; strongly acid (pH 5.5); clear wavy boundary.

Bt1—6 to 16 inches; reddish yellow (7.5YR 6/6) clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common very fine, fine, and medium tubular pores; common moderately thick clay films on peds and in pores; 10 percent pebbles 2 to 15 millimeters in diameter; very strongly acid (pH 4.8); clear smooth boundary.

Bt2—16 to 24 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 4/6) moist; common medium and coarse angular blocky structure; hard, firm, slightly sticky and plastic; many fine, medium, and coarse roots; many very fine, fine, medium, and coarse tubular pores; many moderately thick clay films on peds and in pores; 10 percent soft rock fragments; very strongly acid (pH 4.8); abrupt wavy boundary.

R—24 inches; fractured sandstone; cracks are 1 to 4 inches apart and have yellowish red (5YR 4/6) clay films.

Thickness of the solum and depth to a lithic contact are 20 to 40 inches. The profile between depths of 8 and 19 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature is 52 to 58 degrees F.

Rock fragment content is 10 to 35 percent throughout the profile. Base saturation (sum) is 35 to 50 percent.

The A horizon has color of 10YR 4/2, 5/2, 5/3, 5/4, or 6/4 or of 7.5YR 5/4. Moist colors are 10YR 3/2, 3/3, 3/4, or 4/4; 7.5YR 3/2, 3/3, or 3/4; or 5YR 3/4, 4/3, or 4/4. The horizon is slightly acid to strongly acid.

The Bt horizon has color of 10YR 5/4; 7.5YR 5/4, 6/4, or 6/6; or 5YR 5/6 or 6/6. Moist colors are 10YR 3/4; 7.5YR 3/4, 4/4, or 4/6; or 5YR 4/6. The horizon is clay loam or gravelly clay loam and is 27 to 35 percent clay. It is medium acid to very strongly acid.

The Speaker soils in this survey area have higher temperatures than are defined in the range of the series as mapped elsewhere. They also have a lithic contact instead of a paralithic contact. These differences, however, do not significantly affect their use and management.

Squawrock Series

The Squawrock series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone. Slopes range from 15 to 75 percent.

Soils of the Squawrock series are loamy-skeletal, mixed, thermic Mollic Haploxeralfs.

Typical pedon of a Squawrock cobbly loam in an area of Hopland-Witherell-Squawrock complex, 30 to 50 percent slopes, 1 mile south on Highway 101 from the Boonville-Ukiah cutoff, 0.8 mile west from Highway 101 on farm road, near Ukiah; 1,800 feet north and 200 feet west of southeast corner of sec. 8, T. 14 N., R. 12 W., MDBM, Elledge Peak Quadrangle.

A—0 to 7 inches; yellowish brown (10YR 5/4) cobbly loam, dark brown (7.5YR 3/4) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and few fine and medium tubular pores; common thin silt coatings on peds and in pores; 15 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; medium acid (pH 5.8); gradual wavy boundary.

Bt1—7 to 16 inches; yellowish brown (10YR 5/4) extremely cobbly loam, dark brown (7.5YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine, fine, and medium tubular pores; common thin clay films in pores and on rock fragments; 15 percent pebbles 2 to 75 millimeters in diameter and 55 percent cobbles 75 to 120 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

Bt2—16 to 21 inches; very pale brown (10YR 7/4) very gravelly loam, dark brown (7.5YR 4/4) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; common very fine tubular pores; common thin clay films in pores; 60 percent pebbles 2 to 50 millimeters in diameter; medium acid (pH 5.8); abrupt wavy boundary.

R—21 inches; fractured (fractolithic) sandstone; fractures are 3 to 6 inches apart; does not slake in water.

Thickness of the solum and depth to a lithic contact are 20 to 40 inches. The profile between depths of 10 and 31 inches or to the lithic contact is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 59 to 62 degrees F.

The A horizon has color of 10YR 6/4, 6/3, 6/2, or 5/4. It has moist color of 10YR 4/4, 4/3, 3/3, or 3/2 or of 7.5YR 3/4. It has 12 to 25 percent clay and is medium acid to neutral. Rock fragment content ranges from 15 to 35 percent.

The Bt horizon has color of 10YR 7/4, 7/2, or 5/4. It has moist color of 10YR 5/4, 4/3, 4/2, or 3/4 or of 7.5YR 4/4. The horizon is very gravelly, very cobbly, or extremely cobbly loam, very gravelly or very cobbly clay loam, or very gravelly sandy clay loam and is 20 to 35 percent clay. It is medium acid or slightly acid. Rock fragment content ranges from 35 to 75 percent.

Talmage Series

The Talmage series consists of very deep, somewhat excessively drained soils on alluvial fans and plains. These soils formed in alluvium derived from various kinds of rock. Slopes range from 0 to 2 percent.

Soils of the Talmage series are loamy-skeletal, mixed, thermic Fluventic Haploxerolls.

Typical pedon of Talmage gravelly sandy loam, 0 to 2 percent slopes, in the northwest corner of a small pasture, 400 feet south of the intersection of Millcreek Road and East Side Road, on the Rehabilitation Center grounds on East Side Road, south of Talmage; lat. 39°7′52″ N., long. 123°10′2″ W. (nonsectionized); Ukiah Quadrangle.

A1—0 to 9 inches; brown (10YR 5/3) gravelly sandy

loam, very dark grayish brown (10YR 3/2) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine and few fine and medium tubular pores; 25 percent pebbles 2 to 50 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

A2—9 to 19 inches; brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine and few fine roots; common very fine and few fine and medium tubular pores; 50 percent pebbles 2 to 150 millimeters in diameter; neutral (pH 6.6); gradual wavy boundary.

C1—19 to 33 inches; yellowish brown (10YR 5/4) very gravelly coarse sandy loam, dark brown (10YR 4/3) moist; massive; loose, nonsticky and nonplastic; common very fine roots; few very fine, fine, and medium tubular pores; 60 percent pebbles and cobbles 2 to 200 millimeters in diameter; neutral (pH 6.8); gradual wavy boundary.

C2—33 to 66 inches; yellowish brown (10YR 5/4) very gravelly coarse loamy sand, dark brown (10YR 4/3) moist; massive; loose, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; 40 percent pebbles and cobbles 2 to 200 millimeters in diameter; neutral (pH 7.0).

The profile is more than 60 inches deep. Rock fragment content averages 35 to 60 percent in the particle size control section. The profile is dry in all parts from June to October if not irrigated. It is moist in all parts from December through April. Reaction is medium acid or mildly alkaline. Textures are stratified throughout the profile.

The A horizon has color of 10YR 5/3, 5/2, or 4/2. It has moist color of 10YR 3/3 or 3/2 or of 7.5YR 3/2. This horizon has more than 1 percent organic matter to a depth of 10 inches. It is gravelly sandy loam or very gravelly sandy loam.

The C horizon has color of 10YR 5/3, 5/4, or 6/4 or of 7.5YR 6/4. It has moist color of 10YR 4/3 or 4/4 or of 7.5YR 4/4. The upper part of the C horizon is stratified very gravelly loam to very gravelly coarse sandy loam, and the lower part is very gravelly loamy sand to very gravelly coarse sand.

Tyson Series

The Tyson series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from shale or sandstone. Slopes range from 30 to 75 percent.

Soils of the Tyson series are loamy-skeletal, mixed, mesic Typic Xerumbrepts.

Typical pedon of a Tyson very gravelly loam in an area of Tyson-Updegraff complex, 30 to 50 percent slopes, 150 feet east of Forest Road 1 N 02, 0.5 mile south of intersection of Forest Road 1 N 02 and Mexico Ridge Road (23 N 18) on Etsel Ridge, near Covelo; 2,400 feet south and 1,700 feet west of the northeast corner of sec. 9, T. 22 N., R. 11 W., MDBM, Newhouse Ridge Quadrangle.

O—1 inch to 0; oak leaves and twigs.

A—0 to 7 inches; brown (10YR 5/3) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine, medium, and coarse granular structure; soft, very friable, nonsticky and slightly plastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; 35 percent pebbles 2 to 15 millimeters in diameter and 5 percent cobbles 75 to 150 millimeters in diameter; slightly acid; (pH 6.5); clear smooth boundary.

AB—7 to 13 inches; yellowish brown (10YR 5/4) gravelly loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; 30 percent pebbles 2 to 15 millimeters in diameter; strongly acid (pH 5.5); abrupt smooth boundary.

Bw—13 to 24 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and few fine tubular pores; 50 percent pebbles 2 to 15 millimeters in diameter; very strongly acid (pH 4.5); abrupt smooth boundary.

R—24 inches; fractured shale; fractures are 1/8 inch apart.

Thickness of the solum and depth to bedrock are 20 to 40 inches. The profile between depths of 5 and 15 inches is dry in all parts from June to October and is moist in all parts from December to May. The mean annual soil temperature is 49 to 55 degrees F. Base saturation (ammonium acetate) is less than 50 percent in some horizons. Organic matter content ranges from 2 to 10 percent.

The A horizon has color of 10YR 4/1, 4/2, 5/2, or 5/3

or of 2.5Y 4/1, 4/2, 5/2, or 5/3. It has moist color of 10YR 2/1, 2/2, 3/2, or 3/3 or of 2.5Y 2/2, 3/2, or 3/3. It is gravelly or very gravelly loam and is 18 to 27 percent clay. Rock fragment content ranges from 20 to 60 percent. The horizon is neutral or slightly acid. Base saturation ranges from 45 to 85 percent.

The B horizon has color of 10YR 5/3, 5/4, 6/2, 6/3, or 6/4 or of 2.5Y 5/2, 5/4, or 6/4. It has moist color of 10YR 3/3, 3/4, 4/3, or 4/4 or of 2.5Y 4/2 or 4/4. It is very gravelly loam or very gravelly clay loam and is 20 to 30 percent clay and 35 to 60 percent rock fragments. Base saturation ranges from 40 to 70 percent. The horizon is medium acid to very strongly acid.

Updegraff Series

The Updegraff series consists of deep, well drained soils on hills and mountains. These soils formed in material weathered from graywacke, schist, sandstone, or shale. Slopes range from 15 to 75 percent.

Soils of the Updegraff series are fine-loamy, mixed, mesic Ultic Argixerolls.

Typical pedon of an Updegraff loam in an area of Updegraff-Sanhedrin complex, 15 to 50 percent slopes, about 1.5 miles due south of Finney Lake, near Willits; 0.6 mile northeast from intersection, 0.7 mile southwest to jeep trail and 0.4 mile east on jeep trail crossing small intermittent creek; 1,000 feet south and 250 feet west of the northeast corner of sec. 22, T. 18 N., R. 13 W., MDBM, Willits NE Quadrangle.

O—1 inch to 0; decomposed leaves and twigs.

A1—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, nonsticky and nonplastic; many very fine and common fine roots; many very fine, common fine, and few medium tubular pores; 5 percent pebbles 2 to 20 millimeters in diameter; neutral (pH 7.0); gradual wavy boundary.

A2—7 to 12 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots and few fine, medium, and coarse roots; many very fine and fine tubular pores and few very fine interstitial pores; neutral (pH 6.8); clear wavy boundary.

Bt1—12 to 16 inches; light yellowish brown (10YR 6/4) clay loam, dark brown (10YR 3/3) moist; strong coarse and very coarse subangular blocky structure parting to strong medium subangular blocky; slightly hard, friable, slightly sticky and plastic; common fine roots and few very fine, medium, and coarse roots; few very fine, fine, and coarse tubular pores; slightly acid (pH 6.8); gradual wavy boundary.

Bt2—16 to 22 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; strong coarse and very coarse subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores and few fine interstitial pores; many moderately thick clay films on peds and in pores; 5 percent pebbles 2 to 15 millimeters in diameter and 5 percent cobbles 75 to 150 millimeters in diameter; slightly acid (pH 6.5); gradual wavy boundary.

Bt3—22 to 36 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, very firm, slightly sticky and plastic; few fine roots; few fine tubular pores; many moderately thick clay films in pores and on peds; 10 percent pebbles 2 to 10 millimeters in diameter; medium acid (pH 6.0); gradual wavy boundary.

Bt4—36 to 45 inches; grayish brown (10YR 5/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; very hard, very firm, slightly sticky and plastic; few fine and medium roots; few very fine and fine tubular pores; many moderately thick clay films in pores and on peds; 5 percent soft rock fragments 2 to 30 millimeters in diameter; neutral (pH 6.8).

R—45 inches; fractured schist and graywacke.

The depth to bedrock is 40 to 60 inches. The profile between depths of 6 and 18 inches is dry in all parts from July to October and is moist in all parts from December through May. The mean annual soil temperature ranges from 49 to 59 degrees F. Organic matter content is 1 to 5 percent to a depth of 10 inches. The base saturation (sum) ranges from 60 to 90 percent throughout the profile and is less than 75 percent in some part of the upper 30 inches. A stone line is present in most pedons between depths of 10 and 24 inches. It contains 5 to 30 percent gravel 2 to 75 millimeters in diameter and 5 to 10 percent cobbles 75 to 150 millimeters in diameter. The particle size control section averages 30 to 35 percent clay and 5 to 30 percent rock fragments. Reaction is medium acid to neutral throughout the profile.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3. It has moist color of 10YR 3/2 or 3/3.

The Bt horizon has color of 10YR 4/4, 5/2, 5/3, 5/4,

6/3, or 6/4 or of 7.5YR 5/4. It has moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3, 4/4, 5/2, or 5/4 or of 7.5YR 3/4 or 4/4. It is sandy clay loam, clay loam, or gravelly clay loam and is 20 to 40 percent clay and 0 to 35 percent rock fragments.

The BCt or Ct horizon, where present, has colors and textures similar to those of the Bt horizon. It has weaker structure and fewer clay films.

Witherell Series

The Witherell series consists of shallow, somewhat excessively drained soils on hills and mountains. These soils formed in material weathered from sandstone. Slopes range from 9 to 75 percent.

Soils of the Witherell series are loamy, mixed, thermic Lithic Xerochrepts.

Typical pedon of a Witherell sandy loam in an area of Witherell-Hopland-Squawrock complex, 50 to 75 percent slopes, 75 feet uphill from the turnout on Orr Springs Road, 1.5 miles west of North State Street, near Ukiah; 275 feet south and 1,300 feet west of the northeast corner of sec. 12, T. 15 N., R. 13 W., MDBM, Ukiah Quadrangle.

A—0 to 2 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine interstitial pores; 5 percent pebbles 2 to 60 millimeters in diameter; neutral (pH 6.7); clear smooth boundary.

AB—2 to 7 inches; yellowish brown (10YR 5/4) sandy loam, variegated dark brown (7.5YR 3/4) and brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine and few fine and medium tubular pores; few silt flows; 5 percent pebbles 2 to 60 millimeters in diameter; slightly acid (pH 6.2); clear wavy boundary.

Bt—7 to 12 inches; reddish yellow (7.5YR 6/6) sandy loam, variegated dark brown (7.5YR 3/4) and brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine and few fine and medium tubular pores; few thin clay films in pores; 12 percent pebbles 2 to 60 millimeters in diameter; slightly acid (pH 6.2).

R—12 inches; fractured sandstone; fractures are 0.5 to 1.5 inches apart; about half the fractures are lined with silt coatings.

The thickness of the solum and depth to a lithic contact are 10 to 20 inches. The profile between a depth of 8 inches and bedrock is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 59 to 61 degrees F. Rock fragment content ranges from 5 to 25 percent. Base saturation (ammonium acetate) ranges from 45 to 75 percent.

The A horizon has color of 10YR 5/3, 5/4, 6/3, or 6/4 or of 7.5YR 5/4, 5/6, or 6/4. It has moist color of 10YR 3/3, 3/4, 4/3, or 4/4 or of 7.5YR 3/4 or 4/4. It is slightly acid or neutral.

The B horizon has color of 10YR 5/4, 6/3, 6/4, or 7/4 or of 7.5YR 6/4, 6/6, or 7/4. It has moist color of 10YR 3/3, 3/4, 4/3, or 4/4 or of 7.5YR 3/4, 4/4, or 4/6. It is loam, gravelly loam, or sandy loam and is 12 to 27 percent clay. It is slightly acid to strongly acid. Clay content is less than 1.2 times that of the A horizon.

Wohly Series

The Wohly series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone or shale. Slopes range from 9 to 75 percent.

Soils of the Wohly series are fine-loamy, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Wohly loam in an area of Casabonne-Wohly loams, 30 to 50 percent slopes, 1,000 feet southeast at the end of the right fork of a private road, 0.8 mile northwest of Mountain House Road on Highway 128, about 6 miles south of Hopland; 700 feet north and 1,200 feet west of the southeast corner of sec. 18, T. 12 N., R. 11 W., MDBM, Hopland Quadrangle.

A1—0 to 5 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure parting to granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; few fine tubular pores; 5 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

A2—5 to 11 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure parting to granular; slightly hard, friable, sticky and slightly plastic; common very fine and fine roots and few medium roots; 12 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

Bt1—11 to 17 inches; light reddish brown (5YR 6/4)

gravelly clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine and fine roots, many medium roots, and few coarse roots; common very fine and fine tubular pores; common thin clay films in pores; 15 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 6.8); clear wavy boundary.

Bt2—17 to 24 inches; reddish yellow (5YR 6/8) gravelly clay loam, variegated reddish brown (5YR 4/4) and yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; common thin clay films in pores and on peds; 20 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

Cr—24 inches; red, fractured sandstone; fractures are 0.5 to 3.0 inches apart and have dark red (2.5YR 3/6, moist) soil material in them.

Thickness of the solum and depth to a paralithic contact range from 20 to 40 inches. The profile between depths of 6 and 17 inches is dry in all parts from July to September and is moist in all parts from November to May. Base saturation (ammonium acetate and sum) is 50 to 75 percent throughout. The profile is medium acid to neutral throughout.

The A horizon has color of 10YR 5/4; 7.5YR 6/3, 7/4, or 5/4; or 5YR 6/4. It has moist color of 10YR 3/4; 7.5YR 3/3, 3/4, or 4/4; or 5YR 4/4. Gravel content is 0 to 15 percent.

The Bt horizon has color of 7.5YR 5/4 or 6/6 or of 5YR 6/4 or 6/8. It has moist color of 7.5YR 3/4, 4/4, or 4/6 or of 5YR 4/4, 4/6, or 5/6. It is clay loam, sandy clay loam, or gravelly clay loam and is 25 to 35 percent clay and 10 to 35 percent gravel.

Woodin Series

The Woodin series consists of moderately deep, well drained soils on hills and mountains. These soils formed in material weathered from sandstone. Slopes range from 30 to 75 percent.

Soils of the Woodin series are loamy-skeletal, mixed, mesic Dystric Xerochrepts.

Typical pedon of a Woodin gravelly sandy loam in an area of Maymen-Woodin-Etsel complex, 50 to 75 percent slopes; 0.8 mile east on Bear Pen Canyon Road from Highway 101 and 1,000 feet north uphill from road; 200 feet north and 500 feet east of the southeast corner of sec. 1, T. 21 N., R. 15 W., MDBM, Laytonville Quadrangle.

O—1.5 inches to 0; slightly decomposed needles and twigs.

A—0 to 7 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; 20 percent pebbles 2 to 50 millimeters in diameter; neutral (pH 7.0); clear wavy boundary.

Bw1—7 to 15 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine, fine, and medium tubular and interstitial pores; 15 percent pebbles 2 to 50 millimeters in diameter and 25 percent cobbles 75 to 250 millimeters in diameter; neutral (pH 7.0); gradual wavy boundary.

Bw2—15 to 23 inches; yellowish brown (10YR 5/4) very cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; few very fine and fine interstitial pores; 10 percent pebbles 2 to 50 millimeters in diameter and 35 percent cobbles 75 to 250 millimeters in diameter; slightly acid (pH 6.5); clear wavy boundary.

R—23 inches; hard, fractured sandstone.

Thickness of the solum and depth to bedrock are 20 to 40 inches. The profile between depths of 10 and 31 inches is dry from July through September and is moist in all parts from November through May. The mean annual soil temperature is 54 to 59 degrees F. Reaction is strongly acid to neutral. Rock fragment content in the particle size control section ranges from 35 to 60 percent.

The A horizon has color of 10YR 4/3, 5/2, 5/3, 6/3, or 6/4 or of 7.5YR 5/4 or 6/4. It has moist color of 10YR 3/2, 3/3, 3/4, 4/2, or 4/3 or of 7.5YR 3/4 or 4/4. A gravelly mulch 1 to 3 inches thick is on the surface in some areas.

The B horizon has color of 10YR 5/4, 5/6, or 6/3 or of 7.5YR 5/4, 5/6, or 6/4. It has moist color of 10YR 3/4, 4/3, or 4/4 or of 7.5YR 3/4, 4/4, or 5/6. It is very gravelly or very cobbly loam, very gravelly sandy clay loam, or very gravelly or very cobbly sandy loam and is 15 to 25 percent clay.

Xerochrepts

Xerochrepts are moderately deep to very deep, well drained soils on mountains and dissected stream

terraces. These soils formed in material weathered from ultramafic intrusive rock such as peridotite or serpentinite or in alluvium derived from various kinds of rock. Slopes range from 5 to 75 percent.

Reference pedon of Xerochrepts in an area of Xerochrepts, 5 to 50 percent slopes, 0.3 mile west of Kettenpom Store on Kettenpom-Alderpoint Road, 0.15 mile north on dirt road, 10 feet west of road; 1,800 feet north and 1,900 feet west of southeast corner of sec. 35, T. 3 S., R. 6 E., Humboldt Base and Meridian, Zenia Quadrangle.

O—2 inches to 0; decomposed needles and twigs.

A—0 to 4 inches; reddish brown (5YR 5/4) gravelly loam, dark reddish brown (2.5YR 3/4) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few coarse roots; many very fine and fine interstitial pores; 20 percent pebbles 2 to 75 millimeters in diameter and 10 percent cobbles 75 to 100 millimeters in diameter; mildly alkaline (pH 7.5); clear wavy boundary.

Bw—4 to 16 inches; reddish brown (5YR 5/4) very gravelly clay loam, dark reddish brown (2.5YR 3/4) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; slightly smeary; common very fine, fine, and medium roots and few coarse roots; many very fine and fine interstitial pores; 30 percent pebbles 2 to 75 millimeters in diameter and 15 percent cobbles 75 to 250 millimeters in diameter; mildly alkaline (pH 7.5); clear irregular boundary.

BC—16 to 30 inches; strong brown (7.5YR 5/6) extremely cobbly sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, very friable, sticky and plastic; common very fine and fine roots; many very fine and fine interstitial pores; 25 percent pebbles 2 to 75 millimeters in diameter, 50 percent cobbles 75 to 250 millimeters in diameter, and 10 percent stones; moderately alkaline (pH 7.5); clear irregular boundary.

Cr—30 to 35 inches; reddish yellow (7.5YR 6/6), soft rock fragments, strong brown (7.5YR 4/6) crushed and moist; massive; few very fine and fine roots along rock fractures; moderately alkaline (pH 7.5); abrupt irregular boundary.

R—35 inches; fractured, hard peridotite.

Thickness of the solum ranges from 20 to 60 inches. The profile in the moisture control section is dry in all parts from July to October in most years and is moist in all parts from November to June. The mean annual soil temperature ranges from 53 to 59 degrees F. Base saturation (sum) ranges from 35 to 90 percent throughout the profile. Reaction is slightly acid to mildly alkaline.

The A horizon has color of 10YR 4/4, 5/4, 6/3, or 6/4; 5YR 5/4; or 2.5YR 4/4 or 5/4. It has moist color of 10YR 3/3, 3/4, 4/4, or 5/4; 7.5YR 3/2 or 3/4; or 2.5YR 3/4 or 3/6. It is loam or gravelly loam and is 18 to 27 percent clay, 15 to 30 percent gravel, and 0 to 10 percent cobbles or stones. Total rock fragment content is 15 to 35 percent.

The Bw horizon has color of 10YR 5/6, 6/4, 6/6, or 7/4; 7.5YR 4/6, 5/4, 5/6, or 6/6; or 5YR 5/4. It has moist color of 2.5Y 5/4; 10YR 3/6, 4/4, 4/6, or 5/6; 7.5YR 4/4 or 4/6; 5YR 4/4 or 4/6; or 2.5YR 3/4 or 3/6. It is gravelly loam or sandy loam; very gravelly loam, sandy loam, or clay loam; or very cobbly loam, sandy loam, sandy clay loam, or clay loam. It is 15 to 40 percent clay, 15 to 40 percent gravel, and 0 to 15 percent cobbles and stones. Total rock fragment content ranges from 15 to 60 percent.

In some profiles there is a BC, C, or Cr layer. Colors are the same as those of the Bw horizon. Texture is the same as that of the Bw horizon; is extremely cobbly clay loam, very stony clay loam, or extremely stony clay loam; or is soft rock fragments. The horizon is 15 to 60 percent cobbles and stones and 2 to 60 percent gravel. Total rock fragment content ranges from 35 to 90 percent.

Xerofluvents

Xerofluvents are very deep, well drained to excessively drained soils on flood plains. These soils formed in recent alluvium derived from sedimentary rock. Slopes range from 0 to 2 percent.

Reference pedon of Xerofluvents, 0 to 2 percent slopes, on a protected flood plain, 520 feet west of the Russian River, 3,150 feet east of Highway 101 on the main farm road of Windsor Vineyard, 1.1 miles north of the junction of Highway 101 and Highway 175; lat. 38°59′27″ N., long. 123°6′28″ W. (nonsectionized), Hopland Quadrangle.

Ap—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common fine and very fine roots; many very fine interstitial pores and

common very fine and fine tubular pores; 5 percent pebbles 5 to 15 millimeters in diameter; neutral (pH 7.0); abrupt smooth boundary.

A2—5 to 9 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; 5 percent pebbles 5 to 15 millimeters in diameter; neutral (pH 7.0); abrupt wavy boundary.

A3—9 to 15 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) moist; strong coarse angular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine roots flattened along ped faces; common very fine and fine tubular pores; neutral (pH 7.2); abrupt wavy boundary.

C1—15 to 29 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; 10 percent pebbles 5 to 15 millimeters in diameter; neutral (pH 7.2); abrupt wavy boundary.

C2—29 to 48 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; common fine prominent dark yellowish brown (10YR 4/6, moist) mottles in upper 2 inches; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots and common fine and medium roots; many very fine and fine tubular pores; neutral (pH 7.2); abrupt wavy boundary.

C3—48 to 60 inches; light brownish gray (10YR 6/2) sand, very dark grayish brown (10YR 3/2) moist; single grain; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; mildly alkaline (pH 7.4).

The profile is more than 60 inches deep. Frequent to rare periods of flooding occur for very brief to very long periods of time after heavy rainstorms. The mean annual soil temperature is 59 to 62 degrees F. Organic matter content decreases irregularly with increasing depth.

The A horizon has hue of 10YR or 7.5YR, value of 5 to 8, and chroma of 1 to 3. Where moist, it has hue of 10YR, value of 3 to 7, and chroma of 1 to 4.

The C horizon has moist and dry colors similar to those of the A horizon. The C horizon is highly stratified with layers of sand, loamy sand, sandy loam, loam, gravel, or stones and boulders. It is slightly acid to mildly alkaline. Where there is frequent ponding, mottling extends throughout the profile.

Yellowhound Series

The Yellowhound series consists of deep, well drained soils on mountains. These soils formed in material weathered from sandstone or conglomerate. Slope ranges from 30 to 75 percent.

Soils of the Yellowhound series are loamy-skeletal, mixed, isomesic Ultic Haplustalfs.

Typical pedon of a Yellowhound very gravelly loam in an area of the Yellowhound-Kibesillah complex, 50 to 75 percent slopes, 5.75 miles west from Highway 101 on Reeves Canyon Road, 100 feet south on skid trail to roadcut; 1,200 feet west and 400 feet north of the southeast corner of sec. 30, T. 17 N., R. 13 W., MDBM, Willits SE Quadrangle.

A—0 to 6 inches; light brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and common fine roots; many very fine and fine interstitial pores; 45 percent pebbles 2 to 5 millimeters in diameter; medium acid (pH 5.6); clear wavy boundary.

AB—6 to 15 inches; variegated light brown (7.5YR 6/4) and reddish yellow (5YR 6/6) loam, variegated brown (7.5YR 4/4) and dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine and few fine tubular pores; many silt flows; 8 percent pebbles 2 to 25 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

Bt—15 to 31 inches; variegated very pale brown (10YR 7/4) and reddish yellow (7.5YR 6/6) very gravelly loam, variegated brown (7.5YR 4/4) and yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine and common medium tubular pores; few thin clay films on peds and in pores; many silt flows; 40 percent pebbles 5 to 75 millimeters in diameter and 15 percent cobbles 75 to 150 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

2BC—31 to 58 inches; variegated very pale brown (10YR 7/4) and reddish yellow (7.5YR 7/6) extremely gravelly sandy clay loam, strong brown

(7.5YR 5/6) moist; massive; slightly hard, friable, slightly sticky and plastic; few very fine, fine, and medium roots; many very fine and fine and few medium tubular pores; 70 percent pebbles 2 to 50 millimeters in diameter; medium acid (pH 5.6) abrupt wavy boundary.

R—58 inches; strongly weathered conglomerate.

Depth to a lithic contact is 40 to 60 inches. The mean annual soil temperature is 50 to 56 degrees F. The difference between the mean summer and mean winter soil temperature is less than 9 degrees. The profile between depths of 6 and 28 inches is moist in all parts from November to June and is dry in some parts the rest of the year. The particle size control section averages 20 to 30 percent clay. The profile is slightly acid or medium acid.

The A horizon has color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4, or 7/3 or of 7.5YR 6/4. It has moist color of 10YR 3/2, 3/3, 4/3, 4/4, or 5/4 or of 7.5YR 3/2 or 4/4. It is very gravelly loam or loam.

The Bt horizon has color of 10YR 5/4, 6/2, 6/3, 6/4, 7/3, or 7/4 or of 7.5YR 6/6 or 7/6. In some pedons, matrix color is variegated with 5YR 6/6. The horizon has moist color of 10YR 4/4, 5/4, 5/6, or 5/8 or of 7.5YR 4/4 or 5/6. In some pedons matrix color is variegated with 5YR 3/4 or 4/6. The horizon is very gravelly loam, very gravelly clay loam, very gravelly sandy clay loam, or extremely gravelly sandy clay loam and is 15 to 30 percent clay and 35 to 80 percent gravel. Some profiles do not have the lithologic discontinuity at a depth of about 30 inches.

The BC or C horizon, where present, has the same colors and textures as those of the Bt horizon.

Yokayo Series

The Yokayo series consists of very deep, well drained soils on old dissected terraces. These soils formed in old alluvium derived from sedimentary rock. Slopes range from 0 to 30 percent.

Soils of the Yokayo series are fine, mixed, thermic Typic Palexeralfs.

Typical pedon of Yokayo sandy loam, 15 to 30 percent slopes, on an east-facing slope, 1,500 feet northwest of Yokayo Ranch, near Ukiah; 300 feet north and 4,200 feet east of the southwest corner of sec. 31, T. 16 N., R. 12 W., MDBM, Ukiah Quadrangle.

A—0 to 8 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores; 5 percent pebbles 2 to 75 millimeters in diameter and 5 percent cobbles 75 to 150 millimeters in diameter; medium acid (pH 6.0); abrupt wavy boundary.

Bt1—8 to 18 inches; light yellowish brown (10YR 6/4) clay, light olive brown (2.5Y 5/4) moist; moderate coarse prismatic structure parting to strong medium and coarse angular blocky; very hard, very firm, very sticky and very plastic; common very fine and few fine roots; few very fine tubular pores; common thin clay films on peds; 5 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

Bt2—18 to 32 inches; light yellowish brown (10YR 6/4) clay loam, variegated dark yellowish brown (10YR 4/4) and brown (10YR 4/3) moist; moderate fine, medium, and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; few very fine tubular pores; common thin clay films on peds; 5 percent pebbles 2 to 75 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

Bt3—32 to 48 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine, fine, medium, and coarse roots; few very fine tubular pores; common moderately thick clay films on peds; 10 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.2); clear wavy boundary.

C—48 to 60 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 10 percent pebbles 2 to 75 millimeters in diameter; slightly acid (pH 6.5).

Thickness of the solum averages 30 to 50 inches, and depth to semiconsolidated sediment is more than 60 inches. The profile between depths of 8 and 22 inches is dry from June to October in most years and usually is moist the rest of the year. The mean annual soil temperature is 59 to 61 degrees F. The clay increase from the A horizon to the Bt horizon ranges from 15 to 20 percent within a vertical distance of 1 inch or from 20 to 30 percent within 3 inches. Base saturation (sum) is more than 75 percent throughout the B horizon.

The A horizon has color of 10YR 6/2, 6/3, or 6/4. It has moist color of 10YR 3/2, 3/3, 4/2, 4/3, 5/4, or 5/6.

The horizon is 12 to 20 percent clay, 2 to 10 percent gravel, and 0 to 5 percent cobbles. It is medium acid or slightly acid.

The Bt horizon has color of 10YR 6/3, 6/4, 6/6, 7/3, or 7/4 or of 2.5Y 6/4 or 7/4. It has moist color of 10YR 4/2, 4/3, 4/4, 5/4, 5/6, or 6/3 or of 2.5Y 4/4, 5/4, or 5/6. It is clay loam or clay and is 35 to 50 percent clay and 0 to 12 percent gravel. It is medium acid to neutral.

The C horizon has color of 10YR 6/3, 6/4, 6/6, 7/2, 7/4, or 7/6 or of 2.5Y 7/2 or 7/4. It has moist color of 10YR 4/2, 4/3, 4/4, 5/4, 5/6, or 6/6 or of 2.5Y 5/4, 5/6, or 7/4. Some pedons have variegated colors. The horizon is loam, sandy clay loam, or clay loam and is 22 to 35 percent clay and 0 to 12 percent gravel. It is slightly acid or neutral.

Yorktree Series

The Yorktree series consists of deep, well drained soils on hills and mountains. These soils formed in material weathered from graywacke, shale, sandstone, or siltstone. Slopes range from 15 to 75 percent.

Soils of the Yorktree series are fine, mixed, mesic Ultic Argixerolls.

Typical pedon of a Yorktree loam in an area of Yorktree-Hopland-Woodin complex, 30 to 50 percent slopes; 100 feet west upslope of Pine Ridge Road, 1 mile south of the intersection of Pine Ridge and Low Gap Roads; 1,800 feet north and 2,200 feet east of the southwest corner of sec. 15, T. 15 N., R. 13 W., MDBM, Boonville NE Quadrangle.

A1—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots and few medium roots; many very fine and fine tubular pores and few coarse tubular pores; neutral (pH 6.6); clear wavy boundary.

A2—5 to 12 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium angular and subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores and few coarse tubular pores; few thin silt flows; medium acid (pH 5.8); clear wavy boundary.

2AB—12 to 18 inches; yellowish brown (10YR 5/4) gravelly loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; few thin silt flows; 25 percent pebbles 35 to 75 millimeters in diameter and 5 percent cobbles 75 to 175 millimeters in diameter; medium acid (pH 5.8); clear wavy boundary.

2Bt1—18 to 24 inches; brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist, dark brown (10YR 4/3) moist and crushed; strong fine subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots and common very fine and coarse roots; many very fine and fine tubular pores and common medium tubular pores; common thin clay films in pores and on peds; 25 percent gravel 35 to 75 millimeters in diameter and 5 percent cobbles 75 to 175 millimeters in diameter; medium acid (pH 6.0); clear wavy boundary.

2Bt2—24 to 42 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist, dark brown (10YR 4/3) moist and crushed; moderate medium subangular blocky structure parting to moderate fine angular blocky; very hard, very firm, sticky and plastic; few very fine, fine, and coarse roots and common medium roots; many very fine and fine tubular pores; many moderately thick clay films in pores and on peds; slickensides; 10 percent pebbles 10 to 20 millimeters in diameter; neutral (pH 6.6); gradual wavy boundary.

2Bt3—42 to 51 inches; brown (10YR 5/3) gravelly clay loam, very dark grayish brown (10YR 3/2) moist, brown (10YR 4/3) moist and crushed; moderate fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; common very fine roots; many very fine and common fine tubular pores; many moderately thick clay films in pores and on peds; 25 percent pebbles 35 to 75 millimeters in diameter; slightly acid (pH 6.4); clear wavy boundary.

R—51 inches; fractured graywacke; fractures are 1 to 3 inches apart.

Thickness of the solum is 40 to 60 inches. The profile between depths of 6 and 15 inches is dry from July to October in most years and usually is moist the rest of the year. The mean annual soil temperature ranges from 50 to 59 degrees F. The base saturation (sum) of the upper 75 centimeters ranges from 60 to 90 percent. A stone line occurs in most pedons between depths of 10 and 24 inches. The profile is 15 to 30 percent gravel 2 to 75 millimeters in diameter and 5 to 10 percent cobbles 75 to 150 millimeters in diameter. The particle

size control section is 35 to 50 percent clay and 5 to 35 percent rock fragments. Reaction is medium acid to neutral throughout the profile.

The A horizon dominantly has color of 10YR 4/2, 4/3, 5/2, or 5/3, but in some pedons it has color of 10YR 5/4 in the lower part. It has moist color of 10YR 3/2 or 3/3.

The Bt horizon has color of 10YR 4/4, 5/3, 5/4, or 6/3 or of 7.5YR 5.4. It has moist color of 10YR 3/2, 3/3, 4/2, 4/3, or 4/4 or of 7.5YR 3/4 or 4/4. It is clay loam or clay and is gravelly in some pedons. It is 35 to 50 percent clay and 5 to 35 percent rock fragments.

Yorkville Series

The Yorkville series consists of very deep, moderately well drained soils on hills and mountains. These soils formed in material weathered from chloritic schist, graywacke, or shale. Slopes range from 9 to 50 percent.

Soils of the Yorkville series are fine, mixed, thermic Typic Argixerolls.

Typical pedon of Yorkville loam, 15 to 30 percent slopes: 150 feet south of the cattle corral and 0.9 mile east on dirt road from Mountain House Road (at old rodeo grounds), about 6.4 miles south of Hopland; 1,200 feet north and 2,600 feet east of the southwest corner of sec. 3, T. 12 N., R. 11 W., MDBM, Hopland Quadrangle.

A1—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; common fine tubular pores; medium acid (pH 5.8); clear wavy boundary.

A2—5 to 15 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine and common fine roots; common very fine and fine tubular pores; medium acid (pH 5.8); clear wavy boundary.

Bt—15 to 29 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky and plastic; many very fine roots; common very fine tubular pores; few thin clay films on peds and common thin clay films in pores; 10 percent pebbles 2 to 75 millimeters in diameter; neutral (pH 7.0); gradual wavy boundary.

2Bt—29 to 41 inches; gray (N 6/0) clay loam, dark gray (N 4/0) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; common very fine tubular pores; many moderately thick clay films on peds and in pores; 15 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.5); gradual irregular boundary.

2BCt—41 to 60 inches; gray (N 6/0) gravelly clay loam, dark gray (N 4/0) moist; common medium distinct light yellowish brown (10YR 6/4, moist) mottles; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; many moderately thick clay films on peds and in pores; 25 percent pebbles 2 to 75 millimeters in diameter; mildly alkaline (pH 7.5).

Thickness of the solum is 40 to 60 inches, and depth to bedrock is more than 60 inches. The profile between depths of 6 and 19 inches is dry in all parts from May to October and is moist in all parts from January to March. The mean annual soil temperature is 59 to 62 degrees F. The mineralogy is mixed, and there are large amounts of chlorite and mica. The particle size control section is 35 to 45 percent clay and 10 to 20 percent coarse fragments.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. It has moist color of 10YR 2/2, 3/2, or 3/3. It is medium acid to mildly alkaline and is 10 to 19 inches thick.

The Bt horizon has color of 10YR 5/2 or 5/3, 2.5Y 5/2 or 6/2, N 6/0, or 5Y 5/1 or 6/1. It has moist color of 10YR 3/1, 3/2, 3/4, or 4/3, 2.5Y 4/2, N 4/0, or 5Y 3/2 or 4/1. The horizon is clay loam or clay and is gravelly in some pedons. It is 30 to 50 percent clay and 10 to 30 percent gravel. It is neutral to moderately alkaline.

Zeni Series

The Zeni series consists of moderately deep, well drained soils on mountains. These soils formed in material weathered from sandstone. Slopes range from 9 to 75 percent.

Soils of the Zeni series are fine-loamy, mixed, isomesic Ultic Haplustalfs.

Typical pedon of a Zeni loam in an area of Ornbaun-Zeni loams, 30 to 50 percent slopes, 1 mile west on Threechop Road from its intersection with Highway 20 and 1 mile west on Jackson State Forest Road 100 to a northeast-facing roadcut; 1,000 feet north and 300 feet west of the southeast corner of sec. 23, T. 18 N., R. 15 W., MDBM, Willits NW Quadrangle.

O—1 inch to 0; litter of tanoak leaves.

A—0 to 7 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate very fine, fine, and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; common very fine and fine interstitial and tubular pores; slightly acid (pH 6.2); clear wavy boundary.

Bt1—7 to 15 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine, fine, and medium interstitial and tubular pores and few coarse tubular pores; common thin and moderately thick clay films on peds and in pores; strongly acid (pH 5.5); gradual wavy boundary.

Bt2—15 to 23 inches; light yellowish brown (10YR 6/4) clay loam, strong brown (7.5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, fine, medium, and coarse roots; common fine and medium and few coarse interstitial and tubular pores; common moderately thick and few thick clay films on peds and in pores; strongly acid (pH 5.5); abrupt wavy boundary.

Crt—23 inches; soft, fractured sandstone; cracks 2 to 3 millimeters wide; common fine, medium, and coarse roots; common moderately thick and thick clay films in cracks; slakes in water.

Thickness of the solum and depth to a paralithic contact are 20 to 40 inches. The mean annual soil temperature ranges from 50 to 56 degrees F. The difference between the mean summer and mean winter soil temperatures ranges from 5 to 9 degrees. The profile between depths of 6 and 17 inches is moist in all parts from November 1 to June 1 and is dry in some or all parts from July 1 to October 1 in most years. The particle size control section is 20 to 35 percent clay. Base saturation (sum) ranges from 40 to 75 percent throughout the profile. Reaction is slightly acid to strongly acid, and it becomes more acid with increasing depth.

The A horizon has color of 10YR 5/2, 5/3, 6/2, 6/3, or 6/4 or of 7.5YR 7/4. It has moist color of 10YR 2/2, 3/3, 3/4, 4/2, 4/3, or 4/4 or of 7.5YR 5/6. It is 15 to 25 percent clay.

The Bt horizon has color of 10YR 6/4, 6/6, or 7/6 or of 7.5YR 6/4, 6/6, 7/4, or 7/6. It has moist color of 10YR 4/6 or 5/6 or of 7.5YR 4/4, 4/6, 5/6, 6/4, 6/6, 6/8, or 7/6. It is loam, clay loam, sandy clay loam, or gravelly clay loam and is 20 to 35 percent clay and 0 to 25 percent gravel.

The Crt horizon is highly weathered sandstone that becomes harder and coarser in texture as depth increases.

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