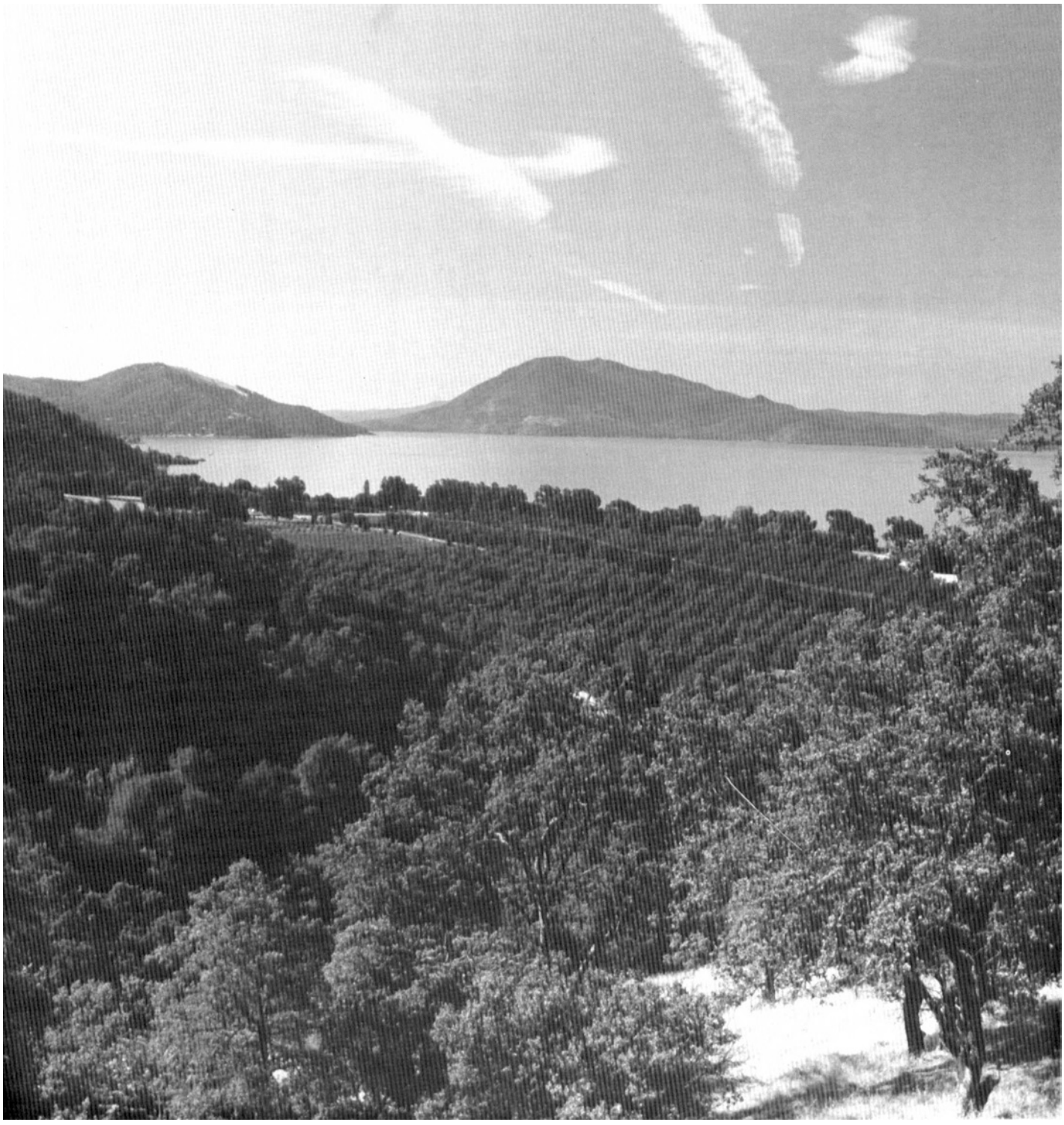
United States Department of Agriculture

Soil Conservation Service

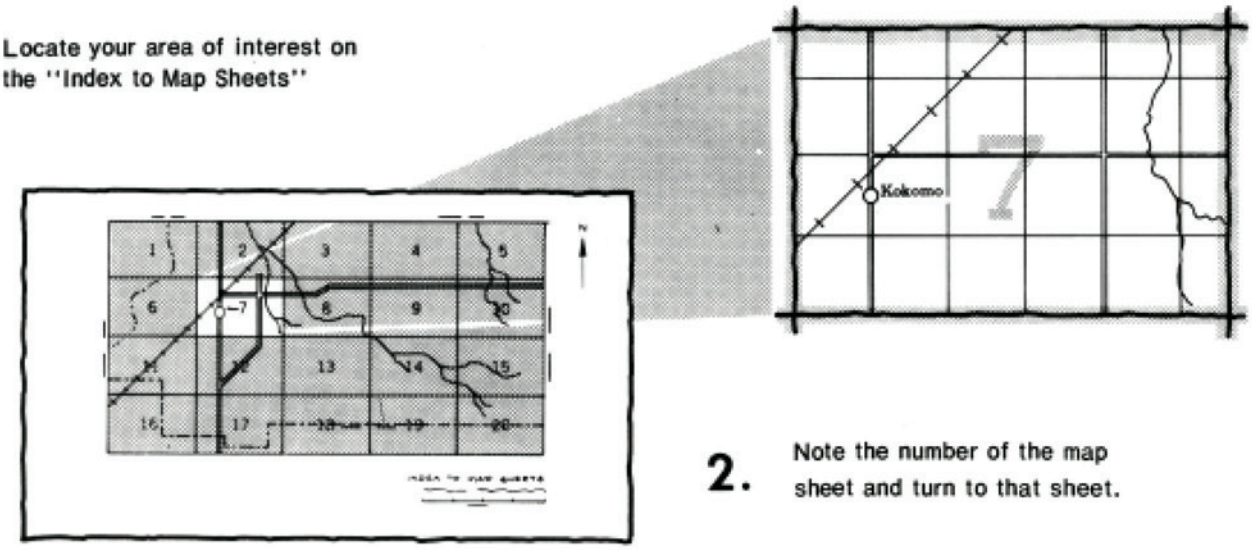
In cooperation with United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Land Management; and the Regents of the University of California (Agricultural Experiment Station)

Soil Survey of Lake County, California



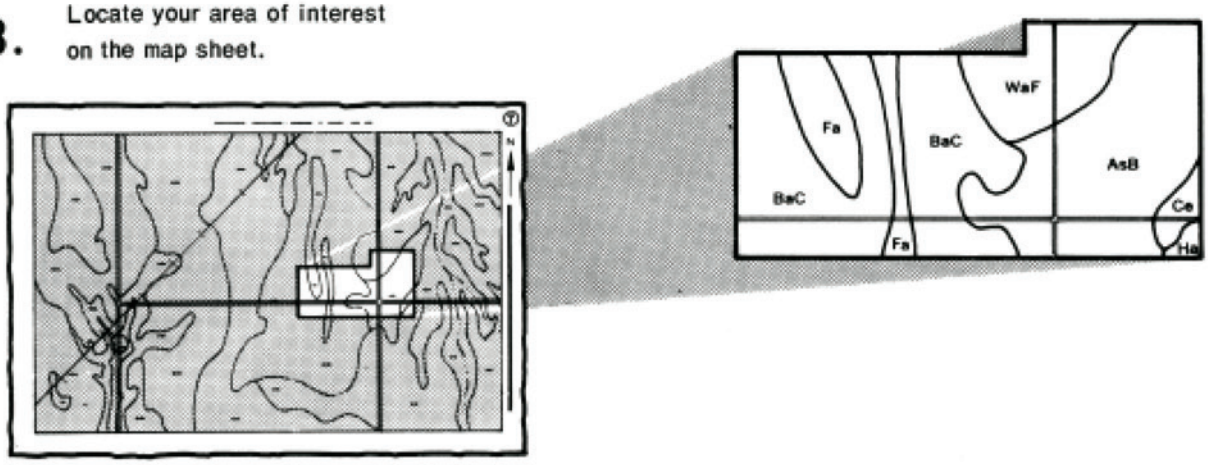
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

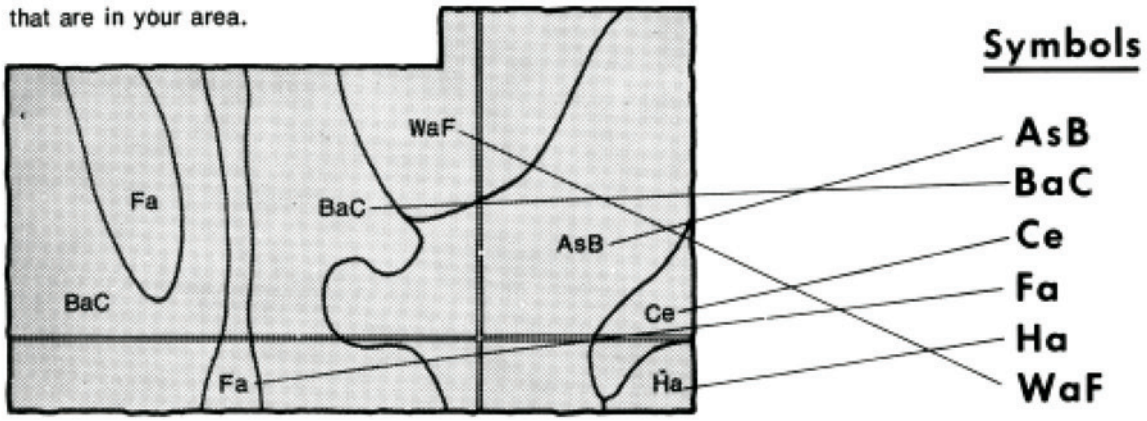


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

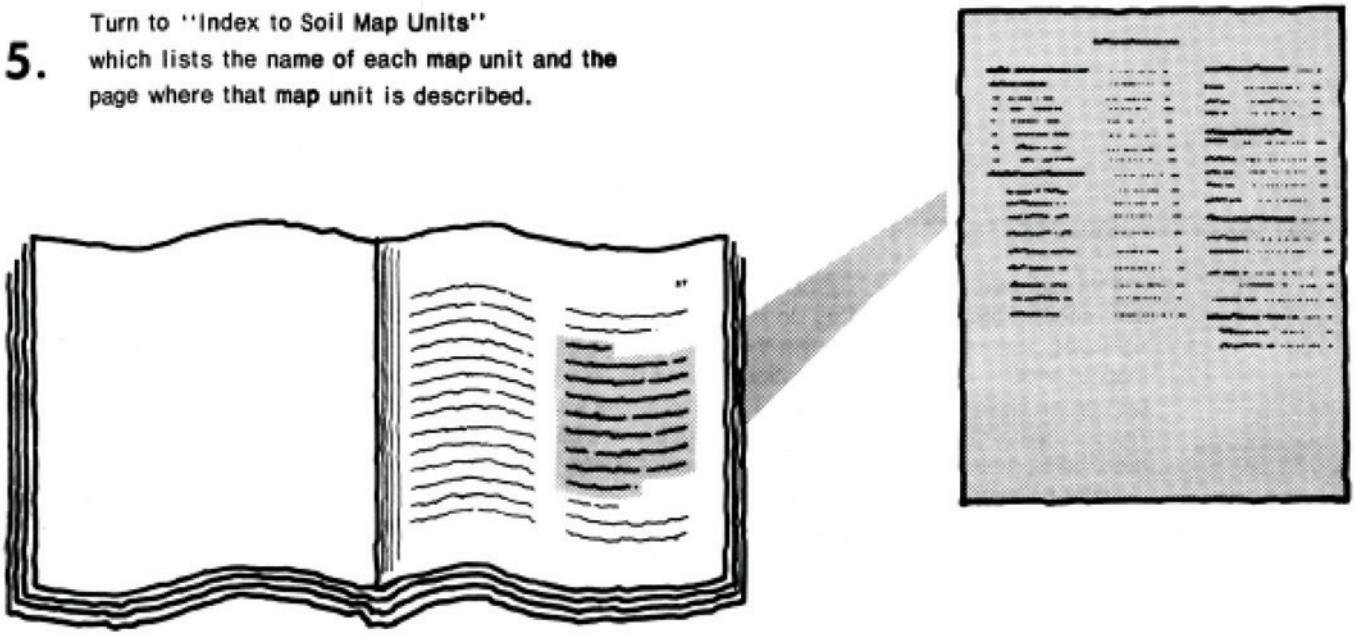


4. List the map unit symbols that are in your area.

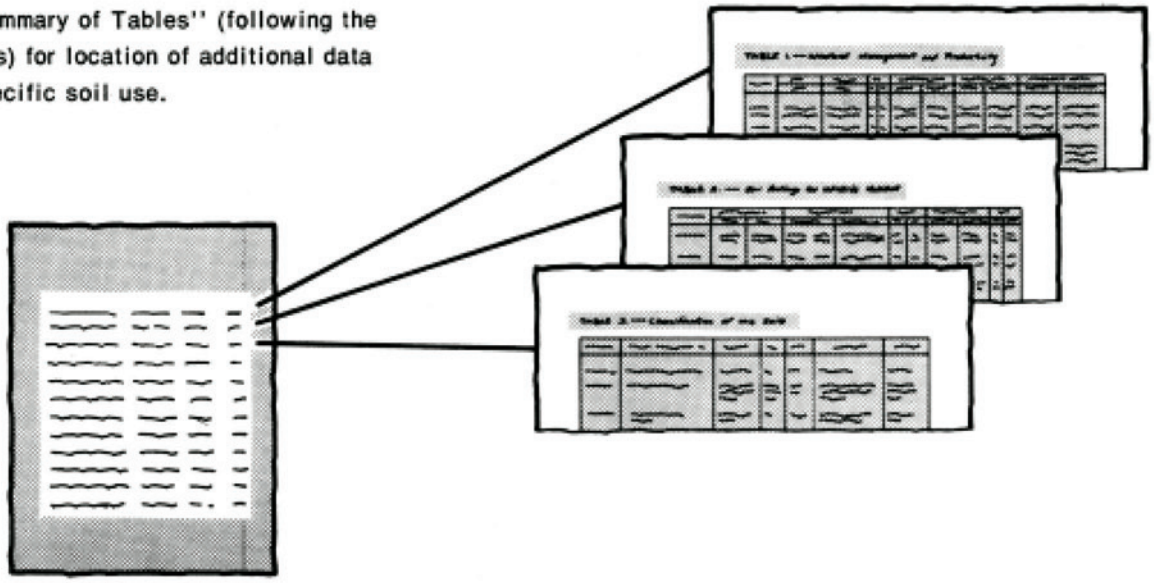


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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 1981. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the Bureau of Land Management, and the Regents of the University of California (Agricultural Experiment Station). It is part of the technical assistance furnished to the East Lake and the West Lake Resource Conservation Districts.

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: Typical area of Lake County, California. Millsholm-Bressa-Hopland association, 30 to 50 percent slopes, in foreground; Cole Variant clay loam and Still loam adjacent to Clear Lake; and Mount Konocti in background.

Contents

Taxonomic units

Issued May 1989

Index to Map Units

Summary of Tables

Preface

This soil survey contains information that can be used in land-planning programs in Lake County, California. 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.

Location of Lake County in California.

Soil Survey of
Lake County, California

By David W. Smith and William D. Broderson, 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 the Regents of the University of California
(Agricultural Experiment Station)

LAKE COUNTY is in the northwestern part of California. It has a land area of about 806,976 acres, or 1,261 square miles. About 31 percent of the county is in the Mendocino National Forest, and about 17 percent is other Federal and State administered land. The population in 1981 was about 39,600. It is estimated that the county receives more than 200,000 tourists annually. Lakeport, the county seat, is on the western shore of Clear Lake, which is near the center of the county.

The county is predominantly hilly and mountainous and has a few broad, flat valleys and several smaller valleys scattered throughout. Clear Lake, with a surface area of 68 square miles, is the largest natural lake that is located entirely within California.

Agriculture and tourism are the main economic enterprises in the county. Timber production, mainly on public land, is also important to the economy. The climate, which is characterized by warm, dry summers and cool, moist winters, is favorable for all of these economic activities.

Soil scientists have determined that there are about 80 different kinds of soil in Lake County. The soils vary widely in depth, texture, natural drainage, and other characteristics. The soils on the hills and mountains are dominantly shallow or moderately deep, medium textured, and moderately well drained or well drained. The soils in the valleys and on low terraces are dominantly deep or very deep, medium textured or fine textured, and poorly drained to well drained.

A survey of the Clear Lake Area was published in 1927 (*26*). Soil-vegetation maps of the county were completed in 1955. Interim reports of the present soil survey were released for the Big Valley, Scotts Valley, and Upper Lake areas in 1979 by the West Lake Resource Conservation District. The present survey updates the earlier surveys and provides additional information and more detailed maps.

The present survey involved detailed mapping on bottom lands and on the low terraces near Lakeport. Less detailed mapping was done in the rangeland, forest land, and brushland areas of the hills and mountains. About 80 percent of the Mendocino National Forest was surveyed by the Forest Service, and 20 percent, in the eastern and southeastern parts, was surveyed by the Soil Conservation Service. All other areas of the county were surveyed by the Soil Conservation Service.

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 better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General Nature of the Survey Area

This section provides general information about the Lake County soil survey area. It discusses history and development; physiography, relief, and drainage; climate; vegetation; and water supply.

History and Development

The first recorded inhabitants in the survey area were American Indians. They belonged primarily to the Pomo tribe, but there were smaller bands of Miwocs, Wappos, and Wintuns (*13*). These Indians lived around Clear Lake and the many streams in the area. They hunted, fished, and gathered roots, acorns, and berries.

In 1836 a Spanish exploratory expedition lead by Captain Salvador Vallejo came to the area. When the Spaniards left, they took Indian captives with them to work the large ranches in Solano and Sonoma Counties. Vallejo returned in 1840 with herds of horses and longhorn cattle and took informal possession of land near Clear Lake, setting up headquarters in Big Valley. The cattle multiplied and soon ran wild in the valley and surrounding hills. Two pioneers, Andy Kelsey and Charles Stone, came to the area in 1847 (*6*). They bought 800 head of cattle from Vallejo and settled near the present site of Kelseyville. Their alleged mistreatment of the local Indians resulted in them being killed by the Indians in 1849. In retaliation, the U.S. Army surrounded and killed 100 Indians in the spring of 1850 on what is now called Bloody Island, near Upper Lake. For several years no further settlement was attempted in the area because of the unstable relations with the Indians. A treaty was signed in 1851 between the Pomo Indians and the United States Government that deeded all of the land west of the Narrows on Clear Lake to the Indians. When Congress refused to ratify the treaty in 1853, Lake County was reopened for settlement.

The first road into the survey area was a rough dirt road from the Napa Valley to Lower Lake. In 1865 a toll road from Calistoga to Middletown was opened. As the population increased, more roads were built, until a total of 15 toll roads were in operation. Today, Lake County is crossed by four major highways. In the early days, transportation within the county, around Clear Lake, was mostly by boat. Boats were used to visit neighbors and stores, and regularly scheduled routes were used to carry mail, express, and passengers. Railroads never came to the county, and the lack of this mode of commercial transportation limited the exportation and importation of goods in the early years.

The cattle industry in Lake County started with the introduction of the Spanish longhorns, which were used mainly for tallow and hides. In 1854 permanent settlers started arriving with dairy cattle. They hunted the remaining herds of wild longhorns and eventually exterminated them. Today, the emphasis of the local cattle industry is on meat production and breeding. In addition, horses, sheep, goats, swine, poultry, and bees have been raised in Lake County during its history.

The first pears in the county were planted in family orchards, and in 1855 commercial pear orchards were planted in Big Valley. During that same year a fruit exhibit sent to the World's Fair in New Orleans made Lake County Bartlett pears internationally famous. Most pears were dried and shipped out of the county until 1923, when the canning industry started buying large quantities of Lake County Bartlett pears. The first English walnut orchards were planted in Big Valley around the turn of the century.

In the following years Zinfandel, Golden Chasselas, Burger, Gultdal, Reisling, and Muscat vineyards were established around Clear Lake. Wine grape vineyards and the associated wineries flourished until Prohibition. The industry then died out; in the 1960's, however, wine grape vineyards again began to be planted. Today, the wine grape industry in the county is again well established.

The mining industry in the county has had a rich and varied history. Borax, sulfur, and mercury are minerals that have been mined to a major extent. By 1872 more than 700 tons of borax had already been removed from Big Borax and Little Borax Lakes. Between 1871 and 1875, 2 million pounds of sulfur were strip mined from the eastern Clear Lake area. Mining of sulfur continued on a large scale during World Wars I and II. The first quicksilver deposit was discovered in 1860, and since that time more than 19,000 tons of mercury has been removed from the county. Minor deposits of low-grade gold and silver ores, lime, manganese, chromium, asbestos, and umbers and ochres for paint have been discovered and worked. Gravel, sand, and cinders are the main mining products mined in the county today. Geothermal well development is also a major endeavor.

Recreation and tourism have always been major sources of income in Lake County. A census taken in 1870 reported 2,959 residents and 5,963 tourists in the county. Tourists came to enjoy the scenery and the many mineral springs in the area. Mineral water, which was reputed to have medicinal qualities, was bottled and sent out of the county by wagon. Gradually, the bottled mineral water and the mineral springs resorts lost their popularity, and the resorts closed or changed over to modern vacation type resorts. Recreation and tourism in Lake County today are centered mainly around water sport activities on Clear Lake.

Physiography, Relief, and Drainage

Lake County is within the northern Coast Range province of California. In general, the Coast Range is composed of rugged hills and mountains and intervening valleys, with ridges trending to the northwest. It is highly dissected with perennial and intermittent streams. The pattern is the result of a complex sequence of geologic folds and faults.

Within the county, modification of the general physiographic province has taken place locally. The county can be divided into four generalized kinds of landscape: (1) broad valleys, low terraces, and rolling hills; (2) rugged mountains; (3) volcanic terrain; and (4) uplifted, dissected hills.

The broad valleys, low terraces, and rolling hills of the Clear Lake Basin occupy a structural depression in the Coast Range. The principal valleys of Big Valley, the area around Upper Lake, and the area around Middletown are filled with unconsolidated sediment, which in places is more than 500 feet thick. The valleys are surrounded by gently sloping to moderately steep hills. Several other smaller valleys are scattered throughout the county, some of which are at higher elevations. Internal soil drainage is very poor to somewhat poor in the soils that are in some of the depressional areas of the valleys. Associated with the valleys are relatively flat, dissected depositional terraces along the west shore of Clear Lake, near Lakeport; in areas of Big Valley; and near Upper Lake. Elevation ranges from 620 feet at Putah Creek, near the Napa County line, to about 2,800 feet, just north of Nice.

Rugged mountains are located in the northern part of the county, mainly in the Mendocino National Forest, and along the western edge of the county. Elevation ranges from about 1,360 feet at Blue Lakes to 7,050 feet on Snow Mountain.

Volcanic flows, lava domes, and ashfall cover about 85 square miles southwest, south, and east of the lower end of Clear Lake. Mount Konocti, a composite volcano, dominates the landscape. The Boggs Mountain area and some of the hills near Middletown are included in the volcanic field. Slopes are moderately steep to very steep. Elevation ranges from 1,326 feet at Clear Lake to 4,722 feet on Cobb Mountain.

East of the city of Clearlake Highlands is an area of gently sloping to very steep, uplifted, dissected hills and scarps that formed in poorly consolidated sediment of the Cache Formation. The area, which covers about 40 square miles, has been described as "semibadland" (*9*). Elevation ranges from about 1,000 feet at Grizzly Canyon to about 2,200 feet on Bald Mountain.

Three principle drainageways are within the county: (1) Clear Lake Basin, (2) Putah Creek, and (3) Eel River. The surface water carried by them is derived from direct precipitation and from spring flow. The volume of water carried reaches its peak in winter and spring and decreases substantially in summer. Creeks in the Clear Lake Basin include Adobe, Cole, Kelsey, Long Valley, North Fork Cache, Scotts, and Siegler Creeks. This water accumulates in Clear Lake and Indian Valley Reservoir and then continues southeasterly out of the county, by way of Cache Creek, into the Sacramento River. Harbin, Soda, and Putah Creeks form the Putah Creek drainageway. This water flows southeasterly out of the county to be discharged into Lake Berryessa, in Napa County. Most of the water in the northern part of the county accumulates in Eel River, flows into Lake Pillsbury, and then continues to the Pacific Ocean, near Eureka in Humboldt County.

Climate

Jerry L. Hatfield, biometeorologist, University of California, Davis, helped to prepare this section.

The climate of Lake County is characterized by warm, dry summers and cool, moist winters. The influence of the Pacific Ocean, which is modified by the distance from the coast and by the intervening mountains, is a major factor. In summer, the influence of a continual tropical airmass results in high daytime temperatures and moderate nighttime cooling. In winter, the presence of a marine airmass generally prevents temperatures from dropping below 20 degrees F. Winter storms periodically sweep in from the Pacific Ocean; however, clear sunny weather is common in winter.

The average annual temperature in the valley regions near Clear Lake is 56 degrees. There is about a 30-degree difference between the average temperatures of the warmest and coldest months. Climatic data are not available for the upland regions, but it is estimated from data collected at nearby areas that the average annual temperature in the forested mountains is about 53 degrees at 3,000 feet elevation and about 47 degrees at 5,000 feet elevation. Table 1 gives the average monthly temperature and precipitation recorded at Lakeport over a 25-year period.

In winter, the average temperature at Lakeport is 44 degrees and the average daily minimum temperature is 33 degrees. The lowest temperature at this location, recorded in 1972, is 9 degrees. In summer, the average temperature at Lakeport is 71 degrees and the average daily maximum temperature is 91 degrees. The highest recorded temperature at this location, recorded in 1972, is 112 degrees.

The average number of growing-degree-days at Lakeport is 3,716. Growing-degree-days are equivalent to "heat units." During the month, growing-degree-days accumulate by the amount that the average temperature each day exceeds a base temperature (65 degrees). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The growing season, which is the average number of days between the last freezing temperature in spring and the first in fall, ranges from 150 to 210 days in the valley regions around Clear Lake. The last freeze in spring commonly occurs from the last week of April to the middle of May, and the first freeze in fall commonly occurs from the middle of October to the middle of November. The variability in the length of the growing season in the valley regions reflects variation in air-drainage patterns, a function of the surrounding topography.

The average date of the last freeze in spring is April 30 at Clearlake Highlands, May 7 at Lake Pillsbury, April 28 at Lakeport, and May 13 at Upper Lake Ranger Station. The average date of the first freeze in fall is October 16 at Clearlake Highlands, October 14 at Lake Pillsbury, October 30 at Lakeport, and October 9 at Upper Lake Ranger Station. The average length of the growing season is 165 days at Clearlake Highlands, 160 days at Lake Pillsbury, 183 days at Lakeport, and 149 days at Upper Lake Ranger Station.

Table 2 gives the probability of freezes at various times in spring and fall at Lakeport.

The average annual precipitation in Lake County ranges from 24 inches in the valley regions to 70 inches or more in the mountains. Figure 1 shows precipitation patterns for the entire county. The average annual precipitation at Lakeport is 30 inches. The largest recorded daily rainfall at this location was 5.4 inches in December 1937. Table 3 gives the probability of receiving varying amounts of rainfall at Lakeport and Middletown. Table 4 gives the frequency of occurrence of rainstorms of varying duration at Lakeport (*38*).

Snowfall is rare at the lower elevations. The average annual snowfall at Lakeport is 0.5 inch. Significant snowfall does occur at the higher elevations in the mountains. The average seasonal snowfall at Hullville, elevation 2,250 feet, is 26 inches.

Relative humidity at Lakeport averages about 80 percent in winter and about 30 percent in summer and early in fall. The evaporation rate is high in summer because of high temperatures and low humidity. Annual evaporation at Lakeport is 65 inches, of which about 70 percent occurs in May to October. There is enough heat energy available that a growing crop might use 23.5 inches of moisture. Without irrigation, however, the annual precipitation distribution limits the crop to the use of 7.6 inches.

Vegetation

The major vegetation types supported by the soils in Lake County are brush, conifer and hardwood forest, oak-grass, annual grass, and freshwater marsh. These vegetation types occur in complexes of varying percentage and acreage, and within each group there are many intergrades. About 5 percent of the acreage in the county, mostly in and around the valley areas, is cultivated for crops and pasture. About 1 percent of the area is Urban land.

Soils that support brush, or chaparral, cover about 40 percent of the survey area. Wildfires and associated soil erosion are common in these areas and have an influence on plant composition. Brush grows at all elevations in the county. The soils commonly are shallow, are coarse- or medium-textured, and have low available water capacity. Examples are the Etsel, Maymen, and Snook soils. At the warm, low elevations, some deeper, finer textured soils on south- and west-facing slopes support brush. Examples are the Arrowhead, Bally, and Benridge soils. At higher elevations, more than 3,500 feet, brush commonly grows only on shallow soils on south- and west-facing slopes. Soils that formed in material weathered from serpentinitic rock, such as Henneke, Montara, and Okiota soils, also support brush. Chamise, manzanita, ceanothus, scrub oak, and toyon are common plants. Scattered McNab cypress grows in some areas of soils that formed in serpentinitic parent material.

Conifer and hardwood forest cover about 35 percent of the survey area, mainly in the Mendocino National Forest, the Boggs Mountain area, and the Mount St. Helena area. Ponderosa pine, Douglas-fir, California black oak, Pacific madrone, and canyon live oak are common tree species. Aiken, Collayomi, Kekawaka, Neuns, and Sanhedrin soils are examples of soils that support these trees. Tanoak grows on Forward Variant soils in an area of high rainfall near Mount St. Helena. White fir, red fir, and Jeffery pine grow on Freezeout soils at elevations above 5,000 feet in the Mendocino National Forest. On some soils, commonly at elevations below 3,000 feet, on north- and east-facing slopes and commonly surrounded by brush, are small areas of hardwood forest. Canyon live oak, California black oak, Pacific madrone, and California-laurel are the dominant trees in these areas, and they grow on soils such as those of the Hopland and Mayacama series. Knobcone pine is common in areas of soils that commonly support conifers and hardwoods but that have a history of wildfires.

Soils that support forage make up about 18 percent of the county. The vegetation types on these soils are oak-grass and annual grass.

Blue oak is the dominant tree in oak-grassland areas, although interior live oak and digger pine also grow in these areas. Bressa, Millsholm, Skyhigh, and Sobrante soils are examples of soils that support this vegetation type. These soils commonly support a 10- to 50-percent canopy cover of oak. The canopy is highly variable, but it commonly is heavier on north-facing slopes. In many areas the trees have been thinned or cleared to increase forage production. Soft chess, wild oat, and scattered forbs are in the understory. Oak-grass vegetation grows mostly at the warm, low to intermediate elevations, but it

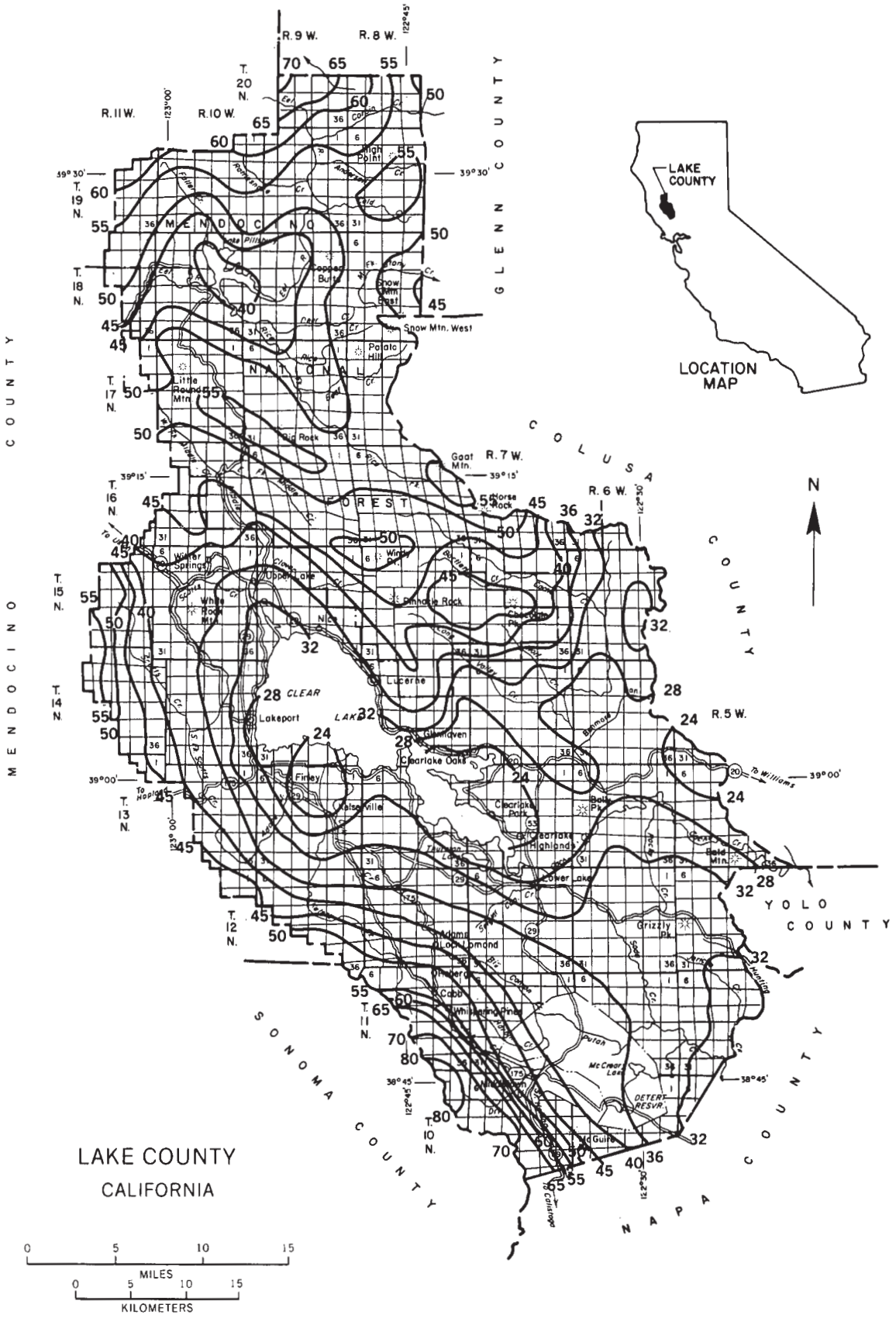

Figure 1.—Isohyetal map showing general precipitation patterns.

also grows at elevations of as much as 4,500 feet on south- and west-facing slopes.

Annual grass vegetation in the county is typified by soft chess, wild oat, filaree, ripgut brome, and annual clover. In some areas are bunchgrasses, especially purple needlegrass. The species composition is highly variable and depends on the kind of soil and the land use history. Scattered oaks and brush are interspersed within many areas of annual grasses. Pomo, Squawrock, and Yorkville soils are examples of soils that support annual grasses.

Freshwater marsh covers less than 1 percent of the survey area, but it provides important habitat for wetland wildlife. Tules, rushes, carex, and cattails are common. Tulelake soils and Fluvaquentic Haploquolls support this vegetation type along the fringes of Clear Lake and in some depressional areas in the valley. Vegetation along stream channels is also important to some wildlife species. Cottonwood, willow, and elderberry are a few of the dominant plants in these areas.

Weeds are a problem in many cultivated areas and in some areas of overgrazed annual grasses. Starthistle, tarweed, fiddleneck, and puncturevine are some of the common weeds in the county.

Water Supply

Water in Lake County is used for agricultural and domestic consumption and for fire protection. It is also a key attraction to thousands of summertime visitors and is important to the abundant wildlife resources of the area. Agricultural use is for irrigation and protection of pears and grapes from frost; for irrigation of walnuts, some field and truck crops, and pasture; and for use by livestock.

Water sources include underground aquifers and surface water. Runoff from precipitation, including rainfall and some snowfall, replenishes these sources. Water for irrigation and frost protection is primarily from ground water sources, but some treated water from Clear Lake is also used. There are more than 99 registered domestic distribution systems in the county, of which 15 have 200 or more service connections. Springs, streams, shallow wells in pockets of alluvium, and small earthen dams that impound water are used throughout the foothill and mountain areas.

The principal ground water aquifers used by the population centers and agricultural areas are in the Big Valley, Collayomi, Scotts Valley, and Upper Lake ground water basins. The combined storage capacity of these basins is about 111,000 acre-feet, and the usable capacity is about 35,000 acre-feet. Several smaller ground water basins throughout the county are also used. Water quality generally is good to excellent, but a few areas have water that is high in content of boron, iron, or manganese, or all of these.

There are three major watershed areas in the county. The Clear Lake Basin watershed includes the Big Valley, Scotts Valley, and Upper Lake ground water basins. The largest body of surface water in this watershed is Clear Lake, which has an area of 43,800 acres. The lake is operated by the Yolo County Flood Control and Water Conservation District, which delivers water to Yolo County to be used primarily for irrigation. Some communities around the lake use the water for domestic supply through riparian water rights or by purchasing it from Yolo County. Indian Valley Reservoir, 3,800 acres, is another major surface water body in the watershed. Most of this water also flows to Yolo County to be used for irrigation. Highland Springs Reservoir, 146 acres, and Adobe Creek Reservoir, 70 acres, provide flood control and ground water recharge to the Big Valley area. Several other creeks and small lakes throughout the county provide additional surface water.

The Upper Putah Creek watershed contains the Collayomi ground water basin. Four creeks, four small reservoirs, and one small lake are the major sources of surface water. These supply water for livestock and for existing agricultural development.

Lake Pillsbury, 2,280 acres, behind Scott Dam, is the major surface water body in the Upper Eel River watershed. It is owned by Pacific Gas and Electric Company and is used to control flow of the Eel River to the Potter Valley Power House in Mendocino County. At the present time no extensive consumptive use of this water is made in the county.

Ground water recharge occurs through seepage and underflow from creek channels, reservoirs, and lakes, rainfall percolation, and irrigation return flow. At present most of the ground water basins seem to recover by the end of the rainy season; however, the Big Valley and Scotts Valley basins have shown some signs of deterioration. During seasonal periods of low rainfall, ground water recharge cannot keep up with the demand for pumping and overdraft can occur. Land subsidence and reduction in ground water storage area have been observed in Scotts Valley, and therefore some wells are being drilled deeper in Big Valley. Recharge capacity, as well as flood protection, can be improved by the implementation of flashboard dams, stream channel improvement, conservative extraction of gravel from stream channels, and the construction of additional reservoirs.

Farming in the county is becoming more water intensive because of increased cultivation of crops that require irrigation and protection from frost. Development opportunities and an increasing number of tourists may also increase the demand for domestic consumption. Careful attention to the ground water situation and water conservation and possible development of outside water sources will ensure an adequate water supply for future use.

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 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. Acreages given in this section do not include water areas.

Map Unit Descriptions

Nearly level to strongly sloping soils in valleys and basins

The soils in this group are in the lower positions on the landscape. Slopes range from 0 to 8 percent but are dominantly less than 5 percent. Elevation ranges from about 620 feet along Putah Creek to about 2,800 feet in Mendocino National Forest. The average annual precipitation is 24 to 50 inches, and the average annual temperature is 54 to 59 degrees F. The frost-free season is 150 to 210 days.

These soils are very deep and are very poorly drained to somewhat excessively drained. They formed in alluvium derived from mixed sources. Vegetation in areas not cultivated is mainly annual grasses and forbs and scattered oaks. Water-tolerant plants grow in marsh areas.

This group is used mainly for irrigated field crops, hay and pasture, and livestock grazing. It is also used for homesite development and wildlife habitat.

Five map units are in this group. They make up about 7 percent of the survey area.

1. Tulelake-Fluvaquentic Haplaquolls

Very deep, nearly level, very poorly drained and poorly drained silty clay loam; in lake basins and marshes

This map unit occurs in marsh and reclaimed marsh areas around Clear Lake, mostly near Anderson Marsh, Rodman Slough, Tule Lake, and the north end of Big Valley. Some areas have been drained and protected from flooding. Vegetation in undrained areas is mainly marsh grasses, tules, rushes, and other water-tolerant plants.

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

Tulelake soils are poorly drained. Typically, the profile is silty clay loam over stratified silty clay loam and silty clay. The water table fluctuates between 36 inches above the surface and 36 inches below the surface in winter.

Fluvaquentic Haplaquolls are very poorly drained. In a reference profile, these soils are silty clay loam over stratified loamy coarse sand, silty clay loam, and loam. The water table fluctuates between 12 inches above the surface and 36 inches below the surface annually.

Of minor extent in this unit are very deep Landlow Variant, Lupoyoma, and Clear Lake soils.

This unit is used mainly as wetland wildlife habitat. Areas that are drained and protected are used for hay and pasture and a few specialty crops.

2. Cole-Clear Lake Variant-Clear Lake

Very deep, nearly level, poorly drained clay loam and clay; in basins

This map unit occurs mainly in Big Valley and the Upper Lake vicinity. Soil drainage has been altered in many areas because of the entrenchment of stream channels. Most areas are cultivated. Vegetation in areas not cultivated is mainly annual grasses and oaks.

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

Cole soils typically are clay loam to a depth of 71 inches or more.

Clear Lake Variant soils typically are clay to a depth of 63 inches or more.

Clear Lake soils typically are clay to a depth of 72 inches or more.

Of minor extent in this unit are very deep, moderately well drained Cole Variant soils and Xerofluvents.

This unit is used mainly for irrigated field crops and hay and pasture.

3. Still-Lupoyoma

Very deep, nearly level, moderately well drained and well drained loam and silt loam; on alluvial plains and flood plains

This map unit is in bottom land areas throughout the county. Most areas are cultivated. Vegetation in areas not cultivated is mainly annual grasses and oaks.

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

Still soils are well drained. Typically, these soils are loam over somewhat stratified clay loam, loam, and extremely gravelly loamy coarse sand to a depth of 70 inches or more.

Lupoyoma soils are moderately well drained. Typically, these soils are silt loam to a depth of 84 inches or more.

Of minor extent in this unit are very deep, well drained Kelsey and Wolfcreek soils; very deep, moderately well drained Cole Variant and Kilaga Variant soils; very deep, well drained Mocho Variant and Maywood Variant soils; and moderately deep, well drained San Joaquin Variant soils.

This unit is used mainly for irrigated field crops and hay and pasture. It is also used for homesite development. Some of the most productive cropland in the county is in this unit.

4. Talmage-Xerofluvents-Riverwash

Very deep, nearly level to moderately sloping, somewhat excessively drained very gravelly sandy loam and very gravelly loamy sand, and Riverwash; on alluvial fans and flood plains

This map unit is in bottom land areas near streams and creeks throughout the county. Vegetation in areas not cultivated is mainly annual grasses and scattered oaks on the Talmage soils and Xerofluvents. Vegetation on Riverwash is sparse; some grasses and shrubs grow on the sandbars and streambanks.

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

Talmage soils typically are very gravelly sandy loam over very gravelly loam to a depth of 69 inches or more.

A reference profile of Xerofluvents is very gravelly loamy sand over very gravelly coarse sand and gravelly coarse sand to a depth of 84 inches or more.

Riverwash consists of erratically stratified layers of water deposited sand, gravel, and cobbles.

Of minor extent in this unit are very deep Still, Kelsey, and Maywood Variant soils.

This unit is used mainly for hay and pasture and as wildlife habitat.

5. Maxwell-Yorkville Variant

Very deep, nearly level to strongly sloping, somewhat poorly drained and well drained clay loam; on valley and basin floors and rims

This map unit is adjacent to serpentinitic uplands, mainly in the southern part of the county. Vegetation is mainly annual grasses and forbs.

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

Maxwell soils typically are clay loam over clay to a depth of 84 inches or more.

Yorkville Variant soils typically are clay loam over sandy clay loam and clay to a depth of 71 inches or more.

This unit is used mainly for hay and pasture.

Gently sloping to moderately steep soils on dissected alluvial terraces

The soils in this group are in the lower positions on the landscape. Slopes range from 2 to 25 percent. Elevation ranges from 1,350 to 1,650 feet. The average annual precipitation is 25 to 35 inches, and the average annual temperature is 55 to 59 degrees F. The frost-free season is 160 to 205 days.

These soils are very deep and are well drained and moderately well drained. They formed in old alluvium derived from mixed sources. Vegetation in areas not cultivated is mainly oaks, annual grasses, and shrubs.

This group is used mainly for crop production, homesite development, hay and pasture, and livestock grazing.

One map unit is in this group. It makes up about 1 percent of the survey area.

6. Manzanita-Wappo-Forbesville

Very deep, gently sloping to moderately steep, moderately well drained and well drained loam; on dissected alluvial terraces

This map unit is in parts of Big Valley and Scotts Valley and near Upper Lake. Much of the city of Lakeport is in this map unit. Vegetation in areas not cultivated is mainly oaks, annual grasses, and shrubs.

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

Manzanita soils typically are loam over clay loam in the upper part. Below this is clay over gravelly clay to a depth of 76 inches or more.

Wappo soils typically are loam over clay in the upper part. Below this is clay loam to a depth of 63 inches or more.

Forbesville soils typically are loam over clay in the upper part. Below this is very gravelly clay to a depth of 70 inches or more.

Of minor extent in this unit are soils that have more than 35 percent rock fragments in the profile or are cooler, very deep Wappo Variant soils, and moderately deep Asbill soils.

This unit is used mainly for walnuts and wine grapes, homesite development, hay and pasture, and livestock grazing.

Moderately sloping to very steep soils on uplifted, dissected hills

The soils in this group are in intermediate positions on the landscape. Slope ranges from 2 to 75 percent. Elevation ranges from about 1,100 feet to 2,500 feet. The average annual precipitation is 25 to 35 inches, and the average annual temperature is 55 to 59 degrees F. The frost-free season is 160 to 200 days.

These soils are very deep and well drained. They formed in semiconsolidated uplifted sediment of the Cache Formation. Vegetation is dominantly brush, oak, and annual grasses.

These soils are used mainly for livestock grazing, wildlife habitat, and watershed.

One map unit is in this group. It makes up about 4 percent of the survey area.

7. Phipps-Bally

Very deep, gently sloping to very steep, well drained loam and gravelly sandy clay loam; on uplifted, dissected hills

This map unit occupies an area east of Clearlake Oaks and Clearlake Highlands. Vegetation is mainly brush, oaks, and annual grasses.

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

Phipps soils typically are loam over gravelly clay loam in the upper part. Below this is gravelly sandy clay loam over very gravelly sandy clay loam. Depth to semiconsolidated sediment is 75 inches or more.

Bally soils typically are gravelly sandy clay loam over very gravelly sandy clay loam in the upper part. The lower part is very gravelly sandy clay. Depth to semiconsolidated sediment is 65 inches or more.

Of minor extent in this unit are soils that have less clay in the profile than do the major soils, very deep Forbesville soils, moderately deep Asbill soils, and Badland.

This map unit is used mainly for livestock grazing, wildlife habitat, and watershed.

Moderately sloping to very steep soils on hills and mountains

The soils in this group are dominantly on the intermediate and upper positions on the landscape. Slope ranges from 5 to 75 percent. Elevation ranges from about 640 feet in the southern part of the county to 7,050 feet on Snow Mountain. The average annual precipitation is 25 to 70 inches, and the average annual temperature is 43 to 60 degrees F. The frost-free season is 90 to 205 days.

The soils are shallow to very deep and are well drained to excessively drained. They formed in residuum derived from sedimentary, metasedimentary, or serpentinitic rock. Vegetation is mainly annual grasses and oak or brush on hills and at the lower elevations of the mountains and is conifer forest at the intermediate and upper elevations of the mountains.

This group is used mainly for livestock grazing, timber production, wildlife habitat, and watershed. It is also used for homesite development and recreation.

Six map units are in this group. They make up about 77 percent of the survey area.

8. Millsholm-Skyhigh-Bressa

Shallow and moderately deep, moderately sloping to steep, well drained loam; on hills

This map unit is mainly in the Clear Lake Basin and in the southern and eastern parts of the county. Small areas occur as glades in the Mendocino National Forest. The soils in this unit formed in material derived mainly from sandstone and shale. Vegetation is mainly annual grasses, forbs, and oak. Elevation ranges from 640 to 4,000 feet. The average annual precipitation is 25 to 60 inches, and the average annual temperature is 54 to 60 degrees F.

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

Millsholm soils are shallow. Typically, the profile is loam over clay loam. Fractured sandstone is at a depth of 18 inches.

Skyhigh soils are moderately deep. Typically, the soils are loam in the upper part and clay loam over clay in the lower part. Fractured sandstone is at a depth of 38 inches.

Bressa soils are moderately deep. Typically, the soils are loam over clay loam. Soft, fractured sandstone is at a depth of 26 inches.

Of minor extent in this unit are deep and very deep Sleeper soils; deep Yorkville, Pomo, and Yorktree soils; shallow Maymen soils; and moderately deep Asbill, Squawrock, Hopland, and Shortyork Variant soils. Some of the minor soils in this unit are at elevations of as much as 4,500 feet, in the Mendocino National Forest, where the average annual precipitation is higher and the average annual temperature is lower than those of the major soils of this unit.

This unit is used mainly for livestock grazing, wildlife habitat, and homesite development.

9. Henneke-Okiota-Montara

Shallow, moderately sloping to steep, well drained and somewhat excessively drained very gravelly loam and clay loam; on hills and mountains

This map unit is in scattered areas throughout the survey area, but the largest areas are in the southern and eastern parts. The soils formed in material derived mainly from serpentinite and peridotite. Vegetation is

mainly brush. Elevation ranges from 900 to 3,500 feet. The average annual precipitation is 25 to 45 inches, and the average annual temperature is 55 to 60 degrees F.

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

Henneke soils are shallow and somewhat excessively drained. Typically, the soils are gravelly loam in the upper part and gravelly clay loam over very gravelly clay in the lower part. Fractured serpentinite is at a depth of 19 inches.

Okiota soils are shallow and well drained. Typically, the soils are very gravelly clay loam in the upper part and clay loam over clay in the lower part. Fractured serpentinite is at a depth of 14 inches.

Montara soils are shallow and well drained. Typically, the soils are clay loam throughout the profile. Fractured serpentinite is at a depth of 12 inches.

Of minor extent in this unit are areas of Rock outcrop, moderately deep Dubakella soils, and shallow Millsholm soils.

This map unit is used mainly for wildlife habitat and watershed. It is also used for homesite development.

10. Maymen-Etsel

Shallow, moderately sloping to very steep, somewhat excessively drained loam and gravelly loam; on hills and mountains

This map unit occurs throughout the survey area, mainly at the lower and intermediate elevations and on warm, dry, south-facing and west-facing slopes at the upper elevations. The soils in this unit formed in material derived mainly from sandstone. Vegetation is mainly brush with scattered hardwood trees at the lower and intermediate elevations and scattered coniferous trees at the upper elevations. Elevation ranges from 1,400 to 4,000 feet. The average annual precipitation is 30 to 60 inches, and the average annual temperature is 52 to 57 degrees F.

This unit makes up about 30 percent of the survey area.

Maymen soils are shallow. Typically, the soils are loamy throughout the profile. Sandstone is at a depth of 12 inches.

Etsel soils are shallow. Typically, the soils are gravelly loam over very gravelly loam. Sandstone is at a depth of 10 inches.

Of minor extent in this unit are moderately deep Mayacama soils; shallow Snook and Millsholm soils; moderately deep Speaker, Hopland, and Marpa soils; deep Sanhedrin soils; and Rock outcrop.

This unit is used mainly for wildlife habitat and watershed. It is also used for recreation and homesite development.

11. Sanhedrin-Speaker-Kekawaka

Moderately deep to very deep, moderately sloping to very steep, well drained loam and gravelly loam; on mountains

This map unit is mainly in the Mendocino National Forest, but some areas are in the Boggs Mountain area. The soils in this unit formed in material derived mainly from sandstone and shale. Vegetation is mainly conifer forest. Elevation ranges from 1,500 to 4,800 feet. The average annual precipitation is 30 to 60 inches, and the average annual temperature is 49 to 58 degrees F.

This unit makes up about 8 percent of the survey area.

Sanhedrin soils are deep. Typically, the soils are gravelly loam over gravelly clay loam. Hard sandstone is at a depth of 57 inches.

Speaker soils are moderately deep. Typically, the soils are gravelly loam over clay loam. Soft sandstone is at a depth of 27 inches.

Kekawaka soils are very deep. Typically, the soils are loam in the upper part and clay loam over clay in the lower part. Soft sandstone is at a depth of more than 70 inches.

Of minor extent in this unit are moderately deep Marpa and Neuns soils, very deep Bamtush soils, shallow Speaker Variant soils on ridgetops, very deep Jafa soils, and shallow Maymen soils on south-facing slopes.

This unit is used mainly for timber production, wildlife habitat, and watershed. Some of the most productive timber land in the county is in this unit.

12. Neuns-Deadwood-Sheetiron

Shallow and moderately deep, moderately steep to very steep, well drained and somewhat excessively drained gravelly loam and very gravelly sandy loam; on mountains

This map unit is mainly in the Mendocino National Forest, but some areas are in the Boggs Mountain area; Sheetiron soils occur mainly in the northeast corner of the survey area. The soils in this unit formed in material derived mainly from metasedimentary sandstone and mica-quartz schist. Vegetation is mainly conifer forest with scattered areas of hardwood trees and brush. Elevation ranges from 2,200 to 5,200 feet. The average annual precipitation is 40 to 60 inches, and the average annual temperature is 47 to 55 degrees F.

This unit makes up about 17 percent of the survey area.

Neuns soils are moderately deep and well drained. Typically, the soils are gravelly loam over very gravelly loam. Hard sandstone is at a depth of 31 inches.

Deadwood soils are shallow and somewhat excessively drained. Typically, the soils are very gravelly sandy loam over extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Sheetiron soils are moderately deep and well drained. Typically, the soils are gravelly loam in the upper part and very gravelly loam over extremely gravelly loam in the lower part. Fractured mica-quartz schist is at a depth of 29 inches.

Of minor extent in this unit are deep Sanhedrin soils; very deep Bamtush soils; moderately deep Speaker, Decy, Tyson, and Marpa soils; shallow Maymen soils; and Rock outcrop.

This map unit is used mainly for timber production, wildlife habitat, and watershed.

13. Freezeout-Yollabolly

Shallow and moderately deep, steep and very steep, well drained and excessively drained very gravelly sandy loam; on mountaintops

This map unit is mainly in the Mendocino National Forest, on Goat, Hull, and Snow Mountains. The soils in this unit formed in material derived mainly from metasedimentary sandstone. Vegetation is adapted to the cold climate and is mainly conifer forest consisting of white fir on the Freezeout soils and brush on the Yollabolly soils. Elevation ranges from 5,000 to 7,050 feet. The average annual precipitation is 50 to 70 inches, most of which occurs as snowfall, and the average annual temperature is 43 to 48 degrees F.

This unit makes up about 2 percent of the survey area.

Freezeout soils are moderately deep and well drained. Typically, the soils are very gravelly sandy loam over extremely gravelly sandy loam. Hard sandstone is at a depth of 25 inches.

Yollabolly soils are shallow and excessively drained. Typically, the soils are very gravelly sandy loam over extremely gravelly loam. Hard sandstone is at a depth of 14 inches.

Of minor extent in this unit are areas of Rock outcrop; areas of debris slopes that are devoid of vegetation; and Deadwood, Neuns, and Bamtush soils at the lower elevations.

This unit is used mainly for recreation, wildlife habitat, and timber production. Among the recreational uses are hiking and bridle paths and hunting.

Gently sloping to very steep soils on volcanic hills and mountains

The soils in this group are in the intermediate and upper positions on the landscape, in the Clear Lake volcanic field. Slope ranges from 2 to 75 percent. Elevation ranges from about 800 feet south of Middletown to 4,600 feet at Cobb Mountain. The average annual precipitation is 25 to 65 inches, and the average annual temperature is 50 to 60 degrees F. The frost-free season is 120 to 205 days.

These soils are shallow to very deep and are well drained. They formed in material derived dominantly from extrusive basic igneous rock. Vegetation is dominantly brush on the hills and at the lower and intermediate positions on the mountains and is conifer forest on the upper positions.

This group is used mainly for timber production, livestock grazing, wildlife habitat, and watershed. It is also used for dryland crop production, firewood production, and homesite development. Geothermal wells are being developed in some areas.

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

14. Glenview-Bottlerock-Arrowhead

Moderately deep and very deep, gently sloping to steep, well drained very gravelly loam, extremely gravelly loam, and extremely gravelly sandy loam; on obsidian hills

This map unit occurs east of Mount Konocti, in the Red Hills and Camelback Ridge areas. The soils in this unit formed in material derived mainly from obsidian. Vegetation is dominantly brush with some scattered areas of conifers. Some areas have been cleared and cultivated. Elevation ranges from 1,500 to 3,000 feet. The average annual precipitation is 30 to 50 inches, and the average annual temperature is 53 to 59 degrees F.

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

Glenview soils are very deep. Typically, the soils are very gravelly loam over gravelly loam in the upper part and gravelly clay loam over clay in the lower part. Fractured obsidian is at a depth of more than 65 inches.

Bottlerock soils are very deep. Typically, the soils are extremely gravelly loam over very gravelly loam in the upper part and very gravelly clay loam over very gravelly clay in the lower part. Fractured obsidian is at a depth of more than 63 inches.

Arrowhead soils are moderately deep. Typically, the soils are extremely gravelly sandy loam over gravelly sandy loam in the upper part and gravelly sandy clay loam over extremely stony clay in the lower part. Fractured obsidian is at a depth of 31 inches.

Of minor extent in this unit are soils that are similar to the major soils but that are on south-facing slopes and have a warmer average annual temperature.

This map unit is used mainly as wildlife habitat and watershed. Cleared areas are used for cultivated crops. They can be used for timber production.

15. Sobrante-Guenoc-Hambright

Shallow and moderately deep, gently sloping to very steep, well drained loam, clay loam, and very gravelly loam; on basalt hills

This map unit is mainly in the southern part of the county, near Middletown and the Spruce Grove Road area. The soils in this unit formed in material derived mainly from olivine basalt. Vegetation is mainly annual grasses and forbs, oaks, and brush with some small areas of conifers. Elevation ranges from 800 to 3,500 feet. The average annual precipitation is 25 to 50 inches, and the average annual temperature is 50 to 60 degrees F.

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

Sobrante soils are moderately deep. Typically, the soils are loam over clay loam. Fractured olivine basalt is at a depth of 38 inches.

Guenoc soils are moderately deep. Typically, the soils are clay loam in the upper part and clay over gravelly clay in the lower part. Fractured olivine basalt is at a depth of 28 inches.

Hambright soils are shallow. Typically, the soils are very gravelly loam throughout the profile. Fractured olivine basalt is at a depth of 16 inches.

Of minor extent in this unit are very deep Neice soils, moderately deep Benridge Variant and Whispering soils, very deep Aiken and Collayomi soils, and shallow Stonyford soils.

This unit is used mainly for livestock grazing, wildlife habitat, watershed, and homesite development.

16. Konocti-Benridge

Moderately deep and very deep, gently sloping to very steep, well drained cobbly loam and loam; on andesite, basalt, and dacite hills and mountains

This map unit is mainly in the area around Mount Konocti and extending southeast toward Lower Lake. Another small area is northeast of Clearlake Oaks, near Round Mountain. The soils in this unit formed in material derived mainly from andesite, basalt, dacite, and pyroclastic material. Vegetation is mainly brush. Some areas have been cleared and cultivated. Elevation ranges from 1,000 to 4,300 feet. The average annual precipitation is 25 to 40 inches, and the average annual temperature is 53 to 60 degrees F.

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

Konocti soils are moderately deep. Typically, the soils are cobbly loam over very stony loam. Fractured dacite is at a depth of 39 inches.

Benridge soils are very deep. Typically, the soils are loam in the upper part and gravelly clay loam over clay in the lower part. Breccia is at a depth of 68 inches.

Of minor extent in this unit are very deep Sodabay soils, shallow Hambright soils, deep Konocti Variant soils, very deep Oxalis Variant soils on alluvial flats, Vitrandepts, Rock outcrop, and Cinderland.

This unit is used mainly as wildlife habitat and watershed. It is also used for cultivated crops and homesite development.

17. Collayomi-Aiken-Whispering

Moderately deep and very deep, moderately sloping to very steep, well drained very gravelly loam and loam; on andesite, basalt, and dacite mountains

This map unit is mainly in the Boggs Mountain and Cobb Mountain areas. The soils in this unit formed in material derived mainly from andesite, basalt, dacite, and pyroclastic tuff. Vegetation is mainly conifer forest. Elevation ranges from 1,400 to 4,600 feet. The average annual precipitation is 35 to 65 inches, and the average annual temperature is 50 to 55 degrees F.

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

Collayomi soils are very deep. Typically, the soils are very gravelly loam. Basalt is at a depth of more than 60 inches.

Aiken soils are very deep. Typically, the soils are loam in the upper part and clay loam over clay in the lower part. Basalt is at a depth of more than 75 inches.

Whispering soils are moderately deep. Typically, the soils are loam in the upper part and gravelly loam over very cobbly loam in the lower part. Fractured andesite is at a depth of 26 inches.

Of minor extent in this unit are shallow Kidd soils, very deep Forward Variant soils, and moderately deep Forward soils.

This unit is used mainly for timber production, wildlife habitat, and watershed. It is also used for homesite development and geothermal well development.

Broad Land Use Considerations

The soils in Lake County vary widely in their potential for major land uses. About 5 percent of the county is used for cultivated crops, mainly pears, walnuts, and wine grapes. The cropland is concentrated largely in general soil map units 2, 3, and 6. Some areas of units 1, 4, 5, and 14 are also used as cropland, mainly for dryland walnuts, specialty crops, and pasture. Seasonal flooding is a concern in units 1 and 2. Wetness caused by flooding and ponding of water is the major soil limitation, and it may result in damage to crops. Soil erosion is a serious concern in areas of unit 14 that are cultivated for crops. Measures are needed to minimize soil loss.

Map units 7, 9, 10, and 16 and parts of units 14 and 15 are dominated by brush and are used mainly as wildlife habitat and watershed. These areas make up about 40 percent of the county. Wildfire and associated soil erosion are major concerns in these areas. Small areas of soils in these map units have the potential to be converted from brush to grass. Plant production on the soils in unit 9 is limited because of inherent soil fertility problems.

About 35 percent of the county supports conifer and hardwood forests. Included within this forest land are areas that are favorable for commercial timber production and for hardwood production. Hardwood production in the county is mainly for use as fuelwood. Timber and hardwood production is high in map units 11, 12, and 17. Some areas of units 13 and 14 have moderate potential for timber production. Areas of units 6, 7, 8, and 15 can be used as a source of fuelwood. The use of heavy equipment is limited to the drier seasons on many of the soils. Steepness of slope, the hazard of soil erosion, shallow depth to bedrock, and a high content of rock fragments in the soil profile are

limitations encountered when harvesting timber and constructing roads on many of the soils in these units.

About 18 percent of the county supports vegetation suitable for livestock grazing. Map units 8 and 15 and parts of units 5, 6, and 7 have high potential for the production of annual grasses and forbs. Compaction by livestock when the soils are wet and the hazard of soil erosion on steep slopes are important limitations of the soils in these units.

Urban land occupies about 1 percent of the county and is concentrated largely on map units 3, 6, 8, 15, and 16. Units 3 and 6 have few limitations for urban uses; however, they are also used as valuable cropland. Areas of units 8, 15, and 16 are limited by steepness of slope and shallow soil depth, which restrict construction of building foundations and septic tank absorption fields. Soils on flood plains generally have low potential for urban development because of flooding. Steepness of slope, restricted soil depth, low soil strength, and high shrink-swell potential are limitations in some or all areas of these map units. Sites that are suitable for houses and small commercial buildings, however, generally are available in these areas if site-specific investigation and design are used.

The potential for recreational use ranges from low to high, depending on the intensity of the intended use and the properties of the soils. In many of the map units, hilly to very steep slopes limit the use of the soils for intensive recreational development such as playgrounds and camp areas; however, small areas suitable for intensive development may be available in map units that have low potential for recreational development. Most of the map units are suitable for extensive recreational uses such as hiking, horseback riding, fishing, and hunting for waterfowl and upland game.

All of the map units have potential for wildlife habitat. Especially important are areas of potential wetland wildlife habitat, which cover about 1 percent of the county. In the section "Wildlife Habitat," the habitat in the county is discussed as it occurs in the general soil map units.

Detailed Soil Map Units

The map units delineated on the detailed maps provided with 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."

Various parts of the survey area were mapped at different levels of detail. The most detailed mapping was accomplished for cropland and urban areas in the valleys. Field procedures consisted of identifying each delineation by transversing or observation or by transecting. Soil boundaries were plotted by observation and aerial photograph interpretation and were verified at closely spaced intervals. Minimum size of delineations was about 10 acres.

The less detailed mapping was accomplished for rangeland and forestland in the hills and mountains. Field procedures consisted of identifying each delineation by transversing or observation or aerial photograph interpretation or by transecting. Boundaries were plotted by observation and by aerial photograph interpretation and were verified by some observations. Minimum size of delineations was about 40 acres.

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, salinity, 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*. The name of a soil phase commonly indicates a feature that affects use or management. For example, Tulelake silty clay loam, flooded, is one of two phases in the Tulelake 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. Sanhedrin-Kekawaka-Speaker complex, 30 to 50 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. Benridge-Konocti association, 15 to 30 percent slopes, is an example.

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

Table 5 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—Aiken-Sobrante association, 5 to 15 percent slopes. This map unit is on hills and mountains. The vegetation is mainly conifers and hardwoods on the Aiken soil and annual grasses and hardwoods on the Sobrante soil. Elevation is 1,400 to 2,400 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 150 to 180 days.

This unit is about 45 percent Aiken loam and 25 percent Sobrante loam. The Aiken soil is on north- and east-facing slopes, and the Sobrante soil is on south- and west-facing slopes.

Included in this unit are small areas of Collayomi, Guenoc, and Whispering soils, Aiken and Sobrante soils that have slopes of 15 to 30 percent, and soils that are similar to the Aiken soil but are less than 60 inches deep or do not have a clay subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Aiken soil is very deep and well drained. It formed in material weathered from basalt. Typically, the upper part of the surface layer is reddish brown loam 5 inches thick and the lower part is reddish brown clay loam 4 inches thick. The upper 11 inches of the subsoil is yellowish red clay loam, and the lower 54 inches is reddish yellow clay and cobbly clay.

Permeability of the Aiken soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for timber production, firewood production, wildlife habitat, and watershed. It is also used for orchards and homesite development.

Ponderosa pine and California black oak are the main tree species on the Aiken soil, and blue oak is the main species on the Sobrante soil. On the basis of a 100-year site curve, the mean site index is 117 for ponderosa pine on the Aiken soil. The potential annual production of ponderosa pine on the Aiken soil is 540 board feet per acre from a fully stocked stand of trees. Volumes of 9 cords of wood per acre have been measured on the Sobrante soil.

A concern 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. Rock for construction of roads is not readily available on this unit.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine seedlings on the Aiken soil. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs periodically. Among the common forest understory plants are bedstraw, greenleaf manzanita, and poison-oak on the Aiken soil and soft chess, ripgut brome, and wild oat on the Sobrante soil.

The main crop grown on this unit, primarily on the Aiken soil, is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. The main limitations are the hazard of erosion and steepness of slope. Depth to bedrock is a major limitation of the Sobrante soil. Use of a cover crop between rows of trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for homesite development, the main limitations are depth to bedrock in the Sobrante soil and the moderately slow permeability and low load bearing capacity of the Aiken soil. If this unit is used for septic

tank absorption fields, the limitations of moderate depth of the Sobrante soil and moderately slow permeability of the Aiken soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the limited ability of the Aiken soil to support a load. If this soil is used for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

The Aiken soil is in capability unit IIIe-1 (5), nonirrigated, and the Sobrante soil is in capability unit IIIe-8 (15), nonirrigated.

102—Aiken-Sobrante association, 15 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly conifers and hardwoods on the Aiken soil and annual grasses and hardwoods on the Sobrante soil. Elevation is 1,400 to 2,400 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 150 to 180 days.

This unit is about 40 percent Aiken loam and 30 percent Sobrante loam. The Aiken soil is on north- and east-facing slopes, and the Sobrante soil is on south- and west-facing slopes.

Included in this unit are small areas of Collayomi, Guenoc, and Whispering soils. Also included are small areas of Aiken and Sobrante soils that have slopes of 5 to 15 percent and soils that are similar to the Aiken soil but are less than 60 inches deep or do not have a clay subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Aiken soil is very deep and well drained. It formed in material weathered from basalt. Typically, the upper part of the surface layer is reddish brown loam 5 inches thick and the lower part is reddish brown clay loam 4 inches thick. The upper 11 inches of the subsoil is yellowish red clay loam, and the lower 54 inches is reddish yellow clay and cobbly clay.

Permeability of the Aiken soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine and California black oak are the main tree species on the Aiken soil, and blue oak is the main species on the Sobrante soil. On the basis of a 100-year site curve, the mean site index is 117 for ponderosa pine on the Aiken soil. The potential annual production of ponderosa pine on the Aiken soil is 540 board feet per acre from a fully stocked stand of trees. Volumes of 9 cords of wood per acre have been measured on the Sobrante soil.

A concern 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. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine seedlings on the Aiken soil. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs periodically. Among the common forest understory plants are bedstraw, greenleaf manzanita, and poison-oak on the Aiken soil and soft chess, ripgut brome, and wild oat on the Sobrante soil.

The main crop grown on this unit, primarily on the Aiken soil, is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. This unit is poorly suited to orchards. The main limitations are the hazard of erosion and steepness of slope. Depth to bedrock is a major limitation of the Sobrante soil. Use of a cover crop between rows of trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

The Aiken soil is in capability unit IVe-1 (5), nonirrigated, and the Sobrante soil is in capability unit IVe-1 (15), nonirrigated.

103—Asbill clay loam, 5 to 8 percent slopes. This moderately deep, well drained soil is on hills. It formed in material weathered from shale and siltstone. The vegetation is mainly annual grasses and scattered oaks. Elevation is 1,350 to 2,100 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is olive gray clay loam 13 inches thick. The underlying material to a depth of 39 inches is olive gray and light olive gray clay. Soft siltstone is at a depth of 39 inches.

Included in this unit are small areas of Kelsey soils in drainageways, Skyhigh soils, Wappo Variant soils on uplifted terraces, and soils that are clay loam or silty clay

loam that is less than 35 percent clay in some or all horizons. Also included are soils that are similar to this Asbill soil but are noncalcareous in some or all horizons and have a clay loam or silty clay loam subsoil that is less than 35 percent clay. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Asbill soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate. The soil is calcareous throughout. The shrink-swell potential is high.

This unit is used mainly for livestock grazing. It is also used for hay and pasture, vineyards, and homesite development. It can be used for firewood production.

The production of forage is limited by the susceptibility of the soil to compaction when moist. Grazing should be deferred when the surface layer is saturated. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The characteristic plant community on this unit is mainly soft chess, wild oat, and annual forbs.

If this unit is used for hay and pasture, the main limitations are the hazard of erosion and slow permeability. Depth to rock and available water capacity also limit use of the shallower areas of this unit. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

This unit is poorly suited to vineyards. The main crop grown is wine grapes. Irrigation commonly is used for maximum production of this crop. Slow permeability, the hazard of erosion, and steepness of slope are the main limitations. Depth to bedrock is also a limitation. Because of the slow permeability of the soil in this unit, irrigation water needs to be applied slowly to minimize runoff. Use of a cover crop between rows of vines helps to control erosion and runoff. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, high shrink-swell potential, and low load bearing capacity. If this unit is used for septic tank absorption fields, the limitations of moderate depth and slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the effects of shrinking and swelling and the limited ability of the soil in this unit to support a load. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIIe-5 (15), irrigated and nonirrigated.

104—Asbill clay loam, 8 to 15 percent slopes. This moderately deep, well drained soil is on hills. It formed in material weathered from shale or siltstone. The vegetation is mainly annual grasses and scattered oaks. Elevation is 1,350 to 2,100 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is olive gray clay loam 13 inches thick. The underlying material to a depth of 39 inches is olive gray and light olive gray clay. Soft siltstone is at a depth of 39 inches. In some areas the surface layer is silty clay loam.

Included in this unit are small areas of Skyhigh soils. Also included are small areas of soils that are less than 10 inches deep and soils, in drainageways, that have 20 to 40 percent gravel throughout. Also included are small areas of soils that are similar to this Asbill soil but are noncalcareous in some or all horizons or have a clay loam subsoil that is less than 35 percent clay. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Asbill soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The soil is calcareous. The shrink-swell potential is high.

This unit is used mainly for livestock grazing. It is also used for hay and pasture and for homesite development. It can be used for firewood production.

The production of forage is limited by the susceptibility of the soil to compaction when moist. Grazing should be deferred when the surface layer is saturated. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The characteristic plant community on this unit is mainly soft chess, wild oat, and annual forbs.

If this unit is used for hay and pasture, the main limitations are the hazard of erosion and slow permeability. Depth and available water capacity also limit use of the shallower areas of this unit. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

If this unit is used for homesite development, the main limitations are depth to bedrock, slow permeability, high shrink-swell potential, and low load bearing capacity. If

this unit is used for septic tank absorption fields, the limitations of moderate depth and slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the effects of shrinking and swelling and the limited ability of the soil in this unit to support a load. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIIe-5 (15), irrigated and nonirrigated.

105—Badland. This map unit is in steep ravines and on barren dissected terrace escarpments. It formed in areas of semiconsolidated uplifted alluvial deposits derived from mixed rock sources. Active geologic erosion is extreme. Slopes are 50 to 100 percent. This unit commonly is barren; however, some areas support very sparse annual grasses or brush. Elevation is 1,100 to 2,000 feet.

Areas of this unit have severely eroded terrace slopes with "V"-shaped gullies or consist of recent slip faces on very steep or nearly vertical stream escarpments. Local relief generally ranges from 50 to 500 feet.

Included in this unit are small areas of Bally and Phipps soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Surface runoff is very rapid, and the hazard of erosion is severe. These actively eroding areas generally produce a high sediment yield to nearby streams.

Areas in which stability is a severe problem commonly are produced by stream channels that undercut the terrace slope. Suitable streambank protectors could be used where the cutting occurs to reduce the amount of sediment in the streams.

Revegetating these areas is difficult because of the extreme geologic erosion, steepness of slope, and the low fertility of the geologic material.

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

106—Bally-Phipps gravelly loams, 2 to 8 percent slopes. This map unit is on uplifted, dissected hills. The vegetation is mainly brush. Elevation is 1,100 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Bally gravelly loam and 35 percent Phipps 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 Talmage soils. Also included are small areas of soils that are similar to the Bally and Phipps soils but have less than 35 percent clay in the subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Bally soil is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is yellowish brown gravelly loam 16 inches thick. The subsoil is yellowish brown very gravelly clay loam 31 inches thick. The substratum to a depth of 80 inches or more is brown very gravelly clay loam.

Permeability of the Bally soil is slow. Available water capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is slight.

The Phipps soil is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is brown gravelly loam 3 inches thick. The upper 20 inches of the subsoil is brown and pale brown gravelly clay loam, and the lower 38 inches is light yellowish brown gravelly clay.

Permeability of the Phipps soil is slow. Available water capacity is 8.0 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is slight.

This unit is used mainly as wildlife habitat and watershed. It is also used for homesite development. It can be used for livestock grazing.

If this unit is used for homesite development, the main limitation is slow permeability. If the soils are used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The production of forage is limited by the tendency of this unit to produce woody species. If shrubs are managed to create open areas, this unit can produce a good stand of desirable grasses and forbs. Woody species should be left in drainageways to reduce erosion and provide habitat for wildlife. The characteristic plant community on this unit is mainly chamise and ceanothus. Estimates of rangeland productivity have not been made for this unit.

This map unit is in capability unit IIIs-3 (15), nonirrigated.

107—Bally-Phipps complex, 15 to 30 percent slopes. This map unit is on uplifted, dissected hills. The vegetation is mainly brush. Elevation is 1,400 to 2,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 40 percent Bally gravelly sandy clay loam and 35 percent Phipps 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 Forbesville soils. Also included are small areas of Bally and Phipps soils that have slopes of more than 30 percent or less than 15 percent, soils that have a very gravelly surface layer, and soils that have a thicker dark colored surface layer and are in areas that are less subject to erosion. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Bally soil is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is yellowish brown gravelly sandy clay loam 2 inches thick. The upper 8 inches of the subsoil is yellowish brown gravelly sandy clay loam, and the lower 27 inches is variegated brown and reddish yellow very gravelly sandy clay loam and very gravelly sandy clay. The substratum to a depth of 65 inches or more is variegated brown and reddish yellow very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam, loam, or gravelly loam.

Permeability of the Bally soil is slow. Available water capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more, but most roots do not penetrate to a depth of more than about 15 to 25 inches because of the clayey texture of the subsoil. Surface runoff is rapid, and the hazard of erosion is moderate.

The Phipps soil is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is dark brown loam 6 inches thick. The subsoil is brown gravelly clay loam about 15 inches thick. The substratum to a depth of 73 inches is brown and yellowish brown gravelly and very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability of the Phipps soil is slow. Available water capacity is 6.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It can also be used for livestock grazing.

The production of forage is limited by the tendency of this unit to produce shrubs. If the shrubs are managed to create open areas, this unit can produce a good stand of desirable grasses and forbs. Woody species should be left in the drainageways and in the steeper areas to reduce erosion and provide habitat for wildlife. This unit should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. The characteristic plant community on this unit is mainly chamise and ceanothus. Estimates of rangeland productivity have not been made for this unit.

This unit is dissected by numerous drainageways. To provide for seasonal runoff, properly designed culverts should be installed where roads cross natural drainageways. Water bars help to control erosion on roads.

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

108—Bally-Phipps-Haploxeralfs association, 30 to 75 percent slopes. This map unit is on uplifted, dissected hills. The vegetation is mainly brush. Active geologic erosion occurs throughout this unit. Elevation is 1,400 to 2,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 35 percent Bally gravelly sandy clay loam, 20 percent Phipps loam, and 20 percent Haploxeralfs. The Bally and Phipps soils have slopes of 30 to 50 percent, and the Haploxeralfs have slopes of 50 to 75 percent. Landslips and active geologic erosion occur on the steeper slopes.

Included in this unit are small areas of Forbesville soils. Also included are small areas of Bally and Phipps soils that have slopes of less than 30 percent, soils that have a thicker dark-colored surface layer and are in areas that are less subject to erosion, and soils that are similar to the Bally soil but have been severely eroded. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Bally soil is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is yellowish brown gravelly sandy clay loam 2 inches thick. The upper 8 inches of the subsoil is yellowish brown gravelly sandy clay loam, and the lower 27 inches is variegated brown and reddish yellow very gravelly sandy clay loam and very gravelly sandy clay. The substratum to a depth of 65 inches or more is variegated brown and reddish yellow very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam, loam, or gravelly loam.

Permeability of the Bally soil is slow. Available water capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more, but most roots do not penetrate to a depth of more than about 15 to 25 inches because of the clayey texture of the subsoil. Surface runoff is very rapid, and the hazard of erosion is severe.

The Phipps soil is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is brown loam 6 inches thick. The subsoil is brown gravelly clay loam about 15 inches thick. The substratum to a depth of 60 inches or more is brown gravelly and very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability of the Phipps soil is slow. Available water capacity is 6.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

Haploxeralfs are moderately deep to very deep and are well drained and somewhat excessively drained. No single profile of these soils is typical, but one commonly observed in the survey area has a surface layer of brown gravelly loam 5 inches thick. The upper 5 inches of the subsoil is light yellowish brown gravelly loam, and the lower 13 inches is light brown and light yellowish brown very gravelly sandy clay loam. The substratum to a depth of 65 inches is yellowish brown very gravelly sandy loam.

Permeability of the Haploxeralfs is moderate to slow. Available water capacity is 2.5 to 10.0 inches. Geologic erosion is high on these soils.

This unit is used mainly as wildlife habitat and watershed. It can also be used for livestock grazing.

The production of forage is limited by the dominance of the brush species on this unit and by steepness of slope. Because of the instability of the soil, trees and brush should be retained on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire. Slope limits access by livestock and results in overgrazing of the less sloping areas. The characteristic plant community on this unit is mainly chamise and ceanothus. Estimates of rangeland productivity have not been made for this unit.

This unit is dissected by numerous drainageways. To provide for seasonal runoff, properly designed culverts should be installed where roads cross natural drainageways. Water bars help to control erosion on roads crossing contours.

The Bally soil is in capability subclass VIs (15), the Phipps soil is in capability subclass VIe (15), and the Haploxeralfs, loamy, are in capability subclass VIIs (15), nonirrigated.

109—Bamtush-Neuns gravelly loams, 15 to 30 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 47 to 53 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 40 percent Bamtush gravelly loam and 30 percent Neuns 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 is about 10 percent Sanhedrin soils. Also included are small areas of Marpa and Shortyork Variant soils, Rock outcrop, Bamtush and Neuns soils that have slopes of less than 15 percent, and soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Bamtush soil is very deep and well drained. It formed in material weathered from sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 7 inches thick. The upper 10 inches of the subsoil is brown very gravelly loam, and the lower 46 inches is strong brown very gravelly loam.

Permeability of the Bamtush soil is moderate. Available water capacity is 5.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Neuns soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1.5 inches thick. The surface layer is brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured metamorphosed sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

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, Pacific madrone, interior live oak, and white fir. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 134 on the Bamtush soil and 113 on the Neuns soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 139 on the Bamtush soil and 106 on the Neuns soil. The potential annual production of ponderosa pine on the Bamtush soil is 830 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Neuns soil is 425 board feet per acre from a fully stocked stand of trees.

There are no major soil limitations for the harvesting of timber on this unit. Rock for construction of roads generally is available.

Seedling survival is a concern in the production and reforestation of timber on these soils. The droughtiness of the surface layer reduces the survival rate of seedlings, especially in areas of the Neuns soil on south- and southwest-facing slopes. Reforestation can be accomplished by planting Douglas-fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers periodically occurs.

Among the common forest understory plants are bedstraw, snowberry, gooseberry, poison-oak, and perennial fescue.

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

110—Bamtush-Speaker-Sanhedrin gravelly loams, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 2,200 to 4,800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 49 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 30 percent Bamtush gravelly loam, 25 percent Speaker gravelly loam, and 20 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 Deadwood, Kekawaka, Marpa, and Neuns soils and Rock outcrop. Also included are small areas of Bamtush, Sanhedrin, and Speaker soils that have slopes of less than 30 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Bamtush soil is very deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 1 inch thick. The surface layer is brown gravelly loam 7 inches thick. The upper 10 inches of the subsoil is brown very gravelly loam, and the lower 46 inches is strong brown very gravelly loam.

Permeability of the Bamtush soil is moderate. Available water capacity is 5.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, 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 ponderosa pine is 139 on the Bamtush soil, 106 on the Speaker soil, and 116 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 134 on the Bamtush soil, 107 on the Speaker soil, and 121 on the Sanhedrin soil. The potential annual production of ponderosa pine on the Bamtush soil is 830 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are sugar pine, canyon live oak, Oregon white oak, and white fir.

Some concerns for the harvesting of timber are steepness of slope, the hazard of erosion, 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. 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 careful use of either wheeled and tracked equipment or cable harvesting systems. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on this unit.

Plant competition is a concern in the reforestation and production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of conifer seedlings. Reforestation can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. If seed trees are present, natural reforestation by conifers frequently occurs.

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

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

111—Bamtush-Speaker-Sanhedrin gravelly loams, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 2,200 to 4,800 feet. The average annual precipitation is 40 to 60 inches, the average annual air

temperature is 49 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 30 percent Bamtush gravelly loam, 30 percent Speaker gravelly loam, and 15 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 Deadwood, Kekawaka, Marpa, and Neuns soils and Rock outcrop. Also included are small areas of Bamtush, Speaker, and Sanhedrin soils that have slopes of less than 50 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Bamtush soil is very deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 1 inch thick. The surface layer is brown gravelly loam 7 inches thick. The upper 10 inches of the subsoil is brown very gravelly loam, and the lower 46 inches is strong brown very gravelly loam.

Permeability of the Bamtush soil is moderate. Available water capacity is 5.0 to 7.5 inches. Effective rooting depth is more than 60 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs about 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

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 134 on the Bamtush soil, 107 on the Speaker soil, and 121 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 139 on the Bamtush soil, 106 on the Speaker soil, and 116 on the Sanhedrin soil. The potential annual production of ponderosa pine on the Bamtush soil is 830 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are sugar pine, canyon live oak, Oregon white oak, and white fir.

The main limitations for the harvesting of timber are steepness of slope and the hazard of erosion. Cable yarding systems generally are used on this unit. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion. 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.

Plant competition is a concern in the production and reforestation of timber on this unit. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of conifer seedlings. Reforestation can be accomplished by planting Douglas-fir, sugar pine, and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers frequently occurs.

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

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

112—Benridge-Konocti association, 15 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush on south- and east-facing slopes and brush with scattered hardwoods and conifers on north- and west-facing slopes. Elevation is 1,300 to 4,300 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 40 percent Benridge loam, 20 percent Konocti cobbly loam, and 20 percent Konocti stony loam. The Konocti soils are on the upper part of side slopes, on ridgetops, and in ravines, and the Benridge soil is in the other areas of the unit.

Included in this unit are small areas of Konocti Variant soils and Rock outcrop and boulders 3 to 20 feet in diameter that are predominantly in areas of the Konocti

soils. Also included are small areas of Benridge and Konocti soils that have slopes of more than 30 percent or less than 15 percent; small areas of soils that are similar to the Benridge and Konocti soils but are cooler; soils that are similar to the Benridge soil but have a thinner surface layer because of erosion; and soils that have 35 to 55 percent rocks and stones throughout. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Benridge soil is very deep and well drained. It formed in material weathered from volcanic ash, breccia, or tuff. Typically, the surface layer is light brown loam 6 inches thick. The upper 57 inches of the subsoil is yellowish red gravelly clay loam, and the lower 5 inches is yellowish red clay. Weathered volcanic breccia is at a depth of 68 inches.

Permeability of the Benridge soil is moderately slow. Available water capacity is 6.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Konocti cobbly loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown cobbly loam 8 inches thick. The upper 8 inches of the subsoil is brown stony loam, and the lower 16 inches is light reddish brown very stony loam. The substratum to a depth of 39 inches is reddish yellow very stony loam. Slightly weathered dacite is at a depth of 39 inches.

Permeability of the Konocti cobbly loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Konocti stony loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown stony loam 4 inches thick. The upper 5 inches of the subsoil is brown stony loam, and the lower 19 inches is light reddish brown very stony clay loam. Slightly weathered dacite is at a depth of 28 inches.

Permeability of the Konocti stony loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It is also used for homesite development.

Woody shrubs are the most extensive plants on this unit. The characteristic vegetation is mainly manzanita, chamise, and California scrub oak with scattered areas of knobcone pine. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and the moderately slow permeability. Other limitations are the depth to bedrock in the Konocti soils and large stones in the Konocti stony loam. Extensive cutting and filling generally are required. Cut and fill slopes are susceptible to erosion. The risk of erosion is increased by leaving the soil surface exposed during site development. Preserving the existing vegetation and revegetating disturbed areas around construction sites helps to control erosion. Cuts needed to provide building sites on the Konocti soils can expose bedrock and large stones. Large stones in the Konocti stony loam may interfere with building site preparation. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. The limitations of moderately slow permeability of the Benridge and Konocti soils and the moderate depth of the Konocti soils can be minimized by increasing the area of the absorption fields or by using a specially designed sewage disposal system.

The Benridge soil is in capability unit IVe-1 (15), nonirrigated. The Konocti soils are in capability unit IVs-1 (15), nonirrigated.

113—Benridge-Konocti association, 30 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush on south- and east-facing slopes and brush with scattered hardwoods and conifers on north- and west-facing slopes. Elevation is 1,300 to 4,300 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 40 percent Benridge loam, 30 percent Konocti cobbly loam, and 15 percent Konocti stony loam. The Konocti soils are on the upper side slopes, on ridgetops, and in ravines, and the Benridge soil is in the other areas of the unit.

Included in this unit are small areas of Konocti Variant soils; Rock outcrop and stones 3 to 25 feet in diameter, mainly in areas of the Konocti soils; Benridge and Konocti soils that have slopes of more than 50 percent; and soils that are similar to the Benridge and Konocti soils but have soil temperatures lower than 59 degrees F. Also included are small areas of soils that are similar to the Konocti soils but have fewer rock fragments and small areas of soils that are similar to the Benridge soil but have 35 to 55 percent rock fragments throughout the profile. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Benridge soil is very deep and well drained. It formed in material weathered from volcanic ash, breccia, or tuff. Typically, the surface layer is light brown loam 6 inches thick. The upper 57 inches of the subsoil is yellowish red gravelly clay loam, and the lower 5 inches is yellowish red clay. Weathered volcanic breccia is at a depth of 68 inches.

Permeability of the Benridge soil is moderately slow. Available water capacity is 6.5 to 10.5 inches. Effective

rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

The Konocti cobbly loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown cobbly loam 8 inches thick. The upper 8 inches of the subsoil is brown stony loam, and the lower 16 inches is light reddish brown very stony loam. The substratum to a depth of 39 inches is reddish yellow very stony loam. Slightly weathered dacite is at a depth of 39 inches.

Permeability of the Konocti cobbly loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Konocti stony loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown stony loam 4 inches thick. The upper 5 inches of the subsoil is brown stony loam, and the lower 19 inches is light reddish brown very stony clay loam. Slightly weathered dacite is at a depth of 28 inches. In some areas the surface layer is very stony loam.

Permeability of the Konocti stony loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It is also used for homesite development.

Woody shrubs are the most extensive plants on this unit. The characteristic vegetation is mainly manzanita, chamise, and California scrub oak with scattered areas of knobcone pine. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and the moderately slow permeability. Other limitations are depth to bedrock in the Konocti soils and large stones in the Konocti stony loam. Preferred building sites are limited to knolls and the less sloping areas. Extensive cutting and filling generally are required to provide building sites. These cuts may expose bedrock and large stones on the Konocti soils. Large stones in the Konocti stony loam may interfere with building site preparation. Cut and fill slopes are susceptible to excessive erosion. The risk of erosion is increased by leaving the soil surface exposed during site development. Preserving the existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Slope is a major limitation for the installation of septic tank absorption fields. Absorption lines should be installed on the contour. If this unit is used for septic tank absorption fields, the limitations of moderate depth of the Konocti soils and moderately slow permeability of the Konocti and Benridge soils can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The Benridge soil is in capability subclass VIe (15), nonirrigated. The Konocti soils are in capability subclass VIs (15), nonirrigated.

114—Benridge-Sodabay loams, 8 to 15 percent slopes. This map unit is on hills. The vegetation is mainly brush with a few scattered oaks and conifers. Elevation is 1,350 to 1,450 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Benridge loam and 40 percent Sodabay 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 Guenoc, Hambright, and Konocti soils. Also included are small areas of soils that are similar to the Benridge and Sodabay soils but are 40 to 60 inches deep to bedrock and Benridge and Sodabay soils that have slopes of 15 to 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Benridge soil is very deep and well drained. It formed in material weathered from dacite, breccia, or tuff. Typically, the surface layer is light brown loam 6 inches thick. The upper 57 inches of the subsoil is yellowish red gravelly clay loam, and the lower 5 inches is yellowish red clay. Weathered breccia is at a depth of 68 inches.

Permeability of the Benridge soil is moderately slow. Available water capacity is 6.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

The Sodabay soil is very deep and well drained. It formed in material weathered from dacite, tuff, breccia, or volcanic ash. Typically, the surface layer is light reddish brown loam 6 inches thick. The upper 46 inches of the subsoil is light reddish brown clay loam, and the lower 11 inches is light reddish brown gravelly clay loam. Weathered pyroclastic tuff is at a depth of 63 inches.

Permeability of the Sodabay soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used for homesite development, wildlife habitat, and watershed.

If this unit is used for homesite development, the main limitation is the moderately slow permeability of the soils. If this unit is used for septic tank absorption fields, 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 IIIe-1 (5), nonirrigated.

115—Benridge-Sodabay loams, 15 to 30 percent slopes. This map unit is on hills. The vegetation is mainly brush with scattered oaks and conifers. Elevation is 1,400 to 2,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 155 to 200 days.

This unit is about 45 percent Benridge loam and 40 percent Sodabay 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 Hambright and Konocti soils. Also included are small areas of soils that are similar to the Benridge and Sodabay soils but are less than 60 inches deep or have slopes of less than 15 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Benridge soil is very deep and well drained. It formed in material weathered from volcanic ash, breccia, or tuff. Typically, the surface layer is light brown loam 6 inches thick. The upper 57 inches of the subsoil is yellowish red gravelly clay loam, and the lower 5 inches is yellowish red clay. Weathered breccia is at a depth of 68 inches. In some areas the surface layer is gravelly loam.

Permeability of the Benridge soil is moderately slow. Available water capacity is 6.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Sodabay soil is very deep and well drained. It formed in material weathered from dacite, tuff, breccia, or volcanic ash. Typically, the surface layer is light reddish brown loam 6 inches thick. The upper 46 inches of the subsoil is light reddish brown clay loam, and the lower 11 inches is light reddish brown gravelly clay loam. Weathered pyroclastic tuff is at a depth of 63 inches.

Permeability of the Sodabay soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It is also used for orchards and homesite development.

Woody shrubs are the most extensive plants on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

The main crop grown on this unit is walnuts. The main limitations are the hazard of erosion and steepness of slope. Where brush is removed to create open areas, this unit can be used for orchards. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. Areas used for walnuts should be restricted to the less sloping areas. Use of cover crops between rows of trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for homesite development, the main limitations are the moderately slow permeability, steepness of slope, and the hazard of erosion. If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Extensive cutting and filling generally are required to provide roadbeds and building sites. Cut and fill slopes are susceptible to excessive erosion. The risk of erosion is increased if the soil surface is left exposed during construction. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour.

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

116—Benridge Variant loam, 2 to 15 percent slopes. This moderately deep, well drained soil is on hillslopes at valley sides. It formed in material weathered from basaltic tuff. The vegetation is mainly oaks, brush, and annual grasses. Elevation is 1,100 to 2,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is reddish brown and light reddish brown loam 11 inches thick. The subsoil is pale yellow gravelly clay 13 inches thick. Weathered tuff is at a depth of 24 inches.

Included in this unit are small areas of Guenoc, Hambright, and Stonyford soils; soils that are less than 10 inches deep to basaltic tuff and are on ridgetops; and soils that are similar to this Benridge Variant soil but have slopes of 15 to 30 percent. Also included are small areas of soils that are similar to this Benridge Variant soil but have a stony surface, are 10 to 20 inches deep and do not have clay that has high shrink-swell potential in the subsoil, or are 40 to 60 inches deep over basaltic tuff. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Benridge Variant soil is very slow. Available water capacity is 2.0 to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential of the subsoil is high.

This unit is used mainly for livestock grazing. It is also used for homesite development. It can be used for firewood production.

The production of forage is limited by the restricted available water capacity. Where oaks and brush grow, forage production will be increased by managing harvesting of the trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 9 cords of wood per acre have been measured on this unit. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are the presence of some stony areas and the tendency of the unit to produce woody plants. Among the common understory plants are soft chess, filaree, and annual clover.

If this unit is used for homesite development, the main limitations are the depth to bedrock, the very slow permeability, and the high shrink-swell potential of the subsoil. If the unit is used for septic tank absorption fields, the limitation of very slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The high shrink-swell potential of the subsoil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be minimized by backfilling with a material that has low shrink-swell potential.

This map unit is in capability unit IVe-8 (15), nonirrigated.

117—Bottlerock-Glenview-Arrowhead complex, 5 to 30 percent slopes. This map unit is on volcanic hills. The vegetation is mainly brush with scattered conifers. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 195 days.

This unit is about 50 percent Bottlerock extremely gravelly loam, 20 percent Glenview very gravelly loam, and 15 percent Arrowhead extremely 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 soils that are similar to the Arrowhead soil but are 10 to 20 inches deep over obsidian and small areas of soils that are similar to the Glenview soil but have 35 to 70 percent cobbles and stones throughout. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Bottlerock soil is very deep and well drained. It formed in material weathered from obsidian. Typically, the upper 5 inches of the surface layer is dark grayish brown extremely gravelly loam and commonly has a surface pavement that is 90 percent gravel, the next 4 inches is light gray very gravelly loam, and the lower 10 inches is very pale brown very gravelly loam. The upper 9 inches of the subsoil is very pale brown very gravelly sandy clay loam, the next 11 inches is light brown very gravelly clay loam, and the lower 24 inches is dark red, strong brown, and reddish yellow very gravelly clay.

Permeability of the Bottlerock soil is slow. Available water capacity is 2.5 to 6.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Glenview soil is very deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown very gravelly loam 1 inch thick and the lower part is brown gravelly loam 5 inches thick. The upper 9 inches of the subsoil is reddish yellow gravelly clay loam, the next 25 inches is reddish yellow gravelly clay, and the lower 25 inches is reddish yellow gravelly clay loam. In some areas the surface layer is very gravelly sandy loam.

Permeability of the Glenview soil is moderately slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Arrowhead soil is moderately deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown extremely gravelly sandy loam 1 inch thick and the lower part is brown gravelly sandy loam 3 inches thick. The upper 4 inches of the subsoil is brown gravelly sandy loam, the next 6 inches is light brown gravelly sandy clay loam, and the lower 17 inches is reddish yellow very stony clay. Hard, fractured obsidian is at a depth of 31 inches.

Permeability of the Arrowhead soil is moderately slow. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

This unit is used mainly as wildlife habitat and watershed. It can be used for production of timber and Christmas trees.

Proper site preparation on the Bottlerock and Glenview soils might make it possible to replace stands of brush and hardwoods with conifers. These soils are suited to the production of ponderosa pine. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 103 on the Bottlerock soil and 110 on the Glenview soil. The potential annual production of ponderosa pine on the Bottlerock soil is 400 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Glenview soil is 460 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for the Arrowhead soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber is the potential shredding effect of the obsidian on rubber tires. The soils in this unit also are subject to gullying when the surface layer is removed. Disturbance of this protective layer can be reduced by the careful use of wheeled and tracked equipment. Establishing plant cover on steep cut

and fill slopes reduces erosion on the Glenview soil; however, revegetation of cut and fill slopes is difficult on the Bottlerock and Arrowhead soils because of the restricted available water capacity and the high content of rock fragments.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished on the Bottlerock and Glenview soils by planting large ponderosa pine seedlings following proper site preparation. The droughtiness of the surface layer reduces the survival rate 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. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Planting on the Arrowhead soil is not practical because of the restricted available water capacity. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are blueblossom ceanothus, interior live oak, and manzanita.

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

118—Bottlerock-Glenview-Arrowhead complex, 30 to 50 percent slopes. This map unit is on volcanic hills. The vegetation is mainly brush with scattered conifers. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 195 days.

This unit is about 40 percent Bottlerock extremely gravelly loam, 20 percent Glenview very gravelly loam, and 15 percent Arrowhead extremely 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 soils that are similar to the Arrowhead soil but are 10 to 20 inches deep over obsidian and small areas of Arrowhead, Bottlerock, and Glenview soils that have slopes of more than 50 percent. Also included are small areas of soils that are similar to the Glenview soil but have 40 to 75 percent stones and cobbles throughout and small areas of soils that are similar to the Bottlerock, Glenview, and Arrowhead soils but are severely eroded. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Bottlerock soil is very deep and well drained and commonly has a surface pavement that is 90 percent gravel. It formed in material weathered from obsidian. Typically, the upper 5 inches of the surface layer is dark grayish brown extremely gravelly loam, the next 4 inches is light gray and very pale brown very gravelly loam, and the lower 10 inches is very pale brown very gravelly loam 10 inches thick. The upper 9 inches of the subsoil is very pale brown very gravelly sandy clay loam, the next 11 inches is light brown very gravelly clay loam, and the lower 24 inches is strong brown and reddish yellow very gravelly clay.

Permeability of the Bottlerock soil is slow. Available water capacity is 2.5 to 6.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Glenview soil is very deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown very gravelly loam 1 inch thick and the lower part is brown gravelly loam 5 inches thick. The upper 9 inches of the subsoil is reddish yellow clay loam, the next 25 inches is reddish yellow gravelly clay, and the lower 25 inches is reddish yellow gravelly clay loam. In some areas the surface layer is very gravelly sandy loam.

Permeability of the Glenview soil is moderately slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Arrowhead soil is moderately deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown extremely gravelly sandy loam 1 inch thick and the lower part is brown gravelly sandy loam 3 inches thick. The upper 4 inches of the subsoil is brown gravelly sandy loam, the next 6 inches is light brown gravelly sandy clay loam, and the lower 17 inches is reddish yellow very stony clay. Hard, fractured obsidian is at a depth of 31 inches.

Permeability of the Arrowhead soil is moderately slow. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It can be used for production of timber and Christmas trees.

Proper site preparation on the Bottlerock and Glenview soils might make it possible to replace stands of brush and hardwoods with conifers. These soils are suited to the production of ponderosa pine. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 103 on the Bottlerock soil and 110 on the Glenview soil. The potential annual production of ponderosa pine on the Bottlerock soil is 400 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Glenview soil is 460 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for the Arrowhead soil have not been made because the vegetation is mostly brush.

Some concerns for the harvesting of timber are steepness of slope, the hazard of erosion, and the potential shredding effect of the obsidian on rubber tires.

The soils in this unit have a tendency to gully when the surface layer is removed. Disturbance of this protective layer can be reduced by the careful use of wheeled and tracked equipment. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying. Rocks and loose soil material may slide down roadcuts on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Glenview soil; however, revegetation of cut and fill slopes is difficult on the Bottlerock and Arrowhead soils because of the restricted available water capacity and the high content of rock fragments.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished on the Bottlerock and Glenview soils by planting large ponderosa pine seedlings following proper site preparation. The droughtiness of the surface layer reduces the survival rate 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. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Planting on the Arrowhead soil is not practical because of the restricted available water capacity. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are blueblossom ceanothus, interior live oak, and manzanita.

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

119—Bressa-Millsholm loams, 8 to 15 percent slopes. This map unit is on hills. The vegetation is mainly annual grasses and oaks. Elevation is 1,200 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Bressa loam and 30 percent Millsholm 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 small areas with stones on the surface. Also included are small areas of Bressa and Millsholm soils that have slopes of less than 8 percent, soils that are similar to the Bressa and Millsholm soils but receive more than 40 inches of precipitation annually, and soils that are similar to the Millsholm soil but are less than 10 inches deep to bedrock. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Bressa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is light brownish gray and pale brown loam 12 inches thick. The subsoil is light yellowish brown clay loam 14 inches thick. Fractured sandstone is at a depth of 26 inches.

Permeability of the Bressa soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 3 inches thick. The subsoil is pale brown clay loam 8 inches thick. Fractured sandstone is at a depth of 11 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover in some areas and the restricted available water capacity and shallow depth of the Millsholm soil. Where oaks are present, forage production can be increased by managed harvesting of the trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes from 13 to 36 cords of wood per acre have been measured on the Bressa soil. The Bressa soil responds well to fertilization, rangeland seeding, and proper grazing use. The main limitation for seeding is the woody canopy cover. Among the common understory plants on this unit are wild oat, soft chess, and filaree.

If this unit is used for homesite development, the main limitation is depth to bedrock. Another limitation is the moderately slow permeability of the Bressa soil. Cuts needed to provide building sites can expose bedrock. Shallow depth to bedrock in the Millsholm soil is a major limitation for septic tank absorption fields. If the Bressa soil is used for septic tank absorption fields, the limitations of depth to bedrock and moderately slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

120—Bressa-Millsholm loams, 15 to 30 percent slopes. This map unit is on hills. The vegetation is mainly annual grasses and oaks. Elevation is 1,200 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Bressa loam and 35 percent Millsholm 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, Skyhigh, and Snook soils. Also included are small areas of soils that are similar to the Bressa soil but receive more than 40 inches of precipitation annually. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Bressa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is light brownish gray and pale brown loam 12 inches thick. The subsoil is light yellowish brown clay loam 14 inches thick. Fractured sandstone is at a depth of 26 inches.

Permeability of the Bressa soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 3 inches thick. The subsoil is pale brown clay loam 8 inches thick. Fractured sandstone is at a depth of 11 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover in some areas and the restricted available water capacity and shallow depth of the Millsholm soil. Where blue oak exists, forage production can be increased by managed harvesting of the trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 13 to 36 cords of wood per acre have been measured on the Bressa soil. The Bressa soil responds well to fertilization and rangeland seeding. The main limitation for seeding is the woody canopy cover. Among the common understory plants are soft chess, wild oat, and filaree.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and the depth to bedrock. Other limitations are the moderately slow permeability and low load bearing capacity of the Bressa soil. Extensive cutting and filling generally are required to provide roadbeds and building sites. Cuts can expose bedrock. Cut and fill slopes are susceptible to erosion. The risk of erosion is increased if the soil surface is left exposed during construction. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Shallow depth to bedrock in the Millsholm soil is a major limitation for septic tank absorption fields. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. The limitations of depth to bedrock in the Millsholm and Bressa soils and moderately slow permeability of the Bressa soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the limited ability of the Bressa soil to support a load.

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

121—Clear Lake clay, drained, cool. This very deep soil is in basins. It formed under poorly drained conditions; however, drainage has been improved in most areas as a result of entrenchment of stream channels. Some areas, particularly in Big Valley near Clear Lake, are still poorly drained. The soil formed in lacustrine deposits derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 1,300 to 1,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is very dark gray and dark gray clay 41 inches thick. The upper 15 inches of the underlying material is grayish brown clay, and the lower part to a depth of 72 inches is pale brown clay loam. Lime commonly occurs below a depth of 6 to 28 inches.

Included in this unit are small areas of Clear Lake Variant and Cole soils and Xerofluvents. Also included are small areas of soils that are similar to this Clear Lake soil but do not have a seasonal high water table. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Clear Lake soil is slow. Available water capacity is 8.5 to 10.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 36 to 60 inches in winter and spring. The water table drops to a depth of 60 inches or more during the growing season. This soil is subject to rare periods of flooding or ponding during prolonged, high-intensity storms. The shrink-swell potential is high.

This unit is used mainly for orchards, vineyards (fig. 2), and hay and pasture. It is also used for homesite development.

The major crops grown on this unit are wine grapes, pears, and walnuts. Irrigation commonly is used for maximum production of these crops. The main limitations are slow permeability, the seasonal high water table, the hazard of flooding or ponding, and the presence of lime. Because of the slow permeability, the application of water should be regulated so that water does not stand

Figure 2.—Irrigated wine grape vineyard in an area of Clear Lake clay, drained, cool.

on the surface for long periods of time and damage the crops. The seasonal high water table may limit the suitability of this unit for deep-rooted perennial crops. Artificial drainage may be necessary. Capital improvements on this unit should be designed to withstand flooding. Chelated iron may have to be applied to correct lime-induced chlorosis.

If this unit is used for hay and pasture, the main limitation is the slow permeability. The application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops.

If this unit is used for homesite development, the main limitations are the hazard of flooding, the seasonal high water table, slow permeability, high shrink-swell potential, and low load bearing capacity. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. The soil in this unit is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Increasing the size of the absorption field or using a specially designed sewage disposal system can help to compensate for the slow permeability. The high shrink-swell potential and the low load bearing capacity of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIw-5 (14), irrigated, and IIIw-5 (14), nonirrigated.

122—Clear Lake Variant clay, drained. This very deep soil is in basins. It formed under poorly drained conditions; however, drainage has been improved as a result of entrenchment of stream channels. Some areas, particularly in Big Valley near Clear Lake, are still poorly drained. The soil formed in lacustrine deposits derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 1,300 to 2,000 feet. The average annual precipitation is 25 to 35

inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is very dark gray clay 38 inches thick. The upper 25 inches of the underlying material is dark and light gray clay, and the lower part to a depth of 72 inches is pale olive clay loam.

Included in this unit are small areas of Clear Lake and Cole soils and Xerofluvents. Also included are small areas of soils that are similar to this Clear Lake Variant soil but have a seasonal high water table at a depth of 12 to 36 inches or do not have a seasonal high water table at all. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Clear Lake Variant soil is slow. Available water capacity is 8.5 to 10.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 36 to 60 inches in winter and spring. The water table drops to a depth of 60 inches or more during the growing season. This soil is subject to rare periods of flooding or ponding during prolonged, high-intensity storms. The shrink-swell potential is high.

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

The major crops grown on this unit are wine grapes, pears, and walnuts. Irrigation commonly is used for maximum production of these crops. The main limitations are the slow permeability, the seasonal high water table, and the hazard of flooding or ponding. Because of the slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops. The seasonal high water table may limit the suitability of this unit for deep-rooted perennial crops. Artificial drainage may be necessary. Capital improvements on this unit should be designed to withstand flooding.

If this unit is used for hay and pasture, the main limitation is the slow permeability. The application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops.

If this unit is used for homesite development, the main limitations are the hazard of flooding, seasonal high water table, slow permeability, high shrink-swell potential, and low load bearing capacity. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and slow permeability. Increasing the size of the absorption field or using a specially designed sewage disposal system can help to compensate for the slow permeability. The high shrink-swell potential of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIw-5 (14), irrigated, and IIIw-5 (14), nonirrigated.

123—Cole clay loam, drained. This very deep soil is in basins and on flood plains. It formed under somewhat poorly drained conditions; however, drainage has been improved in most areas as a result of entrenchment of stream channels. Some areas, particularly in Big Valley near Clear Lake, are still somewhat poorly drained. The soil formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 1,100 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is grayish brown clay loam 6 inches thick. The upper 29 inches of the subsoil is grayish brown and gray clay loam, and the lower 27 inches is pale brown and grayish brown clay loam. The substratum to a depth of 71 inches is brown and pale brown clay loam. In some areas the surface layer is silty clay loam.

Included in this unit are small areas of Clear Lake Variant, Cole Variant, Kelsey, Lupoyoma, and Still soils and Xerofluvents. Xerofluvents are adjacent to stream channels. Also included are small areas of calcareous soils in more poorly drained areas. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Cole soil is slow. Available water capacity is 7.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding or ponding during prolonged, high-intensity storms. The shrink-swell potential is high.

This unit is used mainly for orchards and vineyards. It is also used for hay and pasture and homesite development.

The major crops grown on this unit are pears, walnuts, and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitations are slow permeability and the hazard of flooding or ponding. Because of the slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops. Capital improvements on this unit should be designed to withstand flooding.

If this unit is used for hay and pasture, the main limitation is slow permeability. The application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops.

If this unit is used for homesite development, the main limitations are the hazard of flooding, slow permeability, high shrink-swell potential, and low load bearing capacity. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. If this unit is used for septic tank absorption fields, increasing the size of the absorption fields or using a specially designed disposal system can help to compensate for the slow permeability. The high shrink-swell potential and the low load bearing capacity of the soil should be considered when designing and constructing foundations, concrete structures, and paved roads. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

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

124—Cole Variant clay loam. This very deep, moderately well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and a few scattered oaks. Elevation is 1,300 to 2,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is grayish brown clay loam 8 inches thick. The underlying material to a depth of 60 inches or more is dark gray and grayish brown clay.

Included in this unit are small areas of Clear Lake, Lupoyoma, and Still soils. Also included are small areas of soils that are similiar to this Cole Variant soil but have a calcareous substratum. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Cole Variant soil is slow. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight. The shrink-swell potential is high. This soil is subject to rare periods of flooding or ponding during prolonged, high-intensity storms.

Most areas of this unit are used for orchards, vineyards, and hay and pasture. Some areas are used for homesite development.

The major crops grown on this unit are wine grapes, pears, and walnuts. Irrigation commonly is used for maximum production of these crops. The main limitations are the slow permeability and the hazard of flooding or ponding. Because of the slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods. Capital improvements should be designed to withstand flooding.

If this unit is used for hay and pasture, the main limitation is slow permeability. The application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops.

If this unit is used for homesite development, the main limitations are the slow permeability, high shrink-swell potential, low load bearing capacity, and the hazard of flooding. Increasing the size of the septic tank absorption field or using a specially designed sewage disposal system can help to compensate for the slow permeability. The high shrink-swell potential and the low load bearing capacity of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

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

125—Cole Variant clay loam, calcareous substratum. This very deep, moderately well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs and a few scattered oaks. Elevation is 1,300 to 1,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is dark grayish brown clay loam 20 inches thick. The underlying material to a depth of 60 inches or more is dark grayish brown clay. The soil is calcareous below a depth of 30 inches.

Included in this unit are small areas of Cole soils, noncalcareous Cole Variant soils, and Still soils. Also included are small areas of soils that are similar to this Cole Variant soil but are gravelly in the surface layer and have less clay. Included areas make up about 30

percent of the total acreage. The percentage varies from one area to another.

Permeability of this Cole Variant soil is slow. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. The shrink-swell potential is high. Surface runoff is slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding or ponding during prolonged, high-intensity storms.

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

If this unit is used for hay and pasture, the main limitation is slow permeability. The application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops.

The main crops grown on this unit are wine grapes, pears, and walnuts. Irrigation commonly is used for maximum production of these crops. The main limitations are slow permeability, the presence of lime, and the hazard of flooding or ponding. Because of the slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods. Chelated iron commonly is applied by local growers to correct lime-induced chlorosis. Capital improvements on this unit should be designed to withstand flooding.

If this unit is used for homesite development, the main limitations are the slow permeability, high shrink-swell potential, low load bearing capacity, and the hazard of flooding. Increasing the size of the septic tank absorption fields or using a specially designed sewage disposal system can help to compensate for the slow permeability. The high shrink-swell potential and the low load bearing capacity of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

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

126—Collayomi complex, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and oaks. Elevation is 1,400 to 4,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 40 percent Collayomi very gravelly loam and 35 percent Collayomi stony 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 Aiken and Whispering soils and Rock outcrop. The Aiken soils are on side slopes, and the Whispering soils and Rock outcrop are on ridges. Also included are small areas of Collayomi soils that have slopes of less than 50 percent and soils that are similar to the Collayomi soils but have slopes of more than 75 percent or have a clay subsoil. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Collayomi very gravelly loam is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 10 percent of the surface is covered with stones and boulders. The surface layer is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam.

Permeability of the Collayomi very gravelly loam is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

The Collayomi stony loam is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, about 25 percent of the surface is covered stones and boulders 2 to 8 feet in diameter. The surface layer is dark reddish gray stony loam 4 inches thick. The upper 24 inches of the subsoil is light reddish brown very cobbly clay loam, and the lower 24 inches is reddish yellow very cobbly loam. In some areas the surface layer is cobbly loam.

Permeability of the Collayomi stony loam is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 to 80 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Ponderosa pine, California black oak, Douglas-fir, and sugar pine are the main tree species on this unit. On the basis of a 100-year site curve, the mean site index is 122 for ponderosa pine and 110 for Douglas-fir. The potential annual production of ponderosa pine is 595 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine and black oak have not been made.

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. Stones and boulders on the surface hinder harvesting operations in some areas. Rock for construction of roads generally is available on this unit. Roads may fail and landslides may occur if

deep road cuts are made on the steeper parts of this unit.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir frequently occurs. Areas of Rock outcrop limit the even distribution of reforestation.

Among the common forest understory plants are squawcarpet, coffeeberry, poison-oak, brackenfern, manzanita, and perennial grasses.

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

127—Collayomi-Aiken-Whispering complex, 5 to 30 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and oaks. Elevation is 1,400 to 4,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 35 percent Collayomi very gravelly loam, 35 percent Aiken loam, and 15 percent Whispering 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 near ridges. Also included are small areas of Aiken, Collayomi, and Whispering soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Collayomi soil is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, about 5 percent of the surface is covered with stones and boulders. The surface layer is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam.

Permeability of the Collayomi soil is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Aiken soil is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 1 inch thick. The upper 5 inches of the surface layer is reddish brown loam, and the lower 4 inches is reddish brown clay loam. The upper 11 inches of the subsoil is yellowish red clay loam, and the lower 54 inches is reddish yellow clay and cobbly clay.

Permeability of the Aiken soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Whispering soil is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, about 5 percent of the surface is covered with stones and boulders. The surface is covered with a mat of pine needles and twigs 1 inch thick. The surface layer is brown loam 5 inches thick. The upper 10 inches of the subsoil is reddish yellow gravelly loam, and the lower 11 inches is yellowish red very cobbly clay loam. Hard, fractured andesite is at a depth of 26 inches.

Permeability of the Whispering soil is moderate. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for timber production, wildlife habitat, and watershed. It is also used for homesite development and orchards.

Ponderosa pine, California black oak, sugar pine, 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 ponderosa pine is 122 on the Collayomi soil, 137 on the Aiken soil, and 109 on the Whispering soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 110 on the Collayomi soil, 134 on the Aiken soil, and 107 on the Whispering soil. The potential annual production of ponderosa pine on the Collayomi soil is 595 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Aiken soil is 800 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Whispering soil is 455 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine and California black oak have not been made.

A concern 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 on the Aiken soil are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on the steep cut and fill slopes reduces erosion. Revegetation of cut and fill slopes is difficult on the Collayomi and Whispering soils because of the high content of rock fragments and the restricted available water capacity.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir frequently occurs. The high soil temperature and low content of soil moisture during the growing season cause high mortality of

Douglas-fir seedlings, especially on the south- and southwest-facing slopes.

Among the common forest understory plants are squawcarpet, coffeeberry, poison-oak, brackenfern, manzanita, and perennial grasses.

If this unit is used for homesite development, the main limitations are the steepness of slope and hazard of erosion. Other limitations are the moderately slow permeability and low load bearing capacity of the Aiken soil and the depth to bedrock in the Whispering soil. Cutting and filling generally are required to provide level building sites. Cuts can expose bedrock in the Whispering soil. Cut and fill slopes are susceptible to excessive erosion. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Cut and fill slopes on the Aiken soil are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of the subsoil in the Aiken soil to support a load. If the Aiken soil is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. The limitations of moderately slow permeability of the Aiken soil and moderate depth to bedrock in the Whispering soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The main crop grown on this unit is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. Walnut orchards are primarily in areas of the Aiken and Collayomi soils that have slopes of 5 to 15 percent. The main limitations are the hazard of erosion and steepness of slope. Available water capacity and stones and boulders on the surface also limit use of the Collayomi soil. The Whispering soil is poorly suited to orchards. It is also limited by depth to bedrock, available water capacity, and stones and boulders on the surface. Areas of this unit that have slopes of more than 15 percent are poorly suited to orchards. Use of a cover crop between rows of trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum. Adding organic matter to the soil increases the available water capacity and fertility. Stones and boulders on the surface limit the use of most equipment on the Collayomi and Whispering soils. Rock deflectors should be used on all moving equipment.

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

128—Collayomi-Aiken-Whispering complex, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and oaks. Elevation is 1,400 to 4,000 feet. The average annual precipitation is 35 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 40 percent Collayomi very gravelly loam, 35 percent Aiken loam, and 15 percent Whispering 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 Aiken and Whispering soils that have slopes of less than 30 percent. Also included are small areas of soils that are similar to the Collayomi soil but have more clay in the subsoil. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Collayomi soil is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 5 percent of the surface is covered with stones and boulders. The surface layer is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam.

Permeability of the Collayomi soil is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Aiken soil is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 1 inch thick. The upper part of the surface layer is reddish brown loam 5 inches thick, and the lower part is reddish brown clay loam 4 inches thick. The upper 11 inches of the subsoil is yellowish red clay loam, and the lower 54 inches is reddish yellow clay and cobbly clay.

Permeability of the Aiken soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Whispering soil is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 5 percent of the surface is covered with stones and boulders. The surface is covered with a mat of pine needles and twigs 1 inch thick. The surface layer is brown loam 5 inches thick. The upper 10 inches of the subsoil is reddish yellow gravelly loam, and the lower 11 inches is yellowish red very cobbly clay loam. Hard, fractured andesite is at a depth of 26 inches.

Permeability of the Whispering soil is moderate. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of water erosion is severe.

This unit is used mainly for timber production, wildlife habitat, and watershed. It is also used for homesite development.

Ponderosa pine, California black oak, sugar pine, 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 ponderosa pine is 122 on the Collayomi soil, 137 on the Aiken soil, and 109 on the Whispering soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 110 on the Collayomi soil, 134 on the Aiken soil, and 107 on the Whispering soil. The potential annual production of ponderosa pine on the Collayomi soil is 595 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Aiken soil is 800 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Whispering soil is 455 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine and California black oak have not been made.

Some concerns for the harvesting of timber are steepness of slope, the hazard of erosion, and seasonal soil 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 either wheeled and tracked equipment or cable harvesting systems. Unsurfaced roads and skid trails on the Aiken soil are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is available in some areas of this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Aiken soil. Revegetation of cut and fill slopes is difficult on the Collayomi and Whispering soils because of the high content of rock fragments and restricted available water capacity.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers occurs frequently. The high soil temperature and low content of soil moisture during the growing season cause high mortality of Douglas-fir seedlings, especially on the south- and southwest-facing slopes.

Among the common forest understory plants are squawcarpet, coffeeberry, poison-oak, brackenfern, manzanita, and perennial grasses.

If this unit is used for homesite development, the main limitations are the steepness of slope and hazard of erosion. Other limitations are the moderately slow permeability and low load bearing capacity of the Aiken soil and depth to bedrock in the Whispering soil. Preferred building sites are limited to knolls and the less sloping areas. Extensive cutting and filling generally are required. Cuts needed to provide building sites can expose bedrock in the Whispering soil. Cut and fill slopes are susceptible to erosion. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Cut and fill slopes on the Aiken soil are not stable and are subject to slumping. Buildings and roads should be designed to offset the limited ability of the Aiken soil to support a load. If the Aiken soil is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability. Steepness of slope is a major limitation for septic tank absorption fields. Absorption lines should be installed on the contour. The limitations of moderately slow permeability of the Aiken soil and moderate depth to bedrock in the Whispering soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

129—Collayomi-Whispering complex, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and oaks with an understory of shrubs. Elevation is 3,000 to 4,600 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 120 to 160 days.

This unit is about 60 percent Collayomi very gravelly loam and 30 percent Whispering 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 Aiken loam and Collayomi stony loam. Also included are small areas of Collayomi and Whispering soils that have slopes of more than 50 percent or less than 30 percent and soils that are similar to the Whispering soil but are 40 to 60 inches deep. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Collayomi soil is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 5 percent of the surface is covered with stones and boulders. The surface layer is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam.

Permeability of the Collayomi soil is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Whispering soil is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 5 percent of the surface is covered with stones and boulders. The surface is covered with a mat of pine needles, leaves, and twigs 1 inch thick. The surface layer is brown loam 5 inches thick. The upper 10 inches of the subsoil is reddish

yellow gravelly loam, and the lower 11 inches is yellowish red very cobbly clay loam. Hard, fractured andesite is at a depth of 26 inches.

Permeability of the Whispering soil is moderate. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for timber production, wildlife habitat, and watershed. It is also used for homesite development.

Ponderosa pine, California black oak, sugar pine, 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 ponderosa pine is 122 on the Collayomi soil and 109 on the Whispering soil. The potential annual production of ponderosa pine on the Collayomi soil is 595 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Whispering soil is 450 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine, California black oak, and Douglas-fir have not been made.

A concern for the harvesting of timber is steepness of slope. Stones and boulders on the surface hinder harvesting in some areas. Revegetation of cut and fill slopes is difficult on the Collayomi and Whispering soils because of the high content of rock fragments and the restricted available water capacity. Rock for construction of roads generally is available on this unit.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir occurs periodically. The high soil temperature and low content of soil moisture during the growing season cause high mortality of Douglas-fir seedlings, especially on the south- and southwest-facing slopes.

Among the common forest understory plants are squawcarpet, coffeeberry, poison-oak, brackenfern, manzanita, and perennial grasses.

If this unit is used for homesite development, the main limitations are the steepness of slope and hazard of erosion. Another limitation is depth to bedrock in the Whispering soil. Preferred building sites are limited to knolls and the less sloping areas. Steepness of slope presents many problems if this unit is used for homesite development. Extensive cutting and filling generally are required. Cuts needed to provide building sites can expose bedrock on the Whispering soil. Cut and fill slopes are susceptible to erosion. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion. Steepness of slope is a major limitation for septic tank absorption fields. Absorption lines should be installed on the contour. The limitation of moderate depth to bedrock in the Whispering soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

130—Deadwood-Sheetiron association, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly shrubs with some mixed conifers and hardwoods. Elevation is 3,500 to 5,200 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 47 to 52 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 50 percent Deadwood very gravelly sandy loam and 30 percent Sheetiron gravelly sandy loam. The Deadwood soil is on ridges and south- and west-facing slopes. The Sheetiron soil is on north- and east-facing slopes and benches.

Included in this unit are small areas of Bamtush, Freezeout, Neuns, and Yollabolly soils and Rock outcrop. Also included are small areas of Deadwood and Sheetiron soils that have slopes of less than 50 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sheetiron soil is moderately deep and well drained. It formed in material weathered from mica-quartz schist. The upper part of the surface layer is brown gravelly sandy loam 3 inches thick, and the lower part is pale brown very gravelly sandy loam 5 inches thick. The upper 9 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 12 inches is very pale brown extremely gravelly sandy loam. Fractured mica-quartz schist is at a depth of 29 inches.

Permeability of the Sheetiron soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Canyon live oak, incense-cedar, and scattered Douglas-fir, sugar pine, and ponderosa pine are the main tree species on the Deadwood soil. Douglas-fir,

ponderosa pine, sugar pine, and California black oak are the main tree species on the Sheetiron soil. Among the trees of limited extent are white fir on some north aspects and canyon live oak on some south aspects. On the basis of a 100-year site curve, the mean site index is estimated to be 105 for both ponderosa pine and Douglas-fir on the Sheetiron soil. On the basis of a 100-year site curve, the mean site index is 84 for ponderosa pine and 83 for Douglas-fir on the Deadwood soil. The potential annual production of ponderosa pine on the Sheetiron soil is 425 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for the Deadwood soil have not been made because the vegetation is mostly brush.

The main limitation for the harvesting of timber is steepness of slope. Cable yarding systems generally are used on this unit. Revegetation of cut and fill slopes is difficult on the soils in this unit because of the high content of rocks in the soils and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts, necessitating increased maintenance on roads. Rock for construction of roads is available on this unit but frequently is of low quality. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, treatment of the surface is needed to reduce dustiness.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Movement of loose surface material can reduce seedling survival on the steeper slopes. Even with seed trees present, natural reforestation of cutover areas by conifers occurs infrequently on this unit. Reforestation of the Sheetiron soil can be accomplished by planting seedlings. Planting on the Deadwood soil is not practical because of the high content of rocks and the restricted available water capacity of the soil.

Among the common forest understory plants are California nutmeg and greenleaf manzanita.

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

131—Fluvaquentic Haplaquolls, nearly level. These very deep, very poorly drained soils are in lake marshes. They formed in lacustrine deposits derived from mixed sources. Slope is 0 to 2 percent. The vegetation is mainly tules, rushes, and other water-tolerant plants. Elevation is 1,325 to 1,350 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 170 to 210 days.

No single profile is typical of these Fluvaquentic Haplaquolls, but one commonly observed in the survey area has a surface layer of grayish brown silty clay loam and loam 5 inches thick. The underlying material to a depth of 40 inches or more is stratified, light yellowish brown gravelly loamy coarse sand, olive gray silty clay loam, grayish brown sand, and light olive gray silt loam. The soil below this depth is continuously saturated.

Included in this unit are small areas of Clear Lake clay and Cole Variant and Tulelake soils. Also included are small areas of soils that are similar to these Fluvaquentic Haplaquolls but have less clay or more clay. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Fluvaquentic Haplaquolls is slow. Available water capacity is 7.5 to 10.5 inches when drained. Available water capacity and rooting depth are dependent on the water table, which fluctuates between 1 foot above the surface and 3 feet below the surface annually. Surface runoff is ponded, and the hazard of erosion is slight. This soil is inundated for long periods in winter and spring.

This unit is used mainly as wildlife habitat.

This unit is well suited to wetland wildlife habitat.

This map unit is in capability subclass VIw (14), nonirrigated.

132—Forbesville loam, 2 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly brush, oaks, and annual grasses. Elevation is 1,350 to 1,550 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is brown loam 6 inches thick. The upper 10 inches of the subsoil is yellowish red loam, and the lower 14 inches is red clay. Below this to a depth of 70 inches is red very gravelly clay and reddish yellow very gravelly clay loam.

Included in this unit are small areas of Wappo Variant and Manzanita soils. Also included are small areas, along drainageways, of Forbesville soils that have slopes of more than 5 percent and soils that are similar to this Forbesville soil but are neutral in reaction. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Forbesville soil is slow. Available water capacity is 5.5 to 8.0 inches. Effecting rooting depth is 60 inches or more. The clay layer in the subsoil can restrict root penetration. Surface runoff is slow, and the hazard of erosion is slight. The shrink-swell potential in the subsoil is high.

This unit is used mainly for orchards, vineyards, and homesite development. It is also used for hay and pasture, livestock grazing, and firewood production.

The main crops grown on this unit are walnuts and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitation is the slow permeability of the soil. Because of this limitation, irrigation water needs to be applied slowly to minimize runoff.

If this unit is used for homesite development, the main limitations are the slow permeability, high shrink-swell potential in the subsoil, and low load bearing capacity. If this unit is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The shrink-swell potential and low load bearing capacity of the soil in this unit should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads or streets, it can be mixed with sand and gravel to increase its strength and stability.

If this unit is used for hay and pasture, the main limitation is the slow permeability. Irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and protects the soil from compaction.

The production of forage is limited because of the tendency of this unit to produce woody species. If trees and shrubs are managed to create open areas, this unit can produce a good stand of forage plants. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 25 to 35 cords of wood per acre have been measured on this unit. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The characteristic plant community in uncultivated areas is mainly blue oak, soft chess, and manzanita.

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

133—Forbesville loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly brush, oak, and annual grasses. Elevation is 1,350 to 1,550 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is brown loam 6 inches thick. The upper 10 inches of the subsoil is yellowish red loam, and the lower 14 inches is red clay. Below this to a depth of 70 inches is red very gravelly clay and reddish yellow very gravelly clay loam.

Included in this unit are small areas of Manzanita and Wappo soils. Also included are small areas of Forbesville soils that have slopes of 2 to 5 percent and soils that are similar to this Forbesville soil but have slopes of more than 15 percent or are neutral in reaction. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Forbesville soil is slow. Available water capacity is 5.5 to 8.0 inches. Effective rooting depth is 60 inches or more. The clay layer in the subsoil can restrict root penetration. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential of the subsoil is high.

This unit is used mainly for orchards, vineyards, and homesite development. It is also used for hay and pasture, livestock grazing, and firewood production.

The main crops grown on this unit are walnuts and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitations are the slow permeability of the soil, the hazard of erosion, and steepness of slope. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of a cover crop between rows of trees or vines helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for homesite development, the main limitations are the slow permeability, high shrink-swell potential in the subsoil, and low load bearing capacity. If the unit is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The shrink-swell potential and low load bearing capacity of the soil in this unit should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads or streets, it can be mixed with sand and gravel to increase its strength and stability.

If this unit is used for hay and pasture, the main limitations are the slow permeability and hazard of erosion. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from compaction and erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

The production of forage is limited because of the tendency of this unit to produce woody species. If trees and shrubs are managed to create open areas, this unit can produce a good stand of forage plants. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 25 to 35 cords of wood per acre have been measured on this unit. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The characteristic plant community in uncultivated areas is mainly blue oak, soft chess, and manzanita.

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

134—Forward Variant-Kidd association, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly hardwoods and conifers with an understory of scattered brush and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 145 to 180 days.

This unit is about 50 percent Forward Variant very gravelly loam and 20 percent Kidd gravelly loam. The Forward Variant soil is on mountainsides and toe slopes, and the Kidd soil is on ridgetops and spur ridges and is adjacent to included areas of Rock outcrop on mountainsides.

Included in this unit are small areas of Aiken soils in drainageways and Rock outcrop near ridges. Also included are small areas of Forward Variant and Kidd soils that have slopes of more than 50 percent and soils that are similar to the Kidd soil but are less than 10 inches deep. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Forward Variant soil is very deep and well drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is very pale brown very gravelly loam 7 inches thick. The subsoil is very pale brown and light gray very gravelly loam 55 inches thick. Fractured rhyolitic tuff is at a depth of 62 inches. In some areas the surface layer is gravelly loam.

Permeability of the Forward Variant soil is moderately rapid. Available water capacity is 4.5 to 8.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Kidd soil is shallow and somewhat excessively drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is light gray gravelly loam 4 inches thick. The subsoil is light gray gravelly sandy loam 9 inches thick. Rhyolitic tuff is at a depth of 13 inches.

Permeability of the Kidd soil is moderately rapid. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, and sugar pine are the main tree species on the Forward Variant soil. On the basis of a 100-year site curve, the mean site index is 123 for ponderosa pine and 127 for Douglas-fir. The potential annual production of ponderosa pine is 610 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine have not been made. Among the trees of limited extent are knobcone pine, which is in areas that have been burned repeatedly, tanoak, California black oak, Pacific madrone, and interior live oak. Estimates of the site index and yield for the Kidd soil have not been made because it supports mostly brush.

The main limitations for the harvesting of timber are steepness of slope and the hazard of erosion. 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. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine, sugar pine, or Douglas-fir seedlings on the Forward Variant soil. Even with seed trees present, natural reforestation of cutover areas by ponderosa pine, sugar pine, and Douglas-fir occurs infrequently because of understory plant competition. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are brackenfern, dogwood, manzanita, and toyon.

The Forward Variant soil is in capability subclass VIs (5), nonirrigated. The Kidd soil is in capability subclass VIe (5), nonirrigated.

135—Forward Variant-Kidd association, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly hardwood trees and conifers with an understory of brush and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 145 to 180 days.

This unit is about 50 percent Forward Variant very gravelly loam and 25 percent Kidd gravelly loam. The Forward Variant soil is on mountainsides and toe slopes, and the Kidd soil is on ridgetops and spur ridges. The Kidd soil also occurs randomly on mountainsides adjacent to included areas of Rock outcrop.

Included in this unit are small areas of Aiken and Mayacama soils and Rock outcrop. The Aiken soils are on toe slopes where tuffaceous material is dissected to

the underlying basalt, the Mayacama soils are on sandstone intrusions, and the Rock outcrop occurs on ridges or as escarpments. Also included are small areas of soils that are similar to the Forward Variant soil but are 20 to 40 inches deep and soils that are similar to the Kidd soil but are less than 10 inches deep. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Forward Variant soil is very deep and well drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is very pale brown very gravelly loam 7 inches thick. The subsoil is very pale brown and light gray very gravelly loam 55 inches thick. Fractured rhyolitic tuff is at a depth of 62 inches. In some areas the surface layer is gravelly loam.

Permeability of the Forward Variant soil is moderately rapid. Available water capacity is 4.5 to 8.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Kidd soil is shallow and somewhat excessively drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is light gray gravelly loam 4 inches thick. The subsoil is light gray gravelly sandy loam 9 inches thick. Rhyolitic tuff is at a depth of 13 inches.

Permeability of the Kidd soil is moderately rapid. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, and sugar pine are the main tree species on the Forward Variant soil. On the basis of a 100-year site curve, the mean site index is 123 for ponderosa pine and 127 for Douglas-fir. The potential annual production of ponderosa pine is 610 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine have not been made. Among the trees of limited extent are knobcone pine, which is in areas that have been burned repeatedly, tanoak, California black oak, Pacific madrone, and interior live oak. Estimates of the site index and yield for the Kidd soil have not been made because it supports mostly brush.

The main limitations for the harvesting of timber are steepness of slope and the 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. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine, sugar pine, or Douglas-fir seedlings on the Forward Variant soil. If seed trees are present, natural reforestation of cutover areas by ponderosa pine, sugar pine, and Douglas-fir occurs infrequently. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are brackenfern, dogwood, manzanita, and toyon.

The Forward Variant soil is in capability subclass VIIs (5), nonirrigated, and the Kidd soil is in capability subclass VIIe (5), nonirrigated.

136—Freezeout-Yollabolly very gravelly sandy loams, 30 to 50 percent slopes. This map unit is on mountaintops. The vegetation is mainly mixed conifers. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 43 to 48 degrees F, and the average frost-free period is 90 to 130 days.

This unit is about 50 percent Freezeout very gravelly sandy loam and 30 percent Yollabolly 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 Bamtush, Neuns, and Sheetiron soils and Rock outcrop. The Bamtush, Neuns, and Sheetiron soils are at the lower elevations in this unit. Also included are very deep, gravelly and very gravelly loams that have a frigid soil temperature and small areas of Freezeout and Yollabolly soils that have slopes of less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Freezeout soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed conifer needles, twigs, and bark 1 inch thick. The surface layer is dark grayish brown very gravelly sandy loam 5 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam, and the lower 9 inches is yellowish brown very gravelly sandy loam. Hard metamorphosed sandstone is at a depth of 25 inches.

Permeability of the Freezeout soil is moderately rapid. Available water capacity is 2 to 3 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Yollabolly soil is shallow and excessively drained. It formed in material weathered from metamorphosed sandstone. The surface layer is brown very gravelly sandy loam about 5 inches thick. The underlying material is pale brown extremely gravelly fine sandy loam about 9 inches thick. Metamorphosed sandstone is at a depth of 14 inches.

Permeability of the Yollabolly soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

White fir, Jeffrey pine, and red fir are the main tree species on this unit. Among the trees of limited extent are ponderosa pine, sugar pine, incense-cedar, and Douglas-fir. On the basis of a 50-year site curve, the mean site index is 53 for white fir on the Freezeout soil. Estimates of the site index and yield for the Yollabolly soil have not been made because the vegetation is mostly brush. The potential annual production of white fir on the Freezeout soil is 565 board feet (International rule, one-eighth inch kerf) per acre from a fully stocked stand of trees. Areas of Rock outcrop reduce the yield substantially.

A concern for the harvesting of timber is steepness of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding systems generally disturb the soil less. Snowpack limits the use of equipment and restricts access. Revegetation of cut and fill slopes is difficult on this unit because of the large amount of rock fragments in the soil and the restricted available water capacity. Rock for construction of roads is available on this unit.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. The mortality rate of seedlings is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Even with seed trees present, natural reforestation of cutover areas by conifers occurs infrequently. Reforestation on the Freezeout soil can be accomplished by planting large seedlings. Planting on the Yollabolly soil is not practical because of the large amount of rock fragments on the surface and in the soil.

Among the common forest understory plants are huckleberry oak, whitethorn, and lupine.

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

137—Freezeout-Yollabolly very gravelly sandy loams, 50 to 75 percent slopes. This map unit is on mountaintops. The vegetation is mainly mixed conifers with some shrubs. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 43 to 48 degrees F, and the average frost-free period is 90 to 130 days.

This unit is about 45 percent Freezeout very gravelly sandy loam and 30 percent Yollabolly very gravelly sandy loam. The components of this unit are so intricately intermingled that is was not practical to map them separately at the scale used.

Included in this unit are small areas of Bamtush, Sheetiron, and Neuns soils and Rock outcrop. The Bamtush, Neuns, and Sheetiron soils are in the lower lying areas in the unit. Also included are very deep, gravelly and very gravelly loams that have a frigid soil temperature and small areas of Freezeout and Yollabolly soils that have slopes of less than 50 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Freezeout soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed conifer needles, twigs, and bark 1 inch thick. The surface layer is dark grayish brown very gravelly sandy loam 5 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam, and the lower 9 inches is yellowish brown very gravelly sandy loam. Hard metamorphosed sandstone is at a depth of 25 inches.

Permeability of the Freezeout soil is moderately rapid. Available water capacity is 2 to 3 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Yollabolly soil is shallow and excessively drained. It formed in material weathered from metamorphosed sandstone. The surface layer is brown very gravelly sandy loam about 5 inches thick. The underlying material is pale brown extremely gravelly fine sandy loam about 9 inches thick. Metamorphosed sandstone is at a depth of 14 inches.

Permeability of the Yollabolly soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

White fir, Jeffrey pine, and red fir are the main tree species on this unit. Among the trees of limited extent are sugar pine, ponderosa pine, incense-cedar, and Douglas-fir. On the basis of a 50-year site curve, the mean site index is 53 for white fir on the Freezeout soil. The potential annual production of white fir on the Freezeout soil is 565 board feet (International rule, one-eighth inch kerf) per acre from a fully stocked stand of trees. Estimates of the site index and yield for the Yollabolly soil have not been made because the vegetation is mostly brush.

The main limitation for the harvesting of timber is steepness of slope. Cable yarding systems generally are used on this unit. Snowpack limits the use of equipment and restricts access. Revegetation of cut and fill slopes is difficult on this unit because of the large amount of rock fragments in the soil and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts, necessitating increased maintenance on roads. Rock for construction of roads is available on this unit.

Seedling survival is a concern in the production and reforestation of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. The mortality rate of seedlings is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Movement of loose surface material can reduce seedling survival on the Yollabolly soil. Even with seed trees present, natural reforestation of cutover areas by conifers occurs infrequently. Reforestation on the Freezeout soil can be accomplished by planting large seedlings. Planting on the Yollabolly soil is not practical because of the large number of rocks on the surface and in the soil.

Among the common forest understory plants are huckleberry oak, whitethorn, and lupine.

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

138—Glenview-Arrowhead complex, 5 to 15 percent slopes. This map unit is on volcanic hills. The vegetation is mainly brush with a few scattered conifers. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 195 days.

This unit is about 60 percent Glenview very gravelly loam and 20 percent Arrowhead extremely 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 soils that are similar to the Glenview soil but have 35 to 70 percent obsidian cobbles and stones throughout the profile or are in areas where the average annual temperature is more than 59 degrees. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Glenview soil is very deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown very gravelly loam 1 inch thick and the lower part is brown gravelly loam 5 inches thick. The upper 9 inches of the subsoil is reddish yellow clay loam, the next 25 inches is reddish yellow gravelly clay, and the lower 25 inches is reddish yellow gravelly clay loam. In some areas the surface layer is very gravelly sandy loam.

Permeability of the Glenview soil is moderately slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

The Arrowhead soil is moderately deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown extremely gravelly sandy loam 1 inch thick and the lower part is brown gravelly sandy loam 3 inches thick. The upper 4 inches of the subsoil is brown gravelly sandy loam, the next 6 inches is light brown gravelly sandy clay loam, and the lower 17 inches is reddish yellow very stony clay. Hard, fractured obsidian is at a depth of 31 inches. In some areas the surface layer is sandy loam.

Permeability of the Arrowhead soil is moderately slow. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for orchards, wildlife habitat, and watershed. It is also used for production of timber and Christmas trees.

The main crop grown on this unit is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. This unit is poorly suited to orchards. The hazard of erosion, the tendency of the soils to tie up phosphorus, and the very gravelly and extremely gravelly surface layer are the main limitations. The Arrowhead soil is also limited by depth and restricted available water capacity. Clean tillage in winter is a major cause of accelerated erosion. Use of a cover crop improves tilth and infiltration and reduces runoff and erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum. Diversions, lined waterways, and drop structures can be used to remove excess runoff and reduce erosion. The soils in this unit tie up phosphorus, which limits the amount that is available for the growth of plants. Phosphorous fertilizer may be needed. Rock fragments in the surface layer cause the rapid wear of tillage equipment. If a water supply is available, drip irrigation is the most suitable system for applying water to this unit. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Proper site preparation on the Glenview soil can make it possible to replace stands of brush and hardwoods with conifers. This soil is suited to the production of ponderosa pine. On the basis of a 100-year site curve, the mean site index is 110 for ponderosa pine on the Glenview soil. The potential annual production of ponderosa pine is 460 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for the Arrowhead soil have not been made because it supports mostly brush.

A concern for the harvesting of timber is the potential shredding effect of the obsidian on rubber tires. The soils in this unit also have a tendency to gully when the surface layer is removed. Disturbance of this protective

layer can be reduced by the careful use of wheeled and tracked equipment. Establishing plant cover on steep cut and fill slopes reduces erosion on the Glenview soil; however, revegetation of cut and fill slopes is difficult on the Arrowhead soil because of the restricted available water capacity and high content of rock fragments.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished on the Glenview soil by planting large ponderosa pine seedlings following proper site preparation. The droughtiness of the surface layer reduces the survival rate 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. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Planting on the Arrowhead soil is not practical because of the restricted available water capacity. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are blueblossom ceanothus, interior live oak, and manzanita.

The Glenview soil is in capability unit IVs-0 (5), nonirrigated, and the Arrowhead soil is in capability unit IVs-8 (5), nonirrigated.

139—Glenview-Arrowhead complex, 15 to 30 percent slopes. This map unit is on volcanic hills. The vegetation is mainly brush with a few scattered conifers. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 195 days.

This unit is about 50 percent Glenview very gravelly loam and 20 percent Arrowhead extremely 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 soils that are similar to the Glenview soil but have 35 to 60 percent cobbles and stones throughout the profile or are in areas where the average annual temperature is more than 59 degrees. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Glenview soil is very deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown very gravelly loam 1 inch thick and the lower part is brown gravelly loam 5 inches thick. The upper 9 inches of the subsoil is reddish yellow clay loam, the next 25 inches is reddish yellow gravelly clay, and the lower 25 inches is reddish yellow gravelly clay loam. In some areas the surface layer is very gravelly sandy loam.

Permeability of the Glenview soil is moderately slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Arrowhead soil is moderately deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown extremely gravelly sandy loam 1 inch thick and the lower part is brown gravelly sandy loam 3 inches thick. The upper 4 inches of the subsoil is brown gravelly sandy loam, the next 6 inches is light brown gravelly sandy clay loam, and the lower 17 inches is reddish yellow very stony clay. Hard, fractured obsidian is at a depth of 31 inches. In some areas the surface layer is sandy loam.

Permeability of the Arrowhead soil is moderately slow. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for orchards, wildlife habitat, and watershed. It can be used for production of timber and Christmas trees.

The main crop grown on this unit is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. This unit is poorly suited to orchards. The hazard of erosion, steepness of slope, tendency of the soils to tie up phosphorus, and the very gravelly and extremely gravelly surface layer are the main limitations. The Arrowhead soil is also limited by depth and restricted available water capacity. Clean tillage in winter is a major cause of accelerated erosion. Use of a cover crop is essential to reduce erosion. The cover crop will improve tilth and infiltration and reduce runoff and erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum. Steep slopes may limit the use of farm machinery. Diversions, lined waterways, and drop structures can be used to remove excess runoff and reduce erosion. The soils in this unit tie up large amounts of phosphorus, which limits the amount that is available for the growth of plants. Use of a phosphorous fertilizer may be needed. Rock fragments in the surface layer cause the rapid wear of tillage equipment. If a water supply is available, drip irrigation is the most suitable method for applying water to this unit. Sprinkler irrigation can be used, but water needs to be applied slowly to minimize runoff.

Proper site preparation on the Glenview soil might make it possible to replace stands of brush and hardwoods with conifers. This soil is suited to the production of ponderosa pine. On the basis of a 100-year site curve, the mean site index is 110 for ponderosa pine on the Glenview soil. The potential annual production of ponderosa pine is 460 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for the Arrowhead soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber is the potential shredding effect of the obsidian on rubber tires. The soils in this unit also have a tendency to gully when the surface layer is removed. Disturbance of this protective layer can be reduced by the careful use of wheeled and tracked equipment. Establishing plant cover on steep cut and fill slopes reduces erosion on the Glenview soil; however, revegetation of cut and fill slopes is difficult on the Arrowhead soil because of the restricted available water capacity and high content of rock fragments.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished on the Glenview soil by planting large ponderosa pine seedlings following proper site preparation. The droughtiness of the surface layer reduces the survival rate 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. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Planting on the Arrowhead soil is not practical because of the restricted available water capacity. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are blueblossom ceanothus, interior live oak, and manzanita.

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

140—Glenview-Bottlerock complex, 2 to 5 percent slopes. This map unit is on volcanic hills. The vegetation in areas not cultivated is mainly brush with scattered conifers. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 150 to 195 days.

This unit is about 60 percent Glenview very gravelly loam and 30 percent Bottlerock extremely 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 Arrowhead soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Glenview soil is very deep and well drained. It formed in material weathered from obsidian. Typically, the upper part of the surface layer is brown very gravelly loam 1 inch thick and the lower part is brown gravelly loam 5 inches thick. The upper 9 inches of the subsoil is reddish yellow clay loam, the next 25 inches is reddish yellow gravelly clay, and the lower 25 inches is reddish yellow gravelly clay loam. In some areas the surface layer is very gravelly sandy loam.

Permeability of the Glenview soil is moderately slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight.

The Bottlerock soil is very deep and well drained. It formed in material weathered from obsidian. The soil commonly has a surface pavement that is 90 percent gravel. Typically, the upper 5 inches of the surface layer is dark grayish brown extremely gravelly loam, the next 4 inches is light gray very gravelly loam, and the lower 10 inches is very pale brown very gravelly loam. The upper 9 inches of the subsoil is very pale brown very gravelly sandy clay loam, the next 11 inches is light brown very gravelly clay loam, and the lower 24 inches is dark red strong brown and reddish yellow very gravelly clay.

Permeability of the Bottlerock soil is slow. Available water capacity is 2.5 to 6.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight.

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

The main crop grown on this unit is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. The main limitations are the restricted available water capacity and surface pavement of the Bottlerock soil and the tendency of the soils to tie up phosphorus. These soils tie up phosphorus, limiting the amount that is available for the growth of plants. Adding organic matter to the soil improves fertility and the available water capacity. Use of phosphorous fertilizer may be necessary. Rock fragments on the surface of the Bottlerock soil cause rapid wear of tillage equipment.

Proper site preparation on this unit might make it possible to replace stands of brush and hardwoods with conifers. This unit is suited to the production of ponderosa pine. On the basis of a 100-year site curve, the mean site index for pondorosa pine is 110 on the Glenview soil and 103 on the Bottlerock soil. The potential annual production of ponderosa pine on the Glenview soil is 460 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Bottlerock soil is 400 board feet per acre from a fully stocked stand of trees.

A concern for the harvesting of timber is the potential shredding effect of the obsidian on rubber tires. The soils in this unit also have a tendency to gully when the surface layer is removed. Disturbance of this protective layer can be reduced by the careful use of wheeled and tracked equipment. Establishing plant cover on steep cut and fill slopes reduces erosion on the Glenview soil; however, revegetation of cut and fill slopes is difficult on the Bottlerock soil because of the restricted available water capacity and high content of rock fragments.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished by planting

large ponderosa pine seedlings following proper site preparation. The droughtiness of the surface layer reduces the survival rate 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. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are blueblossom ceanothus, interior live oak, and manzanita.

The Glenview soil is in capability unit IVs-0 (5), nonirrigated, and the Bottlerock soil is in capability unit IVs-4 (5), nonirrigated.

141—Henneke-Montara complex, 8 to 15 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush, scattered conifers, and sparse annual grasses. Elevation is 900 to 3,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 50 percent Henneke gravelly loam and 30 percent Montara 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 Millsholm soils and Rock outcrop. Also included are small areas of soils that are similar to the Henneke and Montara soils but are 20 to 40 inches deep to bedrock. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Henneke soil is shallow and somewhat excessively drained. It formed in material weathered from serpentinitic rock. Typically, 50 percent of the surface is covered with a pavement of stones, cobbles, and pebbles. The surface layer is reddish brown gravelly loam 3 inches thick. The upper 8 inches of the subsoil is reddish brown gravelly clay loam, and the lower 8 inches is dark reddish brown very gravelly clay. Fractured serpentinite is at a depth of 19 inches.

Permeability of the Henneke soil is moderately slow. Available water capacity is 1 inch to 2 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate. Calcium to magnesium ratio is less than 1.

The Montara soil is shallow and well drained. It formed in material weathered from serpentinitic rock. Typically, the soil is grayish brown clay loam 12 inches thick over hard, fractured serpentinite.

Permeability of the Montara soil is moderately slow. Available water capacity is 1 inch to 4 inches. Effective rooting depth is 8 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate. Calcium to magnesium ratio is less than 1.

This unit is used mainly as wildlife habitat and watershed. It is also used for homesite development.

The natural vegetation on this unit is mainly brush because of the limited soil depth, restricted available water capacity, nutrient imbalances, and climate. The vegetation in most areas is mainly chamise, manzanita, buckbrush, and scattered Digger pine. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

If this unit is used for homesite development, the main limitation is depth to bedrock and the moderately slow permeability. Cuts needed to provide building sites can expose bedrock. Shallow depth to bedrock is a major limitation for septic tank absorption fields. The limitations of shallow depth and moderately slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

142—Henneke-Montara-Rock outcrop complex, 15 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush, scattered conifers, and sparse annual grasses. Elevation is 640 to 3,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 40 percent Henneke gravelly loam, 30 percent Montara clay loam, and 15 percent Rock outcrop. 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 Dubakella, Maxwell, Millsholm, and Okiota soils. Also included are small areas of clayey soils that are 20 to 40 inches deep to bedrock, clayey soils that develop deep wide cracks when dry and are 20 to 40 inches deep to bedrock, Henneke and Montara soils that have slopes of 50 to 75 percent, and soils that are similar to the Henneke and Montara soils but are 20 to 40 inches deep to bedrock or are cooler. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Henneke soil is shallow and somewhat excessively drained. It formed in material weathered from serpentinitic rock. Typically, about 50 percent of the surface is covered with a pavement of stones, cobbles, and pebbles. The surface layer is reddish brown gravelly loam 3 inches thick. The upper 8 inches of the subsoil is reddish brown gravelly clay loam, and the lower 8 inches

is dark reddish brown very gravelly clay. Fractured serpentinite is at a depth of 19 inches.

Permeability of the Henneke soil is moderately slow. Available water capacity is 1 inch to 2 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe. Calcium to magnesium ratio is less than 1.

The Montara soil is shallow and well drained. It formed in material weathered from serpentinitic rock. Typically, the soil is grayish brown clay loam 12 inches thick over hard, fractured serpentinite.

Permeability of the Montara soil is moderately slow. Available water capacity is 1 inch to 4 inches. Effective rooting depth is 8 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe. Calcium to magnesium ratio is less than 1.

Rock outcrop consists of hard, fractured serpentinitic rock. It occurs as small masses of intruding bedrock or as detached stones and boulders on the land surface. Areas of Rock outcrop are 50 feet to 1 acre in size.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush because of the limited soil depth and the restricted available water capacity. The vegetation in most areas is mainly chamise, manzanita, buckbrush, and Digger pine. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

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

143—Henneke-Okiota complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush and a few conifers with an understory of sparse annual grasses. Elevation is 1,100 to 3,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 50 percent Henneke gravelly loam and 30 percent Okiota very gravelly 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 Henneke and Okiota soils that have slopes of less than 30 percent. Also included are small areas of soils that are similar to the Henneke and Okiota soils but are eroded to a depth of less than 10 inches; soils that are similar to the Okiota soil but are 20 to 40 inches deep to bedrock; and soils that are similar to the Okiota soil but are on north-facing slopes, support dense stands of cypress, and are cooler. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Henneke soil is shallow and somewhat excessively drained. It formed in material weathered from serpentinitic rock. Typically, 55 percent of the surface is covered with a pavement consisting of 15 percent cobbles and stones and 40 percent pebbles. The surface layer is reddish brown gravelly loam 3 inches thick. The upper 8 inches of the subsoil is reddish brown gravelly clay loam, and the lower 8 inches is dark reddish brown very gravelly clay. Serpentinite is at a depth of 19 inches. In some areas the surface layer is very cobbly clay loam.

Permeability of the Henneke soil is moderately slow. Available water capacity is 1 inch to 2 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe. Calcium to magnesium ratio is less than 1.

The Okiota soil is shallow and well drained. It formed in material weathered from serpentinitic rock. Typically, 35 percent of the surface is covered with a pavement consisting of 5 percent cobbles and 30 percent pebbles. The upper part of the surface layer is dark reddish brown very gravelly clay loam 1 inch thick, and the lower part is reddish brown clay loam 2 inches thick. The subsoil is dark reddish brown clay 11 inches thick. Hard, fractured serpentinite is at a depth of 14 inches. Depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is gravelly clay loam or clay loam. In a few areas 20 to 40 percent of the surface is covered with cobbles and stones.

Permeability of the Okiota soil is slow. Available water capacity is 1.5 to 3.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe. Calcium to magnesium ratio is less than 1. The shrink-swell potential is high.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush because of the limited soil depth, restricted available water capacity, nutrient imbalances, and climate. The vegetation in most areas is mainly chamise, manzanita, scrub oak, and scattered Digger pine. Properly planned and prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

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

144—Jafa loam, 2 to 5 percent slopes. This very deep, well drained soil is on terraces and fans. It formed in alluvium derived from mixed sources. The vegetation is mainly conifers with an understory of brush, grasses, and forbs. Elevation is 800 to 2,200 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 150 to 190 days.

Typically, the upper part of the surface layer is pale brown loam 8 inches thick and the lower part is light

brown loam 8 inches thick. The upper 16 inches of the subsoil is brown clay loam, the next 8 inches is reddish yellow clay loam, and the lower 28 inches is yellowish red clay loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Speaker soils and small areas of somewhat poorly drained soils that have a gravelly substratum and a seasonal high water table and are in the Middletown area, near Dry Creek Cutoff. Also included are small areas of soils that are similar to this Jafa soil but have a clayey subsoil, have less clay in the subsoil, have a gravelly and cobbly subsoil, or have a warmer average annual temperature and are in areas of this unit that have been cleared. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Jafa soil is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for timber production. It is also used for homesite development. Areas that have been cleared are also used for livestock grazing, orchards, vineyards, and hay 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 is 118 for ponderosa pine and 122 for Douglas-fir. The potential annual production of ponderosa pine is 550 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are Oregon white oak, Pacific madrone, sugar pine, and knobcone pine.

A concern 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. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit.

Seedling mortality is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir frequently occurs. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. The high soil temperature during the growing season can cause mortality of seedlings.

Among the common forest understory plants are poison-oak, whiteleaf manzanita, greenleaf manzanita, and iris.

This unit can produce a good stand of forage plants by adjusting the overstory of trees and shrubs. The production of forage is limited by a tendency to produce woody species. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Buckbrush, manzanita, and poison-oak provide food and cover for deer, rabbits, quail, and other wildlife. Deferred grazing is needed to reestablish trees. Among the common understory plants suitable for use as forage are soft chess, filaree, and blue wildrye.

If this unit is used for homesite development, the main limitation is the moderately slow permeability. If it is used for septic tank absorption fields, the limitation of moderately slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The main crops grown on this unit are wine grapes and walnuts. Where water is available, irrigation is used for maximum production of these crops. Because of the moderately slow permeability, the application of water should be regulated so that water does not stand on the surface for long periods of time and damage the crops.

This unit is well suited to hay and pasture.

This map unit is in capability units IIe-1 (5), irrigated, and IIIe-1 (5), nonirrigated.

145—Jafa loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces and fans. It formed in alluvium derived from mixed sources. The vegetation is mainly conifers with an understory of brush, grass, and forbs. Elevation is 800 to 2,200 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 150 to 190 days.

Typically, the upper part of the surface layer is pale brown loam 8 inches thick and the lower part is light brown loam 8 inches thick. The upper 16 inches of the subsoil is brown clay loam, the next 8 inches is reddish yellow clay loam, and the lower 28 inches is yellowish red clay loam. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Speaker soils. Also included are small areas of soils that are similar to this Jafa soil but have a clayey subsoil, have less clay in the subsoil, have a gravelly and cobbly subsoil, or have a warmer average annual soil temperature and are in areas of this unit that have been cleared. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Jafa soil is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for timber production. It is also used for homesite development. Areas that have been cleared are used for livestock grazing and for hay 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 is 118 for

ponderosa pine and 122 for Douglas-fir. The potential annual production of ponderosa pine is 550 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are Oregon white oak, Pacific madrone, sugar pine, and knobcone pine.

A concern for the harvesting of timber is seasonal wetness. Use of wheeled and tracked equipment when the soil in this unit 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. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit.

Seedling mortality is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir frequently occurs. Reforestation should be carefully managed to reduce competition from undesirable plants and to provide partial shade for seedlings. The high soil temperature during the growing season can cause mortality of seedlings, especially on the south- and southwest-facing slopes.

Among the common forest understory plants are poison-oak, whiteleaf manzanita, greenleaf manzanita, and iris.

This unit can produce a good stand of forage plants if the overstory of trees and shrubs is adjusted. The production of forage is limited by a tendency of the soils to produce woody species. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Buckbrush, manzanita, and poison-oak provide food and cover for deer, rabbits, quail, and other wildlife. Deferred grazing is needed to reestablish trees. Among the common understory plants suitable for use as forage are soft chess, filaree, and blue wildrye.

If this unit is used for homesite development, the main limitation is the moderately slow permeability. If it is used for septic tank absorption fields, the limitation of moderately slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

If this unit is used for hay and pasture, the main limitation is the hazard of erosion. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

This map unit is in capability unit IIIe-1 (5), irrigated and nonirrigated.

146—Jafa complex, 5 to 30 percent slopes. This map unit is on dissected terraces. The vegetation is mainly mixed conifers and hardwoods, but there are some areas of brush on south-facing slopes. Elevation is 1,800 to 2,700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 150 to 180 days.

This unit is about 45 percent Jafa loam and 30 percent Jafa 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 and Speaker soils. Also included are small areas of soils that are similar to these Jafa soils but have more than 35 percent rock fragments throughout the profile or have been eroded, or both. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Jafa loam is very deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface is covered with a mat of leaves, twigs, and bark 2 inches thick. The upper part of the surface layer is brown loam 6 inches thick, and the lower part is light brown gravelly loam 7 inches thick. The upper 12 inches of the subsoil is reddish yellow gravelly loam, and the lower 60 inches is reddish yellow gravelly clay loam.

Permeability of the Jafa loam is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Jafa gravelly loam is very deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface is covered with a mat of leaves and grass 0.5 inch thick. The upper part of the surface layer is brown gravelly loam 10 inches thick, and the lower part is light brown gravelly loam 7 inches thick. The upper 7 inches of the subsoil is reddish yellow gravelly loam, the next 15 inches is reddish yellow gravelly clay loam, and the lower 50 inches is reddish yellow very gravelly clay loam.

Permeability of the Jafa gravelly loam is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

This unit is used mainly for timber production and wildlife habitat. 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 is 118 for ponderosa pine and 122 for Douglas-fir. The potential annual production of ponderosa pine is 550 board feet per acre from a fully stocked stand of trees.

A concern 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 readily available on this unit.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine or Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers frequently occurs. Among the common forest understory plants are poison-oak and bedstraw.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and the moderately slow permeability. Because of the steepness of slope, cutting and filling generally are required to provide level building sites. Cut and fill slopes are susceptible to erosion. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Slope limits installation of septic tank absorption fields. 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. In some areas contrasting soil layers cause shallow rooting of trees. Occasional high winds can blow down these trees, resulting in damage to homes and other structures.

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

147—Kelsey fine sandy loam. This very deep, well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 900 to 1,600 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is brown fine sandy loam 11 inches thick. The underlying material to a depth of 60 inches is stratified, brown and pale brown very fine sandy loam, fine sandy loam, and sandy loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Cole, Maywood Variant, Still, and Talmage soils and small areas of Riverwash and Xerofluvents. Also included are soils that are similar to this Kelsey soil but have a thicker, dark colored surface layer, are in the Collayomi Valley and have average annual precipitation of 40 to 50 inches, or have thin layers of clay, gravel, or sand below a depth of 40 inches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Kelsey soil is moderately rapid. Available water capacity is 7.0 to 8.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding during prolonged, high-intensity storms.

This unit is used mainly for hay and pasture, orchards, and vineyards. It is also used for livestock grazing and homesite development.

This unit is well suited to hay and pasture.

The main crops grown on this unit are pears, walnuts, and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitation is the hazard of flooding. Capital improvements on this unit should be designed to withstand flooding.

The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. To reduce erosion, fences should be used to keep livestock away from streambanks. If the plant cover is disturbed, protection from flooding is needed to control gullying, streambank cutting, and sheet erosion. The characteristic plant community on this unit is mainly wild oat, soft chess, and filaree.

If this unit is used for homesite development, the main limitation is the hazard of flooding. Some low areas near stream channels are flooded during prolonged, high-intensity winter storms. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

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

148—Kidd-Forward complex, 5 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush and scattered conifers on the Kidd soil and hardwoods and conifers with an understory of shrubs on the Forward soil. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 51 to 55 degrees F, and the average frost-free period is 150 to 185 days.

This unit is about 60 percent Kidd gravelly loam and 20 percent Forward 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 Aiken soils and Rock outcrop. The areas of Rock outcrop occur as escarpments. Also included are small areas of Forward and Kidd soils that have slopes of more than 30 percent; soils that are similar to the Forward soil but have a clayey subsoil; soils that are similar to the Forward and Kidd soils, near Kelseyville and Clearlake Highlands, but have warmer soil temperatures, are sandy loam or loamy sand throughout the profile, and have rapid permeability; and soils that are more than 60 inches deep. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Kidd soil is shallow and somewhat excessively drained. It formed in material weathered from rhyolitic

tuff. Typically, the surface layer is light gray gravelly loam 9 inches thick. The subsoil is very pale brown gravelly loam 7 inches thick. Rhyolitic tuff is at a depth of 16 inches.

Permeability of the Kidd soil is moderately rapid. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate.

The Forward soil is moderately deep and well drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is light gray loam 9 inches thick. The subsoil is light gray gravelly loam 16 inches thick. Rhyolitic tuff is at a depth of 25 inches.

Permeability of the Forward soil is moderately rapid. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is severe.

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

Estimates of the site index and yield for the Kidd soil have not been made because the vegetation is mainly brush.

Ponderosa pine, Douglas-fir, and sugar pine are the main tree species on the Forward soil. On the basis of a 100-year site curve, the mean site index is 102 for ponderosa pine and 97 for Douglas-fir. The potential annual production of ponderosa pine is 390 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine have not been made. Among the trees of limited extent are knobcone pine in areas that have been repeatedly burned, tanoak, California black oak, Pacific madrone, and interior live oak.

A concern 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. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine, sugar pine, or Douglas-fir seedlings on the Forward soil. If seed trees are present, natural reforestation of cutover areas by ponderosa pine, sugar pine, and Douglas-fir occurs infrequently. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are whiteleaf manzanita, greenleaf manzanita, coffeeberry, and buckbrush.

If this unit is used for homesite development, the main limitations are steepness of slope and depth to bedrock. Extensive cutting and filling generally are required. Deep cuts can expose bedrock. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. Shallow depth of the Kidd soil is a major limitation for septic tank absorption fields. The limitation of moderate depth of the Forward soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

149—Kidd-Forward complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush and scattered conifers on the Kidd soil and hardwoods and conifers with an understory of shrubs on the Forward soil. Elevation is 1,500 to 3,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 51 to 55 degrees F, and the average frost-free period is 150 to 185 days.

This unit is about 45 percent Kidd gravelly loam and 35 percent Forward 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 is about 10 percent Forward Variant soils. Also included are small areas of Rock outcrop in the form of escarpments, Kidd and Forward soils that have slopes of more than 50 percent, soils that are similar to the Forward soil but are skeletal, and soils that are similar to the Kidd soil but are less than 10 inches deep. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Kidd soil is shallow and somewhat excessively drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is light gray gravelly loam 9 inches thick. The subsoil is very pale brown gravelly loam 7 inches thick. Rhyolitic tuff is at a depth of 16 inches.

Permeability of the Kidd soil is moderately rapid. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Forward soil is moderately deep and well drained. It formed in material weathered from rhyolitic tuff. Typically, the surface layer is light gray loam 9 inches

thick. The subsoil is light gray gravelly loam 16 inches thick. Rhyolitic tuff is at a depth of 25 inches.

Permeability of the Forward soil is moderately rapid. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Estimates of the site index and yield for the Kidd soil have not been made because the vegetation is mostly brush.

Ponderosa pine, Douglas-fir, and sugar pine are the main tree species on the Forward soil. On the basis of a 100-year site curve, the mean site index is 102 for ponderosa pine and 97 for Douglas-fir. The potential annual production of ponderosa pine is 390 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for sugar pine have not been made. Among the trees of limited extent are knobcone pine in areas that have been repeatedly burned, tanoak, California black oak, Pacific madrone, and interior live oak.

Some concerns for the harvesting of timber are steepness of slope and hazard of erosion. 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. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine, sugar pine, or Douglas-fir seedlings on the Forward soil. If seed trees are present, natural reforestation of cutover areas by ponderosa pine, sugar pine, and Douglas-fir occurs infrequently. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Among the common forest understory plants are whiteleaf manzanita, greenleaf manzanita, coffeeberry, and buckbrush.

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

150—Kilaga Variant loam, 0 to 5 percent slopes. This very deep, moderately well drained soil is on alluvial plains and stream terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 1,550 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 61 to 64 degrees F, and the average frost-free period is 170 to 210 days.

Typically, the surface layer is pale brown loam 10 inches thick. The upper 32 inches of the subsoil is grayish brown and light brownish gray clay loam, and the lower 29 inches is light brownish gray, pale brown, and brown clay. In some areas the surface layer is sandy loam or silty clay loam.

Included in this unit are small areas of soils that are similar to the Kilaga Variant soil but have less clay or have a perched high water table at a depth of 18 to 40 inches in winter and early in spring. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Kilaga Variant soil is slow. Available water capacity is 9 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of erosion is slight. A seasonal perched water table is at a depth of 3 to 6 feet.

This unit is used mainly for livestock grazing. It is also used for hay and pasture.

The production of forage is limited by the susceptibility of the soil to compaction when moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The characteristic plant community on this unit is mainly soft chess, burclover, filaree, and wild oat.

If this unit is used for hay and pasture, the main limitation is the slow permeability. Application of irrigation water should be regulated so that water does not stand on the surface for long periods and damage crops.

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

151—Konocti-Benridge complex, 50 to 75 percent slopes. This map unit is on hills and mountains. Rock outcroppings and stones 3 to 25 feet in diameter occur at random throughout the unit. The vegetation is mainly brush on south- and east-facing slopes and brush with scattered hardwoods and conifers on north- and west-facing slopes. Elevation is 1,300 to 4,300 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 53 to 59 degrees F, and the average frost-free period is 140 to 200 days.

This unit is about 40 percent Konocti stony loam, 30 percent Konocti cobbly loam, and 15 percent Benridge 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 Konocti Variant and Sodabay soils. Also included are small areas of soils that are similar to the Benridge soil but have 35 to 60 percent rock fragments and soils that are similar to the Konocti and Benridge soils but are 40 to 60 inches deep. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Konocti stony loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown stony loam 4 inches thick. The upper 5 inches of the subsoil is brown stony loam, and the lower 19 inches is light reddish brown very stony clay loam. Fractured dacite is at a depth of 28 inches. In some areas the surface layer is very stony loam.

Permeability of the Konocti stony loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Konocti cobbly loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown cobbly loam 8 inches thick. The upper 8 inches of the subsoil is brown stony loam, and the lower 16 inches is light reddish brown very stony loam. The substratum to a depth of 39 inches is reddish yellow very stony loam. Slightly weathered dacite is at a depth of 39 inches.

Permeability of the Konocti cobbly loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Benridge soil is very deep and well drained. It formed in material weathered from volcanic ash, breccia, or tuff. Typically, the surface layer is light brown loam 6 inches thick. The upper 57 inches of the subsoil is yellowish red gravelly clay loam, and the lower 5 inches is yellowish red clay. Weathered breccia is at a depth of 68 inches.

Permeability of the Benridge soil is moderately slow. Available water capacity is 6.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed.

Woody shrubs are the most extensive plants on this unit. The characteristic vegetation is mainly manzanita, chamise, and California scrub oak with scattered areas of knobcone pine. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, improve access, and reduce the risk of fire.

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

152—Konocti-Hambright complex, 5 to 15 percent slopes. This map unit is on hills. The vegetation is oaks, brush, and annual grasses. Rock outcroppings and stones 10 inches to 50 feet in diameter commonly are throughout the unit. Elevation is 1,000 to 2,500 feet. The average annual precipitation is about 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Konocti gravelly loam and 20 percent Hambright 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 Aiken, Collayomi, Guenoc, Konocti Variant, and Sobrante soils and Rock outcrop. Rock outcrop occurs as escarpments. Also included are small areas of Hambright and Konocti soils that have slopes of less than 5 percent, soils that are similar to Hambright and Konocti soils but have stratified welded tuff and clay below the subsoil or have clay loam textures, and soils that are similar to the Konocti soil but are less than 20 inches deep to basalt. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Konocti soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, 10 percent of the surface is covered with cobbles and stones. The surface layer is brown gravelly loam 6 inches thick. Below this is strong brown gravelly loam 4 inches thick. The subsoil is yellowish red very stony clay loam 19 inches thick. Hard basalt is a depth of 29 inches. In some areas the surface layer is loam.

Permeability of the Konocti soil is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown very gravelly loam about 4 inches thick. The subsoil is reddish brown very gravelly loam about 12 inches thick. Fractured basalt is at a depth of 16 inches. In some areas the surface layer is clay loam.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate.

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

If this unit is used for homesite development, the main limitations are depth to bedrock in the Konocti and Hambright soils and the moderately slow permeability of the Konocti soil. Another limitation is the presence of stones and boulders. Cuts needed to provide level building sites can expose bedrock, stones, and boulders.

The shallow depth to bedrock in the Hambright soil is a major limitation for septic tank absorption fields. The limitations of moderate depth to bedrock and of moderately slow permeability of the Konocti soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. The risk of erosion is increased if the soil is left exposed during site development. Revegetating disturbed areas around construction sites helps to control erosion. Access roads should be designed to control surface runoff and help stabilize cut slopes. Plans for homesite development should provide for the preservation of as many trees as possible.

The production of forage is limited by the restricted available water capacity, the stony surface, and a tendency of the soils to produce woody species. Brush clearing, rangeland seeding, and fertilizing to improve forage production generally are not practical. In areas dominated by brush, properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire. Among the common understory plants are manzanita, chamise, soft chess, and filaree.

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

153—Konocti-Hambright complex, 15 to 30 percent slopes. This map unit is on hills. Rock outcroppings and stones 10 inches to 50 feet in diameter are common throughout the unit. The vegetation is mainly oaks, brush, and annual grasses. Elevation is 1,000 to 2,500 feet. The average annual precipitation is about 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 40 percent Konocti gravelly loam and 30 percent Hambright 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 Aiken, Collayomi, Guenoc, and Neice soils and Rock outcrop. Rock outcrop occurs as escarpments. Also included are small areas of Hambright and Konocti soils that have slopes of 5 to 15 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Konocti soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, 10 percent of the surface is covered with cobbles and stones. The surface layer is brown gravelly loam 6 inches thick. Below this is strong brown gravelly loam 4 inches thick. The subsoil is yellowish red very stony clay loam 19 inches thick. Hard basalt is at a depth of 29 inches.

Permeability of the Konocti soil is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Fractured basalt is at a depth of 16 inches. In some areas the surface layer is clay loam.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and depth to bedrock in the Konocti and Hambright soils and the moderately slow permeability of the Konocti soil. Another limitation is the presence of stones and boulders. Steepness of slope presents many problems when this unit is used for homesite development. Extensive cutting and filling generally are required. Cuts needed to provide building sites can expose bedrock or stones and boulders. Cut slopes are susceptible to erosion. The risk of erosion is increased if the soil is left exposed during construction. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. Shallow depth to bedrock in the Hambright soil is a major limitation for septic tank absorption fields. The limitations of moderate depth and moderately slow permeability of the Konocti soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The production of forage is limited on this unit by the restricted available water capacity, the stony surface, and the tendency of the soils to produce woody species. Brush clearing, rangeland seeding, and fertilizing to improve forage production on this unit generally are not practical. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire in areas dominated by brush. Among the common understory plants are manzanita, chamise, soft chess, and filaree.

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

154—Konocti-Hambright-Rock outcrop complex, 30 to 75 percent slopes. This map unit is on hills. The

vegetation is mainly brush or annual grasses and oak. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 30 percent Konocti gravelly loam, 30 percent Hambright very gravelly loam, and 15 percent Rock outcrop. 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 Benridge, Konocti Variant, Neice, Sobrante, and Sodabay soils. Also included are small areas of soils that are similar to the Hambright and Konocti soils but are on north-facing slopes that are cooler or are clay loam. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Konocti soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, 10 percent of the surface is covered with cobbles and stones. The surface layer is brown gravelly loam about 6 inches thick. Below this is strong brown gravelly loam 4 inches thick. The subsoil is yellowish red very stony clay loam about 19 inches thick. Basalt is at a depth of 29 inches.

Permeability of the Konocti soil is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown very gravelly loam about 4 inches thick. The subsoil is reddish brown very gravelly loam about 12 inches thick. Fractured basalt is at a depth of 16 inches.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

Rock outcrop consists of unweathered basaltic rock. It occurs as small masses of intruding bedrock or as detached stones and boulders on the land surface and are as much as 50 feet in diameter.

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

The production of forage is limited by the restricted available water capacity, the stony surface, and a tendency of the soils to produce woody species. Brush clearing, rangeland seeding, and fertilizing to improve forage production on this unit generally are not practical. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire in areas dominated by brush. 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 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 vegetation suitable for grazing. Among the common understory plants are manzanita, chamise, soft chess, and filaree.

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

155—Konocti Variant-Konocti-Hambright complex, 2 to 15 percent slopes. This map unit is on hills. The vegetation is mainly oaks, brush, and annual grasses. Elevation is 1,200 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Konocti Variant gravelly loam, 20 percent Konocti cobbly loam, and 15 percent Hambright 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 Benridge, Sobrante, and Sodabay soils and Rock outcrop. Also included are small areas of soils that are similar to the Konocti and Konocti Variant soils but have a clayey subsoil and soils that are similar to the Hambright soil but are clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Konocti Variant soil is deep and well drained. It formed in material weathered from basalt. Typically, the surface is covered with a mat of partially decomposed oak and manzanita leaves and twigs about 0.5 inch thick. In some areas 5 to 15 percent of the surface is covered with cobbles and stones. The surface layer is yellowish brown gravelly loam 4 inches thick. The upper 18 inches of the subsoil is brown and strong brown very gravelly loam and very gravelly clay loam, and the lower 31 inches is strong brown very cobbly clay loam and light brown very stony clay loam. Olivine basalt is at a depth of 53 inches.

Permeability of the Konocti Variant soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is medium, and the hazard of erosion is slight.

The Konocti soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, 25 percent of the surface is covered with cobbles, stones, and boulders. The surface layer is dark brown cobbly loam 11 inches thick. The subsoil is dark brown very stony clay loam 17 inches thick. Hard, fractured basalt is at a depth of 28 inches.

Permeability of the Konocti soil is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, 20 to 30 percent of the surface is covered with cobbles and stones. The surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Fractured basalt is at a depth of 16 inches.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate.

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

The production of forage is limited by the restricted available water capacity, the stony surface, and a tendency of the soils to produce woody species. Where trees and brush grow on the Konocti Variant soil, 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. Volumes of 25 cords of wood per acre have been measured on the Konocti Variant soil.

Brush clearing, rangeland seeding, and fertilizing on the Konocti and Hambright soils generally are not practical. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire in areas dominated by brush. Among the common understory plants are manzanita, mountainmahogany, and annual grasses on the Konocti Variant soil and manzanita, chamise, soft chess, and filaree on the Konocti and Hambright soils.

If this unit is used for homesite development, the main limitations are the depth to bedrock in the Konocti and Hambright soils and the moderately slow permeability of the Konocti Variant and Konocti soils. Another limitation is the presence of stones and boulders. Cuts needed to provide building sites on this unit can expose bedrock or stones and boulders. Shallow depth to bedrock in the Hambright soil is a major limitation for septic tank absorption fields. The limitations of moderate depth of the Konocti soil and moderately slow permeability of the Konocti and Konocti Variant soils can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

156—Konocti Variant-Konocti-Hambright complex, 15 to 30 percent slopes. This map unit is on hills. The vegetation is mainly oaks, brush, and annual grasses. Elevation is 1,200 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Konocti Variant gravelly loam, 20 percent Konocti cobbly loam, and 15 percent Hambright 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 Benridge, Sobrante, and Sodabay soils and Rock outcrop. Also included are small areas of soils that are similar to the Konocti and Konocti Variant soils but have a clayey subsoil and soils that are similar to the Hambright soil but are clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Konocti Variant soil is deep and well drained. It formed in material weathered from basalt. Typically, the surface is covered with a mat of partially decomposed oak and manzanita leaves and twigs about 0.5 inch thick. In some areas 5 to 15 percent of the surface is covered with cobbles and stones. The surface layer is yellowish brown gravelly loam 4 inches thick. The upper 18 inches of the subsoil is brown and strong brown very gravelly loam and very gravelly clay loam, and the lower 31 inches is strong brown very cobbly clay loam and light brown very stony clay loam. Olivine basalt is at a depth of 53 inches.

Permeability of the Konocti Variant soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Konocti soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, 25 percent of the surface is covered with cobbles, stones, and boulders. The surface layer is dark brown cobbly loam 11 inches thick. The subsoil is dark brown very stony clay loam 17 inches thick. Hard, fractured basalt is at a depth of 28 inches.

Permeability of the Konocti soil is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, 20 to 30 percent of the surface is covered with cobbles and stones. The surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Fractured basalt is at a depth of 16 inches.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

The production of forage is limited by the restricted available water capacity, the stony surface, and a tendency of the soils to produce woody species. Where

trees and brush grow on the Konocti Variant soil, forage production can be increased by properly managing the harvesting of trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 25 cords of wood per acre have been measured on the Konocti Variant soil.

Brush clearing, rangeland seeding, and fertilizing on the Konocti and Hambright soils generally are not practical. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire in areas dominated by brush. Among the common understory plants are manzanita, mountainmahogany, and annual grasses on the Konocti Variant soil and manzanita, chamise, soft chess, and filaree on the Konocti and Hambright soils.

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

157—Landlow Variant silty clay loam. This very deep, poorly drained soil is in basins and on flood plains. It formed in alluvium derived from recent lacustrine deposits. Slope is 0 to 2 percent. The vegetation is mainly marshgrasses and other water-tolerant species. Elevation is 1,100 to 1,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 170 to 210 days.

Typically, the surface layer is grayish brown silty clay loam 7 inches thick. The subsoil is grayish brown silty clay 16 inches thick. The substratum to a depth of 84 inches is light olive gray, olive gray, and gray silty clay loam. In some areas the surface layer is silt loam.

Included in this unit are small areas of Clear Lake, Cole, and Mocho Variant soils. Also included are small areas of soils, near drainageways, that have a gravelly or cobbly substratum. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Landlow Variant soil is slow. Available water capacity is 8.5 to 10.5 inches. Effective rooting depth is limited by a seasonal high water table that is at a depth of 0.5 to 1.0 foot from December to March. The water table drops to a depth of 4 to 6 feet during the growing season. Surface runoff is slow, and the hazard of erosion is slight. This soil is subject to occasional periods of flooding for 2 to 7 days in winter and spring. The shrink-swell potential is high.

This unit is used mainly for hay and pasture and for wildlife habitat. It is also used for homesite development.

If this unit is used for hay and pasture, the main limitations are slow permeability, poor drainage, and the hazard of flooding. Because of the slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Excess water can be removed by installing subsurface drains or drainage ditches if an outlet is available. The risk of flooding can be reduced by the use of dikes and levees.

If this unit is used for homesite development, the main limitations are the hazard of flooding, the seasonal high water table, slow permeability, high shrink-swell potential, and low load bearing capacity. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. Drainage is needed if roads and building foundations are constructed. This unit is very poorly suited to septic tank absoprtion fields because of the seasonal high water table, the hazard of flooding, and the slow permeability. The high shrink-swell potential of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

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

158—Lupoyoma silt loam, protected. This very deep, moderately well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks. Elevation is 800 to 1,450 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is brown silt loam 31 inches thick. The underlying material to a depth of 84 inches is brown and very dark grayish brown silt loam. In some areas the surface layer is loam.

Included in this unit are small areas of Cole Variant, Kelsey, and Maywood Variant soils and Xerofluvents. Xerofluvents are along drainageways. Also included are soils that are similar to this Lupoyoma soil but are well drained. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Lupoyoma soil is moderately slow. Available water capacity is 8.5 to 11.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding in winter and early in spring. Some areas are not subject to flooding because of the development of flood control structures.

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

The main crops grown on the unit are pears, walnuts, and wine grapes (fig. 3). The main limitation is the hazard of flooding. Capital improvements should be designed to withstand flooding.

This unit is well suited to hay and pasture.

If this unit is used for homesite development, the main limitations are the moderately slow permeability and the hazard of flooding. If this unit is used for septic tank absorption fields, increasing the size of the absorption field or using a specially designed sewage disposal system can help to compensate for the moderately slow permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

This map unit is in capability class I (14), irrigated, and capability unit IIIc-1 (14), nonirrigated.

159—Manzanita loam, 2 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is oaks, manzanita,

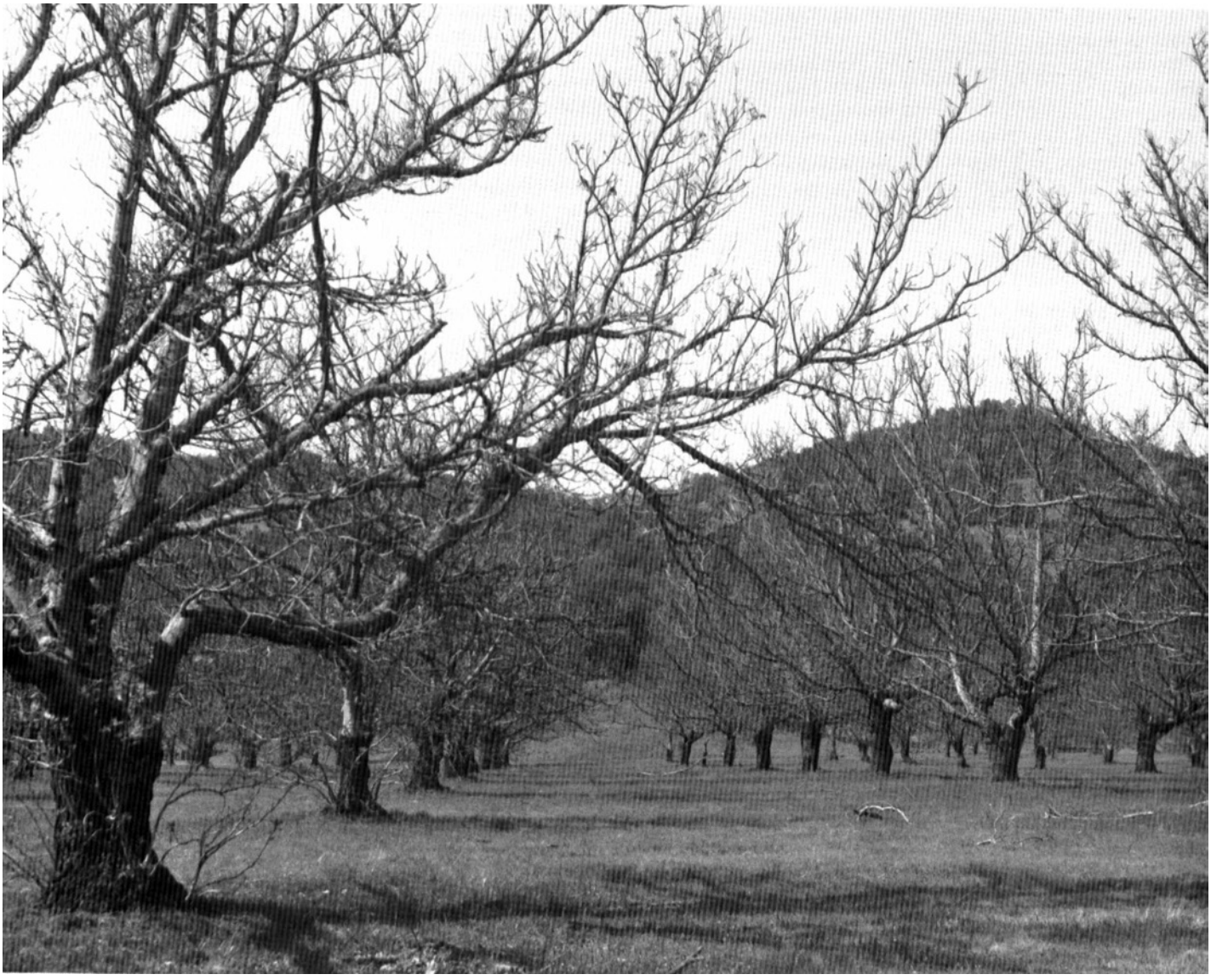

Figure 3.—Nonirrigated walnut orchard in an area of Lupoyoma silt loam, protected, in Middle Creek Valley.

and annual grasses. Elevation is 1,400 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the upper 5 inches of the surface layer is light yellowish brown loam and the lower 14 inches is strong brown loam. The upper 9 inches of the subsoil is strong brown loam, and the lower 56 inches is variegated strong brown and yellowish red clay loam.

Included in this unit are small areas of Forbesville soils. Also included are small areas of soils that are similar to this Manzanita soil but have a gravelly subsoil. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Manzanita soil is slow. Available water capacity is 7.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for orchards, hay and pasture, livestock grazing, and homesite development. It is also used for firewood production.

The main crop grown on this unit is walnuts. Where water is available, irrigation is used for maximum production of this crop. The unit has potential for vineyards. The main limitation is the slow permeability. Because of this limitation, irrigation water needs to be applied slowly to minimize runoff.

If this unit is used for hay and pasture, the main limitation is the slow permeability of the soil. Because of this limitation, irrigation water needs to be applied slowly to minimize runoff.

The production of forage is limited by the tendency of the soil in this unit to produce woody species. Where trees 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. Volumes of 25 cords of wood per acre have been measured on this unit. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Among the common understory plants are soft chess, purple needlegrass, and filaree.

If this unit is used for homesite development, the main limitation is the slow permeability of the soil. If the soil is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

160—Manzanita loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is oak, manzanita, and annual grasses. Elevation is 1,400 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the upper 5 inches of the surface layer is light yellowish brown loam and the lower 14 inches is strong brown loam. The upper 9 inches of the subsoil is strong brown loam, and the lower 56 inches is variegated strong brown and yellowish red clay loam.

Included in this unit are small areas of Forbesville soils. Also included are small areas of soils that are similar to this Manzanita soil but have a gravelly subsoil. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Manzanita soil is slow. Available water capacity is 7.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used for homesite development, hay and pasture, livestock grazing, and orchards. It is also used for firewood production.

If this unit is used for homesite development, the main limitation is the slow permeability of the soil. If the soil is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

If this unit is used for hay and pasture, the main limitations are the slow permeability of the soil and the hazard of erosion. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

The production of forage is limited by the tendency of the soil in this unit to produce woody species. Where trees 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. Volumes of 25 cords of wood per acre have been measured on this unit. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Among the common understory plants are soft chess, purple needlegrass, and filaree.

The main crop grown on this unit is walnuts. This crop commonly is not irrigated because an adequate irrigation water supply has not been developed. This unit has potential for wine grapes. It is limited mainly by the hazard of erosion and steepness of slope. Use of a cover crop between rows of trees or vines helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

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

161—Manzanita loam, 15 to 25 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation is oak, manzanita, and annual grasses. Elevation is 1,400 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the upper 5 inches of the surface layer is light yellowish brown loam and the lower 14 inches is strong brown loam. The upper 9 inches of the subsoil is strong brown loam, and the lower 56 inches is variegated strong brown and yellowish red clay loam.

Included in this unit are small areas of Forbesville soils. Also included are small areas of Manzanita soils that have slopes of 5 to 15 percent and soils that are similar to this Manzanita soil but have a gravelly subsoil or are on north-facing slopes that are slightly cooler. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Manzanita soil is slow. Available water capacity is 7.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used for homesite development and livestock grazing. It is also used for firewood production.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and slow permeability. Extensive cutting and filling generally are required. Cuts needed to provide building sites can expose the clayey subsoil. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation and revegetating disturbed areas help to control erosion. Slope limits installation of septic tank absoprtion fields. Absorption lines should be installed on the contour. If this unit is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The production of forage is limited by the tendency of this unit to produce woody species. Where trees 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. Volumes of 25 cords of wood per acre have been measured on this unit. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Livestock grazing should be managed to protect the soil from excessive erosion. Among the common understory plants are soft chess, purple needlegrass, and filaree.

This map unit is in capability unit IVe-1 (14), nonirrigated.

162—Manzanita gravelly loam, 2 to 8 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly scattered oaks, manzanita, and annual grasses. Elevation is 1,350 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is brown gravelly loam 7 inches thick. The upper 28 inches of the subsoil is reddish yellow gravelly clay loam, and the lower 25 inches is reddish yellow gravelly clay.

Included in this unit are small areas of Forbesville and Manzanita loams. Also included are small areas of Manzanita soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Manzanita soil is slow. Available water capacity is 6 to 9 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing, homesite development, and orchards. It is also used for hay and pasture and for firewood production.

The production of forage is limited by the tendency of this unit to produce woody species. Where trees 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. Volumes of 25 cords of wood per acre have been measured on this unit. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Among the common understory plants are slender oat, soft chess, annual clover, and filaree.

If this unit is used for homesite development, the main limitation is slow permeability. If it is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The main crop grown on this unit is walnuts. This crop commonly is not irrigated because an adequate irrigation water supply has not been developed. This unit has potential for wine grapes. It is limited mainly by the hazard of erosion and by steepness of slope in some areas. Use of a cover crop between rows of trees or vines helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are slow permeability and the hazard of erosion. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted

grazing during wet periods helps to keep the pasture in good condition and to protect the unit from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

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

163—Manzanita gravelly loam, 8 to 25 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation is mainly scattered oaks, manzanita, and annual grasses. Elevation is 1,350 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is brown gravelly loam 7 inches thick. The upper 28 inches of the subsoil is reddish yellow gravelly clay loam, and the lower 25 inches is reddish yellow gravelly clay.

Included in this unit are small areas of Forbesville and Manzanita loams and soils that are similar to this Manzanita soil but have slopes of more than 25 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Manzanita soil is slow. Available water capacity is 6 to 9 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used for livestock grazing and homesite development. It is also used for orchards and firewood production.

The production of forage is limited by the tendency of this unit to produce woody species. Where trees and brush are present, forage production will be increased by harvesting trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 25 cords of wood per acre have been measured on this unit. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Among the common understory plants are slender oat, soft chess, annual clover, and filaree.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and slow permeability. Extensive cutting and filling generally are required. Cut slopes are susceptible to excessive erosion, and intensive runoff control measures are needed. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation and revegetating disturbed areas help to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. If this unit is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

The main crop grown on this unit is walnuts. This crop commonly is not irrigated because an adequate irrigation water supply has not been developed. This unit has potential for wine grapes. The hazard of erosion and steepness of slope are major limitations for this use. Use of a cover crop between rows of trees or vines helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

This map unit is in capability unit IVe-1 (14), nonirrigated.

164—Maxwell clay loam, 0 to 2 percent slopes. This very deep, somewhat poorly drained soil is in basins. It formed in alluvium derived dominantly from serpentinitic rock. The vegetation is mainly annual grasses and forbs. Elevation is 800 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is dark gray clay loam 6 inches thick over gray clay 32 inches thick. The underlying material to a depth of 84 inches is calcareous gray clay. In some areas the upper part of the surface layer is clay.

Included in this unit are small areas of Cole, Mocho Variant, and Yorkville Variant soils. Also included are soils that are similar to this Maxwell soil but have a layer of overwash on the surface, soils that are 20 to 40 inches deep over serpentinitic bedrock, and extremely gravelly soils in drainageways. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Maxwell soil is very slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 42 to 60 inches from 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 1.

This unit is used mainly for hay and pasture and livestock grazing. It is also used for homesite development.

This unit is poorly suited to hay and pasture. The main limitations are the very slow permeability and low calcium to magnesium ratio. Because of the very slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods of time and damage the crops. Growth of many plants is limited by the low calcium to magnesium ratio; however, overcoming it is not economically feasible because of the large amount of calcium needed.

The production of forage is limited by the low calcium to magnesium ratio and susceptibility of the soil to compaction when moist. Rangeland seeding and fertilizing generally are not practical because of the low calcium to magnesium ratio. Overcoming this limitation is not economically feasible because of the large amount of calcium needed. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly slender oat, soft chess, and wild oat.

If this unit is used for homesite development, the main limitations are the seasonal high water table, very slow permeability, high shrink-swell potential, and low load bearing capacity. This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and very slow permeability. If the soil in this unit is used for absorption fields, using a specially designed sewage disposal system can help to compensate for these limitations. The high shrink-swell potential of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIIw-9 (14), irrigated and nonirrigated.

165—Maxwell clay loam, 2 to 8 percent slopes. This very deep, somewhat poorly drained soil is in basins and on basin rims. It formed in alluvium derived dominantly from serpentinitic rock. The vegetation is mainly annual grasses and forbs. Elevation is 800 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is dark gray clay loam 6 inches thick over gray clay 32 inches thick. The underlying material to a depth of 84 inches is calcareous gray clay. In some areas the upper part of the surface layer is clay.

Included in this unit are small areas of Henneke, Montara, and Yorkville Variant soils and Rock outcrop. Rock outcrop occurs as escarpments. Also included are small areas of serpentinitic colluvium at the base of some slopes, soils that are 20 to 40 inches deep over serpentinitic bedrock, extremely gravelly and cobbly soils in drainageways, and Maxwell soils that have slopes of 8 to 15 percent. Included areas make up about 40 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Maxwell soil is very slow. Available water capacity is 6.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate. 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 1.

This unit is used mainly for hay and pasture and livestock grazing. It is also used for homesite development.

This unit is poorly suited to hay and pasture. The main limitations are the very slow permeability, low calcium to magnesium ratio, and the hazard of erosion. Because of the very slow permeability, irrigation water needs to be applied slowly to minimize runoff. Overcoming the limitation of low calcium to magnesium ratio is not economically feasible because of the large amount of calcium needed. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

The production of forage is limited by the low calcium to magnesium ratio and the susceptibility of the soil to compaction when it is moist. Rangeland seeding and fertilizing on this unit generally are not practical because of the calcium to magnesium ratio. Overcoming this limitation is not economically feasible because of the large amount of calcium needed. Grazing should be deferred when the surface layer is saturated. The characteristic plant community on this unit is mainly slender oat, soft chess, and wild oat.

If this unit is used for homesite development, the main limitations are the seasonal high water table, very slow permeability, high shrink-swell potential, and low load bearing capacity. This unit is poorly suited to septic tank absorption fields because of the seasonal high water table and very slow permeability. Using a specially designed sewage disposal system can help to compensate for the very slow permeability and seasonal high water table. The high shrink-swell potential of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIIe-9 (14), irrigated and nonirrigated.

166—Maymen-Etsel-Mayacama complex, 15 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush on the Maymen and Etsel soils and hardwoods with scattered conifers on the

Mayacama soils. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 135 to 180 days.

This unit is about 40 percent Maymen gravelly loam, 20 percent Etsel gravelly loam, and 20 percent Mayacama 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 Henneke, Montara, Neuns, Sanhedrin, Snook, and Speaker soils and Rock outcrop. Sandstone and graywacke rock outcroppings 10 to 60 feet in diameter are on ridgetops and metastable side slopes. Also included are small areas of soils at more than 4,000 feet elevation. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. The soil is very pale brown gravelly loam 3 inches thick over very pale brown very gravelly loam 7 inches thick. Fractured sandstone is at a depth of 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is pale brown very gravelly sandy loam 5 inches thick. The subsoil is very pale brown very gravelly sandy clay loam 26 inches thick. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

This unit is used mainly as wildlife habitat and watershed. It is also used for firewood production. Areas that are cleared can be used for livestock grazing.

The natural vegetation on the Maymen and Etsel soils is mainly brush. The species on these soils are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Canyon live oak, California black oak, and Douglas-fir are the main tree species on the Mayacama soil. Among the trees of limited extent are California nutmeg and knobcone pine. Estimates of the site index for this soil have not been made. Volumes of 40 to 90 cords of wood per acre have been measured on the Mayacama soil. There are no major limitations for the harvesting of firewood. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

The production of forage is limited by a dense canopy of woody species. Brush management to increase forage production through type conversion generally is not practical on this unit. If the Maymen soil is cleared for firebreaks, however, seeding grass will provide forage for some livestock grazing and will help to prevent erosion. The Etsel and Mayacama soils cannot support good stands of grasses.

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

167—Maymen-Etsel-Mayacama complex, 30 to 75 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush on the Maymen and Etsel soils and hardwoods with scattered conifers on the Mayacama soil. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 135 to 180 days.

This unit is about 35 percent Maymen gravelly loam, 25 percent Etsel gravelly loam, and 20 percent Mayacama 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 Henneke, Millsholm, Montara, Neuns, Sanhedrin, Snook, and Speaker soils and Rock outcrop. Sandstone and graywacke rock outcroppings 10 to 60 feet in diameter are on ridgetops and metastable side slopes. Also included are small areas of soils at more than 4,000 feet elevation. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the soil is very pale brown gravelly

loam 3 inches thick over very pale brown very gravelly loam 7 inches thick. Fractured sandstone is at a depth of 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is pale brown very gravelly sandy loam 5 inches thick. The subsoil is very pale brown very gravelly sandy clay loam 26 inches thick. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

The natural vegetation on the Maymen and Etsel soils is mainly brush. The main species are chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Canyon live oak, California black oak, and Douglas-fir are the main tree species on the Mayacama soil. Among the trees of limited extent are California nutmeg and knobcone pine. Estimates of the site index and yield for this soil have not been made. Conifer stands commonly are small and widely scattered, making them generally noncommercial. The main limitations for the harvesting of firewood are steepness of slope and the low volume of commercial species. Because of these limitations, harvesting of trees generally is not economically feasible.

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

168—Maymen-Etsel-Snook complex, 15 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush with some hardwoods and annual grasses. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 56 to 57 degrees F, and the average frost-free period is 135 to 185 days.

This unit is about 45 percent Maymen gravelly loam, 15 percent Etsel gravelly loam, and 15 percent Snook loam. Areas of the Snook soil at elevations above 3,500 feet are on south-facing 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 Mayacama and Speaker soils and Rock outcrop. Rock outcroppings are on ridgetops and in steep drainageways. Also included are small areas of soils that are similar to the Maymen soil but have a significant clay increase in the subsoil, soils that are similar to Snook soil but have neutral reaction, and soils that are at an elevation of more than 4,000 feet or less than 1,500 feet. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the soil is light yellowish brown gravelly loam 3 inches thick over light yellowish brown very gravelly loam 5 inches thick. Sandstone is at a depth of 8 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Snook soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the soil is light yellowish brown loam 5 inches thick. Fractured sandstone is at a depth of 5 inches.

Permeability of the Snook soil is moderate. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 4 to 10 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Brush management to increase forage production through type conversion generally is not practical. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, improve access, and reduce the risk of fire. Constructing firebreaks on ridgetops helps to prevent wildfire, which results in erosion. Where the Maymen soil is cleared for firebreaks, seeding grass reduces erosion. The Etsel soil will not support good stands of grass.

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

169—Maymen-Etsel-Snook complex, 30 to 75 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush with some hardwoods and annual grasses. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 30 to 50 inches, the

average annual air temperature is 56 to 57 degrees F, and the average frost-free period is 135 to 185 days.

This unit is about 35 percent Maymen gravelly loam, 20 percent Etsel gravelly loam, and 20 percent Snook loam. Areas of the Snook soil at elevations above 3,500 feet are on south-facing 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 Bressa, Hopland, Mayacama, Millsholm, Neuns, and Speaker soils, Rock outcrop, and soils that are covered with stones. Rock outcroppings and stones 6 inches to 6 feet in diameter are on higher side slopes and ridgetops. Also included are small areas of soils that are similar to the Snook soil but have neutral reaction; small areas of soils that are at an elevation of more than 4,000 feet; and, in an area 2 to 10 miles east of Lower Lake, particularly near Brushy Skyhigh, shallow and moderately deep soils that have a clayey subsoil. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the soil is light yellowish brown gravelly loam 3 inches thick over light yellowish brown very gravelly loam 5 inches thick. Sandstone is at a depth of 8 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Snook soil is shallow and somewhat excessively drained. If formed in material weathered from sandstone or shale. Typically, the soil is light yellowish brown loam 5 inches thick. Fractured sandstone is at a depth of 5 inches.

Permeability of the Snook soil is moderate. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 4 to 10 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire. Constructing firebreaks or ridgetops helps to prevent wildfire, which results in erosion. Where the Maymen soil is cleared for firebreaks, seeding grass reduces erosion. The Etsel soil will not support good stands of grass.

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

170—Maymen-Etsel-Speaker association, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly brush on the Maymen and Etsel soils and mixed conifers and hardwoods on the Speaker soil. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 35 percent Maymen gravelly loam, 30 percent Etsel very gravelly loam, and 20 percent Speaker gravelly loam. The Speaker soil is on north- and east-facing slopes, and the Maymen and Etsel soils are on ridgetops and on south- and west-facing slopes.

Included in this unit are small areas of Marpa, Neuns, and Sanhedrin soils and Rock outcrop. Rock outcrop is on ridgetops and in steep drainageways. Also included are small areas of soils that are at an elevation of more than 4,000 feet and soils that have slopes of 15 to 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Maymen soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is light yellowish brown gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the soil is very pale brown gravelly loam 3 inches thick over very pale brown gravelly loam 7 inches thick. Fractured sandstone is at a depth of 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The natural vegetation on the Maymen and Etsel soils is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Douglas-fir, ponderosa pine, and California black oak are the main tree species on the Speaker soil. Among the trees of limited extent are Pacific madrone and knobcone pine. Some areas are dominated by knobcone pine because of past fires. On the basis of a 100-year site curve, the mean site index is 107 for Douglas-fir and 106 for ponderosa pine. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

Some concerns for the harvesting of timber are steepness of slope 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. 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 careful use of either wheeled and tracked equipment or cable harvesting systems. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads generally is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished by planting Douglas-fir and ponderosa pine seedlings on the Speaker soil. If seed trees are present, natural reforestation of cutover areas by Douglas-fir and ponderosa pine occurs periodically. The high soil temperature and low content of soil moisture during the growing season result in a high mortality rate for Douglas-fir, especially on the south- and southwest-facing slopes. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit.

Among the common forest understory plants on the Speaker soil are poison-oak, perennial fescue, and bedstraw.

The Maymen soil is in capability subclass VIIe (15), nonirrigated; the Etsel soil is in capability subclass VIIs (15), nonirrigated; and the Speaker soil is in capability subclass VIe (5), nonirrigated.

171—Maymen-Hopland-Etsel association, 15 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly brush on the Maymen and Etsel soils and hardwoods on the Hopland soil. Elevation is 1,500 to 3,200 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 54 to 57 degrees F, and the average frost-free period is 145 to 185 days.

This unit is about 30 percent Maymen gravelly loam, 30 percent Hopland loam, and 20 percent Etsel gravelly loam. The Maymen and Etsel soils are on ridgetops and on south- and west-facing slopes. The Hopland soil is on north- and east-facing slopes and in ravines.

Included in this unit are small areas of Henneke, Mayacama, Millsholm, Montara, Sanhedrin, Snook, and Speaker soils and Rock outcrop. Also included are small areas of soils that are similar to the Etsel soil but have a thermic temperature where they occur above 2,000 feet elevation. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 6 inches thick. The upper 9 inches of the subsoil is brown loam, and the lower 19 inches is light brown clay loam. Soft, highly weathered sandstone is at a depth of 34 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is very pale brown gravelly loam 3 inches thick. The subsoil is very pale brown very gravelly loam 7 inches thick. Fractured sandstone is at a depth of 10 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

The natural vegetation on the Maymen and Etsel soils is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or

mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

California black oak, Pacific madrone, and interior live oak are the main tree species on the Hopland soil. Volumes of 22 to 94 cords of wood per acre have been measured on this soil.

Some concerns for the harvesting of firewood are seasonal soil wetness and the hazard of erosion. 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. They may be impassable during rainy periods. Rock for construction of roads generally is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion. Revegetation of cut and fill slopes is difficult on the Etsel soil because of the restricted available water capacity. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Planting conifers on the Hopland soil is not practical because of the restricted available water capacity and high soil temperature in summer. Hardwoods can regenerate by sprouting after cutting. Regrowth is best if cutting is done in December through May.

Among the common forest understory plants on Hopland soil are poison-oak, scrub oak, and sparse annual forbs.

The Maymen soil is in capability subclass VIIe (15), nonirrigated; the Hopland soil is in capability subclass VIe (5), nonirrigated; and the Etsel soil is in capability subclass VIIs (15), nonirrigated.

172—Maymen-Hopland-Mayacama complex, 9 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly hardwoods with a few conifers and an understory of brush. Elevation is 1,500 to 3,500 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 57 degrees F, and the average frost-free period is 140 to 185 days.

This unit is about 40 percent Maymen gravelly loam, 30 percent Hopland loam, and 15 percent Mayacama 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 Mayacama and Maymen soils that have slopes of more than 30 percent or less than 9 percent and soils that are similar to the Maymen soil but have a clay loam subsoil. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 6 inches thick. The upper 9 inches of the subsoil is brown loam, and the lower 19 inches is light brown clay loam. Soft, weathered and fractured sandstone is at a depth of 34 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is pale brown very gravelly sandy loam 5 inches thick. The subsoil is very pale brown very gravelly sandy clay loam 26 inches thick. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

The natural vegetation on the Maymen soil is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire. Brush control through type conversion to improve forage production generally is not practical. If the Maymen soil is cleared for firebreaks, however, seeding grass provides forage for limited livestock grazing and helps to control erosion.

California black oak, Pacific madrone, and interior live oak are the main tree species on the Hopland and Mayacama soils. Volumes of about 35 cords of wood per acre have been measured on the Hopland soil. Volumes of about 20 cords of wood per acre have been measured on the Mayacama soil. Among the trees of limited extent are Douglas-fir and ponderosa pine.

A concern 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. Rock for construction of roads generally is available on this unit. Conifer plantings on the Hopland and Mayacama soils have a low chance of survival because of the restricted available water capacity and high temperature of the surface layer. After cutting, hardwoods can regenerate by sprouting.

Regrowth is best if cutting is done in December through May.

Among the common forest understory plants are brushy live oak, manzanita, and sparse annual forbs.

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

173—Maymen-Hopland-Mayacama association, 30 to 50 percent slopes. This map unit is on hills and mountains. Rock outcroppings and stones 6 to 25 feet in diameter occur randomly throughout the unit. The vegetation is mainly brush and annual grasses on the Maymen soil and brush and hardwoods with a few conifers on the Hopland and Mayacama soils. Elevation is 1,500 to 3,500 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 57 degrees F, and the average frost-free period is 140 to 185 days.

This unit is about 40 percent Maymen gravelly loam, 20 percent Hopland loam, and 20 percent Mayacama very gravelly sandy loam. The Hopland and Mayacama soils are on north- and east-facing slopes. The Maymen soil is on south- and west-facing slopes and ridgetops.

Included in this unit are small areas of Bressa, Etsel, Henneke, Millsholm, Montara, Sanhedrin, and Speaker soils. Also included are small areas of deep gravelly loam that has more than 40 percent cobbles and stones throughout the profile. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 6 inches thick. The upper 9 inches of the subsoil is brown loam, and the lower 19 inches is light brown clay loam. Soft, highly weathered sandstone is at a depth of 34 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is pale brown very gravelly sandy loam 5 inches thick. The subsoil is very pale brown very gravelly sandy clay loam 26 inches thick. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is 1 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The natural vegetation on the Maymen soil is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire. Brush control through type conversion to improve forage production generally is not practical. If the Maymen soil is cleared for firebreaks, however, seeding grass will provide forage for limited livestock grazing and will help to control erosion.

California black oak, Pacific madrone, and interior live oak are the main tree species on the Mayacama and Hopland soils. Volumes of about 20 cords of wood per acre have been measured on the Mayacama soil. Volumes of about 35 cords of wood per acre have been measured on the Hopland soil. Among the trees of limited extent are Douglas-fir and California-laurel on the Mayacama soil. Estimates of the yield for Douglas-fir have not been made.

Some concerns for the harvesting of firewood are steepness of slope, seasonal wetness, and the hazard of erosion. 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. They may be impassable during rainy periods. Rock for construction of roads generally is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Hopland soil. Revegetation of cut and fill slopes is difficult on the Mayacama soil because of the amount of rock in the soil. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Planting of conifers on the Mayacama and Hopland soils is not practical because of the restricted available water capacity, the high temperature of the surface layer, and the large amount of rock fragments. Hardwoods can regenerate by sprouting after cutting. Regrowth is best if cutting is done in December through May.

Among the common forest understory plants on these soils are California nutmeg, scrub oak, and poison-oak.

The Maymen soil is in capability subclass VIIe (15), nonirrigated; the Hopland soil is in capability subclass VIe (5), nonirrigated; and the Mayacama soil is in capability subclass VIs (5), nonirrigated.

174—Maymen-Hopland-Mayacama association, 50 to 75 percent slopes. This map unit is on hills and mountains. Rock outcroppings and stones 6 to 25 feet in diameter occur randomly throughout the unit. The

vegetation is mainly brush and annual grasses on the Maymen soil and brush and hardwoods with a few conifers on the Hopland and Mayacama soils. Elevation is 1,500 to 3,500 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 53 to 57 degrees F, and the average frost-free period is 140 to 185 days.

This unit is about 40 percent Maymen gravelly loam, 20 percent Hopland loam, and 20 percent Mayacama very gravelly sandy loam. The Hopland and Mayacama soils are on north- and east-facing slopes. The Maymen soil is on south-facing slopes and ridgetops.

Included in this unit are small areas of Bressa, Etsel, Henneke, Montara, Sanhedrin, and Speaker soils. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 6 inches thick. The upper 9 inches of the subsoil is brown loam, and the lower 19 inches is light brown clay loam. Soft, highly weathered sandstone is at a depth of 34 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Mayacama soil is moderately deep and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is pale brown very gravelly sandy loam 5 inches thick. The subsoil is very pale brown very gravelly sandy clay loam 26 inches thick. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Mayacama soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on the Maymen soil is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

The natural vegetation on the Hopland and Mayacama soils is mainly hardwood trees and some brush and conifers. California black oak, Pacific madrone, and canyon live oak are the main tree species on these soils. Among the trees of limited extent are Douglas-fir and California-laurel on the Mayacama soil. The harvesting of firewood on these soils generally is not practical because of the steepness of slope.

The Maymen soil is in capability subclass VIIe (15), nonirrigated; the Hopland soil is in capability subclass VIIe (5), nonirrigated; and the Mayacama soil is in capability subclass VIIs (5), nonirrigated.

175—Maymen-Millsholm-Bressa complex, 30 to 50 percent slopes. This map unit is on hills. Rock outcrop and stones 10 inches to 2 feet in diameter are on the upper part of south-facing slopes and on ridgetops. The vegetation is mainly brush and annual grasses on the Maymen soil and oaks and annual grasses on the Millsholm and Bressa soils. Elevation is 1,400 to 3,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 57 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 30 percent Maymen gravelly loam, 20 percent Millsholm loam, and 15 percent Bressa loam. The components of this unit are so intricately intermingled that it was not practical to map separately at the scale used.

Included in this unit are small areas of Etsel, Hopland, Snook, and Squawrock soils. Also included are small areas of soils that are similar to the Millsholm soil but are less than 10 inches deep or have more than 35 percent gravel. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

The Maymen soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is light yellowish brown gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam about 3 inches thick. The subsoil is pale brown clay loam about 8 inches thick. Fractured sandstone is at a depth of 11 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Bressa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is light brownish gray and

pale brown loam about 12 inches thick. The subsoil is light yellowish brown clay loam about 14 inches thick. Fractured sandstone is at a depth of 26 inches.

Permeability of the Bressa soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The natural vegetation on the Maymen soil is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

The production of forage is limited by a dense canopy cover in some areas and the restricted available water capacity and shallow depth of Millsholm soil. Where blue oak exists, forage production can be increased by managed harvesting of trees on slopes of less than 40 percent. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 13 to 36 cords of wood per acre have been measured on the Bressa soil.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly located salt and livestock watering facilities 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 potential of the unit to produce plants suitable for grazing. Among the common understory plants on the Millsholm and Bressa soils are soft chess, wild oat, and filaree.

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

176—Maywood Variant sandy loam. This very deep, well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and scattered oaks and willows. Elevation is 1,300 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is brown sandy loam 10 inches thick. The underlying material to a depth of 64 inches is stratified, light brownish gray and pale brown sandy loam and silt loam.

Included in this unit are small areas of Kelsey and Lupoyoma soils and Xerofluvents. Also included are small areas of soils, in areas adjacent to streams in Scott's Valley, that are similar to this Maywood Variant soil but are somewhat poorly drained. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Maywood Variant soil is moderate. Available water capacity is 5.5 to 8.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. This soil is subject to occasional flooding for periods of 2 to 7 days during prolonged, high-intensity storms.

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

If this unit is used for hay and pasture, the main limitation is the hazard of flooding. The risk of flooding can be reduced by the use of dikes and levees.

The main crops grown on this unit are pears, walnuts, and wine grapes. Irrigation commonly is used for the maximum production of these crops. The main limitation is the hazard of flooding. Capital improvements on this unit should be designed to withstand flooding.

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

177—Millsholm-Bressa loams, 30 to 50 percent slopes. This map unit is on hills. The vegetation is mainly annual grasses, oaks, and brush. Elevation is 1,200 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Millsholm loam and 35 percent Bressa 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, Mayacama, Maymen, Skyhigh, Snook, and Squawrock soils. Also included are soils that are similar to the Millsholm soil but have more than 35 percent coarse fragments. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 9 inches thick. The next layer is pale brown clay loam 6 inches thick. The subsoil is pale brown clay loam 3 inches thick. Fractured sandstone is at a depth of 18 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Bressa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is light brownish gray and pale brown loam 12 inches thick. The subsoil is light yellowish brown clay loam 14 inches thick. Fractured sandstone is at a depth of 26 inches.

Permeability of the Bressa soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective

rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It can be used for firewood production.

The production of forage is limited by a dense canopy cover in some areas and by the restricted available water capacity and shallow depth of the Millsholm soil. Where blue oak exists, forage production can be increased by managed harvesting of trees on slopes of less than 40 percent. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 13 to 36 cords of wood per acre have been measured on the Bressa soil. The Bressa soil responds well to fertilizing and rangeland seeding. The main limitations for seeding are steepness of slope and the woody canopy cover.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly located salt and livestock watering facilities 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 potential of the unit to produce plants suitable for grazing. Among the common understory plants are soft chess, wild oat, and filaree.

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

178—Millsholm-Bressa-Hopland association, 30 to 50 percent slopes. This map unit is on hills. The vegetation is mainly brush and annual grasses on the Millsholm and Bressa soils and hardwood trees and annual grasses on the Hopland soil. Elevation is 1,400 to 3,000 feet. The average annual precipitation is 30 to 40 inches. The average annual air temperature in areas of the Millsholm and Bressa soils is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days. The average annual air temperature in areas of the Hopland soil is 54 to 57 degrees F, and the average frost-free period is 155 to 190 days.

This unit is about 35 percent Millsholm loam, 20 percent Bressa loam, and 15 percent Hopland loam. The Hopland soil is on north- and east-facing slopes, and the Millsholm and Bressa soils are on south-facing slopes.

Included in this unit are small areas of Mayacama, Maymen, Pomo, Skyhigh, Snook, Speaker, and Squawrock soils. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 3 inches thick. The subsoil is pale brown clay loam 8 inches thick. Fractured sandstone is at a depth of 11 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Bressa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is light brownish gray and pale brown loam 12 inches thick. The subsoil is light yellowish brown clay loam 14 inches thick. Fractured sandstone is at a depth of 26 inches.

Permeability of the Bressa soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is brown loam 6 inches thick. The upper 9 inches of the subsoil is brown loam, and the lower 19 inches light brown clay loam. Sandstone is at a depth of 34 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for firewood production.

The production of forage is limited by the dense canopy cover in some areas and by restricted available water capacity and shallow depth of the Millsholm soil. The Hopland soil supports sparse stands of plants suitable for grazing. Where blue oak exists, forage production can be increased by managed harvesting of trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 13 to 36 cords of wood per acre have been measured on the Bressa soil, and volumes of 22 to 94 cords per acre are common on the Hopland soil. The Bressa soil responds well to fertilizing and rangeland seeding. The main limitations for seeding are steepness of slope and the woody canopy cover.

Slope limits access by livestock and results in overgrazing of the less sloping areas. 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 suitable for grazing. Among the common understory plants are soft chess, wild oat, and filaree on the Millsholm and Bressa soils and poison-oak and blue wildrye on the Hopland soil.

The Millsholm and Bressa soils are in capability subclass VIe (15), nonirrigated. The Hopland soil is in capability subclass VIe (5), nonirrigated.

179—Millsholm-Squawrock-Pomo complex, 30 to 50 percent slopes. This map unit is on hills and mountains. The Pomo soils are susceptible to slumping.

The vegetation is mainly annual grasses with scattered oaks and brush on the Millsholm and Squawrock soils and annual grasses on the Pomo soil. Elevation is 1,400 to 3,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 195 days.

This unit is about 30 percent Millsholm loam, 30 percent Squawrock gravelly loam, and 20 percent Pomo 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 Bressa, Hopland, Mayacama, Maymen, Skyhigh, and Yorkville soils and Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 3 inches thick. The subsoil is pale brown clay loam 8 inches thick. Hard, fractured sandstone is at a depth of 11 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is grayish brown gravelly loam 8 inches thick. The subsoil is light brownish gray very gravelly clay loam 29 inches thick. Sandstone is at a depth of 37 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Pomo soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown loam 11 inches thick. The subsoil is yellowish brown and dark yellowish brown gravelly loam 29 inches thick. The substratum is dark yellowish brown very gravelly clay loam 18 inches thick. Fractured, weathered sandstone is at a depth of 58 inches.

Permeability of the Pomo soil is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe. Slopes are unstable if disturbed.

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

The production of forage is limited by the restricted available water capacity of the Millsholm and Squawrock soils, by the dense canopy cover in some areas of the Millsholm soil, and by the susceptibility of the Pomo soil to compaction when wet. Where oaks are present on the Millsholm soil, forage production can be increased by managed harvesting of the trees. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. This unit responds well to seeding, fertilizing, and proper grazing use. The main limitations for seeding are steepness of slope and woody species on the Millsholm soil.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly located salt and livestock watering facilities promote uniform distribution of livestock grazing. Springs and seeps are common on this unit. They can be developed as watering facilities for wildlife and to achieve better livestock distribution. Livestock grazing should be managed to protect this 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 suitable for grazing. Among the common understory plants on the Millsholm soil are soft chess, filaree, and manzanita. The characteristic plant community on the Squawrock soil is mainly wild oat, soft chess, and filaree and it is wild oat, purple needlegrass, and filaree on the Pomo soil.

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

180—Mocho Variant loam. This very deep, well drained soil is on alluvial plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs with scattered oaks. Elevation is 1,000 to 1,600 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the upper part of the surface layer is brown loam 6 inches thick and the lower part is brown clay loam 10 inches thick. The underlying material to a depth of 40 inches is brown clay loam. Below this to a depth of 70 inches is stratified extremely gravelly sandy clay loam and sandy clay loam.

Included in this unit are small areas of Lupoyoma and Still soils and Xerofluvents. Also included are small areas of soils that are similar to this Mocho Variant soil but have a clay substratum between depths of 40 and 60 inches and have a perched water table in winter and spring. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Mocho Variant soil is moderately slow. Available water capacity is 8.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight.

This unit is used mainly for livestock grazing. It is also used for orchards, vineyards, hay and pasture, and homesite development.

The production of forage is limited by the susceptibility of the soil to compaction when wet. Grazing should be

delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. The soil responds well to fertilizing, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess, annual clover, and wild oat.

This unit is well suited to hay and pasture.

The main crops grown on this unit are walnuts, pears, and wine grapes. Irrigation commonly is used for maximum production of these crops.

If this unit is used for homesite development, the main limitation is the moderately slow permeability. Increasing the size of the septic tank absorption fields or using a specially designed sewage disposal system can help to compensate for the moderately slow permeability.

This map unit is in capability class I (14), irrigated, and capability unit IIIc-1 (14), nonirrigated.

181—Neice-Sobrante-Hambright complex, 15 to 30 percent slopes. This map unit is on hills. The vegetation is mainly oaks, brush, and annual grasses. Elevation is 1,500 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 195 days.

This unit is about 40 percent Neice gravelly loam, 15 percent Sobrante loam, and 15 percent Hambright 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 Millsholm soils. Also included are small areas of soils that are similar to the Neice soil but have less than 35 percent rock fragments in the subsoil or are less than 60 inches deep to bedrock and small areas of Hambright, Neice, and Sobrante soils that have slopes of more than 30 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Neice soil is very deep and well drained. It formed in material weathered from metavolcanic basalt. Typically, the surface layer is yellowish red gravelly loam 11 inches thick. The upper 9 inches of the subsoil is yellowish red gravelly clay loam, and the lower 50 inches is dark red very gravelly clay. In some areas the surface layer is clay loam.

Permeability of the Neice soil is moderately slow. Available water capacity is 5 to 6 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from metavolcanic basalt. Typically, the surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Basalt is at a depth of 38 inches. In some areas the surface layer is clay loam.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hambright soil is shallow and well drained. It formed in material weathered from metavolcanic basalt. Typically, the surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Basalt is at a depth of 16 inches. In some areas the surface layer is clay loam.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, firewood production, wildlife habitat, and watershed. It is also used for homesite development.

The production of forage is limited by a tendency of the soils to produce woody species and the restricted available water capacity of the Hambright soil. If trees and brush are managed to create open areas, this unit can produce a good stand of desirable grasses and forbs. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 9 cords of wood per acre have been measured on the Sobrante and Hambright soils. Among the common understory plants are blue oak, manzanita, and buckbrush on the Neice soil; soft chess, wild oat, and ripgut brome on the Sobrante soil; and soft chess, filaree, and manzanita on the Hambright soil.

If this unit is used for homesite development, the main limitations are steepness of slope and the hazard of erosion. Other limitations are the moderately slow permeability of the Neice soil and depth to bedrock in the Hambright and Sobrante soils. Extensive cutting and filling generally are required. Cuts needed to provide building sites on the Hambright and Sobrante soils can expose bedrock. The risk of erosion is increased if the soil is left exposed during construction. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. Shallow depth to bedrock in the Hambright soil is a major limitation for septic tank absorption fields. The limitations of depth to bedrock in the Sobrante soil and moderately slow permeability of the Neice soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system.

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

182—Neice-Sobrante-Hambright complex, 30 to 75 percent slopes. This map unit is on hills. The vegetation

is mainly oaks, brush, and annual grasses. Elevation is 1,500 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 195 days.

This unit is about 40 percent Neice gravelly loam, 15 percent Sobrante loam, and 15 percent Hambright 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 Millsholm soils and clayey soils that are moderately deep to serpentine. Also included are small areas of soils that are similar to the Neice soil but have less than 35 percent rock fragments or are less than 60 inches deep. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Neice soil is very deep and well drained. It formed in material weathered from metavolcanic basalt. Typically, the surface layer is yellowish red gravelly loam 11 inches thick. The upper 9 inches of the subsoil is yellowish red gravelly clay loam, and the lower 50 inches is dark red very gravelly clay. In some areas the surface layer is clay loam.

Permeability of the Neice soil is moderately slow. Available water capacity is 5 to 6 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from metavolcanic basalt. Typically, the surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Basalt is at a depth of 38 inches. In some areas the surface layer is clay loam.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Hambright soil is shallow and well drained. It formed in material weathered from metavolcanic basalt. Typically, the surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Basalt is at a depth of 16 inches. In some areas the surface layer is clay loam.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

This unit is poorly suited to livestock grazing. The production of forage is limited by steepness of slope, a tendency of the soils to produce woody species, and the restricted available water capacity of the Hambright soil. To control erosion and provide wildlife habitat, woody plants should be retained on this unit. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and proper placement of livestock watering facilities and salt promote good distribution of grazing. 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. Among the common understory plants are blue oak, manzanita, and buckbrush on the Neice soil; soft chess, wild oat, and ripgut brome on the Sobrante soil; and soft chess, filaree, and manzanita on the Hambright soil.

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

183—Neuns-Bamtush-Deadwood association, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and hardwoods on the Neuns and Bamtush soils and shrubs and hardwoods with scattered conifers on the Deadwood soil. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 47 to 53 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 35 percent Neuns gravelly loam, 25 percent Bamtush gravelly loam, and 20 percent Deadwood very gravelly sandy loam. The Neuns and Bamtush soils are on side slopes, toe slopes, and benches. The Deadwood soil is on ridges.

Included in this unit are small areas of Freezeout, Marpa, Sanhedrin, Shortyork Variant, and Yollabolly soils and Rock outcrop. Also included are small areas of soils that are similar to the Neuns soil but have less clay in the subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1.5 inches thick. The surface layer is brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured metamorphosed sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Bamtush soil is very deep and well drained. It formed in material weathered from sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly

loam 7 inches thick. The upper 10 inches of the subsoil is brown very gravelly loam, and the lower 46 inches is strong brown very gravelly loam.

Permeability of the Bamtush soil is moderate. Available water capacity is 5.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard, fractured sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, and California black oak are the main tree species on the Neuns and Bamtush soils. Canyon live oak and scattered Douglas-fir and ponderosa pine are the main tree species on the Deadwood soil. Among the trees of limited extent are sugar pine, Pacific madrone, and white fir. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 113 on the Neuns soil, 134 on the Bamtush soil, and 83 on the Deadwood soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil, 139 on the Bamtush soil, and 84 on the Deadwood soil. The potential annual production of ponderosa pine on the Neuns soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Bamtush soil is 830 board feet per acre from a fully stocked stand of trees. Estimates of the yield for the Deadwood soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber is steepness of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Revegetation of cut and fill slopes on this unit is difficult because of the large amount of rock fragments in the soil. Rock for construction of roads generally is available on this unit.

Seedling survival is a concern in the reforestation and production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially in areas of the Neuns and Deadwood soils on south- and southwest-facing slopes. Plantings on the Deadwood soil have a low chance of survival because of the restricted available water capacity. Reforestation of the Neuns and Bamtush soils can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers frequently occurs on the Neuns and Bamtush soils.

Among the common forest understory plants are serviceberry, gooseberry, brackenfern, and perennial fescue.

The Neuns and Bamtush soils are in capability subclass VIe (5), nonirrigated, and the Deadwood soil is in capability subclass VIIe (5), nonirrigated.

184—Neuns-Deadwood-Bamtush association, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and hardwoods on the Neuns and Bamtush soils and brush and hardwoods with scattered confiers on the Deadwood soil. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 47 to 53 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 35 percent Neuns gravelly loam, 25 percent Deadwood very gravelly sandy loam, and 20 percent Bamtush gravelly loam. The Neuns and Bamtush soils are on side slopes, toe slopes, and benches. The Deadwood soil is on ridgetops.

Included in this unit are small areas of Freezeout, Marpa, Shortyork Variant, and Yollabolly soils and Rock outcrop. Also included are small areas of soils that are similar to the Neuns soil but have less clay in the subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1.5 inches thick. The surface layer is brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured, metamorphosed sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard, fractured sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Bamtush soil is very deep and well drained. It formed in material weathered from sandstone throughout most of the survey area and from greenstone in the Snow Mountain area. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 7 inches thick. The upper 10 inches of the subsoil is brown very gravelly loam, and the lower 46 inches is strong brown very gravelly loam.

Permeability of the Bamtush soil is moderate. Available water capacity is 5.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, and California black oak are the main tree species on the Neuns and Bamtush soils. Canyon live oak and scattered Douglas-fir and ponderosa pine are the main tree species on the Deadwood soil. Among the trees of limited extent are sugar pine, white fir, and Pacific madrone. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 113 on the Neuns soil, 83 on the Deadwood soil, and 134 on the Bamtush soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil, 84 on the Deadwood soil, and 139 on the Bamtush soil. The potential annual production of ponderosa pine on the Neuns soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Bamtush soil is 830 board feet per acre from a fully stocked stand of trees. Estimates of the yield for the Deadwood soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber is steepness of slope. When harvesting timber, steepness of slope limits the use of wheeled and tracked equipment in skidding. Cable yarding systems generally disturb the soil less. Revegetation of cut and fill slopes is difficult on this unit because of the large amount of rock fragments in the soil. Rocks and loose soil material may slide down from roadcuts on this unit, increasing the need for road maintenance. Rock for construction of roads generally is available on this unit.

Seedling survival is a concern in the reforestation and production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially in areas of the Neuns and Deadwood soils on south- and southwest-facing slopes. Plantings on the Deadwood soil have a low chance of survival because of the restricted available water capacity. Movement of loose material on the surface can reduce the seedling survival rate in the steeper areas of this unit.

Reforestation of the Neuns and Bamtush soils can be accomplished by planting ponderosa pine and Douglas-fir seedlings. If seed trees are present, natural reforestation of cutover areas by conifers frequently occurs on the Neuns and Bamtush soils.

Among the common forest understory plants are brushy live oak, California nutmeg, and scattered annual forbs. Gooseberry and serviceberry are present on the Bamtush soil.

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

185—Neuns-Decy-Sanhedrin complex, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods with some shrubs. Elevation is 2,800 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 120 to 170 days.

This unit is about 35 percent Neuns gravelly loam, 30 percent Decy gravelly sandy loam, and 15 percent Sanhedrin gravelly loam. The Decy soil occurs at elevations of more than 3,500 feet. 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 Bamtush and Deadwood soils and Rock outcrop. Also included are small areas of Decy, Neuns, and Sanhedrin soils, on Boardman Ridge, that have slopes of 15 to 30 percent, soils that have slopes of more than 50 percent, soils that are similar to the Decy soil but have 20 to 40 percent cobbles in the profile, and soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 1.5 inches thick. The surface layer is light yellowish brown and brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Decy soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface layer is brown gravelly sandy loam 8 inches thick. The upper 7 inches of the subsoil is brown gravelly sandy loam, and the lower 9 inches is yellowish brown very gravelly sandy loam. Hard sandstone and shale are at a depth of 24 inches.

Permeability of the Decy soil is moderately rapid. Available water capacity is 1.5 to 4.0 inches. Effective

rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, live oak, and California black oak are the main tree species on the Neuns soil. On the basis of a 100-year site curve, the mean site index is 106 for ponderosa pine and 113 for Douglas-fir. The potential annual production of ponderosa pine is 425 board feet per acre from a fully stocked stand of trees.

Ponderosa pine, Douglas-fir, California black oak, and Pacific madrone are the main tree species on the Decy and Sanhedrin soils. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Decy soil and 116 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 101 on the Decy soil and 121 on the Sanhedrin soil. The potential annual production of ponderosa pine on the Decy soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are sugar pine, live oak, and white fir.

Some concerns for the harvesting of timber are steepness of slope and the hazard of erosion. Establishing plant cover on steep cut and fill slopes reduces erosion on the Sanhedrin soil. Revegetation of cut and fill slopes is difficult on the Neuns and Decy soils because of the high content of rock and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts on the Neuns and Decy soils and thus increase the need for maintenance on roads. Rock for construction of roads generally is available on this unit. Unless adequate plant cover or water bars are provided, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying on the Sanhedrin soil. Disturbance of the protective layer of duff can be reduced by the careful use of wheeled and track equipment or cable yarding systems.

Seedling establishment is a concern in the production of timber on the Neuns and Decy 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 in the reforestation of the Sanhedrin soil. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas-fir and ponderosa pine seedlings on this unit. If seed trees are present, natural reforestation by conifers frequently occurs on the Sanhedrin soil but is less reliable on the Neuns and Decy soils.

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

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

186—Neuns-Sanhedrin-Deadwood complex, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods with some shrubs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 110 to 170 days.

This unit is about 40 percent Neuns gravelly loam, 25 percent Sanhedrin gravelly loam, and 15 percent Deadwood 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 Bamtush, Marpa, Maymen, Shortyork Variant, and Speaker soils and Rock outcrop. Also included are small areas of Deadwood, Neuns, and Sanhedrin soils that have slopes of less than 30 percent and soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone and metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1.5 inches thick. The surface layer is light yellowish brown and brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil

is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface layer is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, and California black oak are the main tree species in areas where the Neuns soil is on north-facing slopes and at higher elevations. Canyon live oak and California nutmeg are dominant in hot, dry areas of the Neuns soil. On the basis of a 100-year site curve, the mean site index is 113 for Douglas-fir and 106 for ponderosa pine. The potential annual production of ponderosa pine is 425 board feet per acre from a fully stocked stand of trees. Low stocking of the main commercial species generally reduces the yield substantially in the hotter areas.

Douglas-fir, ponderosa pine, sugar pine, and California black oak are the main tree species on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index is 121 for Douglas-fir and 116 for ponderosa pine. The potential annual production of ponderosa pine is 530 board feet per acre from a fully stocked stand of trees.

Canyon live oak is the main tree species on the Deadwood soil. Among the trees of limited extent are ponderosa pine, Douglas-fir, and sugar pine. On the basis of a 100-year site curve, the mean site index is 84 for ponderosa pine. Estimates of the potential annual production on the Deadwood soil have not been made because the conifers commonly are widely scattered.

A concern for the harvesting of timber is steepness of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Rock for construction of roads is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Sanhedrin soil. Revegetation of cut and fill slopes is difficult on the Neuns and Deadwood soils because of the high content of rock fragments and restricted available water capacity. Rocks and loose soil material may slide down roadcuts on the Neuns and Deadwood soils and thus increase the need for road maintenance.

Seedling survival is a concern in the production of timber on the Neuns and Deadwood soils. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Natural reforestation of cutover areas by Douglas-fir occurs infrequently. Proper site preparation on the Neuns soil is neccessary to replace stands of brush and hardwoods with conifers. Reforestation of the Neuns soil can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. Planting on the Deadwood soil is not practical because of the high content of rocks and the shallow depth of the soil.

Plant competition is a concern in the production of timber on the Sanhedrin soil. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas-fir frequently occurs.

Among the common forest understory plants are wild pea, nutmeg, California fescue, and manzanita.

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

187—Neuns-Sanhedrin-Deadwood complex, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods with some shrubs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 110 to 170 days.

This unit is about 40 percent Neuns gravelly loam, 20 percent Sanhedrin gravelly loam, and 20 percent Deadwood 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 Bamtush, Marpa, Maymen, Shortyork Variant, and Speaker soils and Rock outcrop. Also included are small areas of soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone and metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1.5 inches thick. The surface layer is light yellowish brown and brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish

yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper part of the subsoil is light yellowish brown very gravelly sandy loam 5 inches thick, and the lower part is brownish yellow extremely gravelly sandy loam 4 inches thick. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, and California black oak are the main tree species in areas of the Neuns soil on north-facing slopes and at higher elevations. Canyon live oak and California nutmeg are dominant in hot, dry areas of the Neuns soil. On the basis of a 100-year site curve, the mean site index is 113 for Douglas-fir and 106 for ponderosa pine. The potential annual production of ponderosa pine is 425 board feet per acre from a fully stocked stand of trees. Low stocking of the main commercial species generally reduces the yield substantially in the hotter areas.

Douglas-fir, ponderosa pine, sugar pine, and California black oak are the main tree species on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index is 121 for Douglas-fir and 116 for ponderosa pine. The potential annual production of ponderosa pine is 530 board feet per acre from a fully stocked stand of trees.

Canyon live oak is the main tree species on the Deadwood soil. Among the trees of limited extent are ponderosa pine, Douglas-fir, and sugar pine. On the basis of a 100-year site curve, the mean site index is 84 for ponderosa pine. Estimates of the potential annual production on the Deadwood soil have not been made because the conifers commonly are widely scattered.

A concern 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. Establishing plant cover on steep cut and fill slopes reduces erosion on the Sanhedrin soil. Revegetation of cut and fill slopes is difficult on the Neuns and Deadwood soils because of the high content of rock and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts on the Neuns and Deadwood soils and thus increase the need for road maintenance. Rock for construction of roads generally is available on this unit.

Seedling survival is a concern in the production of timber on the Neuns and Deadwood soils. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Movement of loose material on the surface can reduce seedling survival in the steeper areas of the Neuns and Deadwood soils. Natural reforestation of cutover areas by Douglas-fir occurs infrequently on the Deadwood and Neuns soils. Proper site preparation and planting may make it possible to replace stands of brush and hardwoods with conifers. Reforestation of the Neuns soil can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. Planting on the Deadwood soil is not practical because of the high content of rock and the shallow depth of the soil.

Plant competition is a concern in the production of timber on the Sanhedrin soil. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas-fir and ponderosa pine frequently occurs.

Among the common forest understory plants are wild pea, nutmeg, California fescue, and manzanita.

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

188—Neuns-Sanhedrin-Speaker gravelly loams, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 35 percent Neuns gravelly loam, 30 percent Sanhedrin 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 Deadwood, Kekawaka, and Maymen soils. Also included are Neuns, Sanhedrin, and Speaker soils that have slopes of less than 30 percent and small areas of soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 1.5 inches thick. The surface layer is light yellowish brown and brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, California black oak, and canyon live oak are the main tree species on the Neuns soil. On the basis of a 100-year site curve, the mean site index is 106 for ponderosa pine and 113 for Douglas-fir. The potential annual production of ponderosa pine is 425 board feet per acre from a fully stocked stand of trees.

Ponderosa pine, Douglas-fir, California black oak, and Pacific madrone are the main tree species on the Sanhedrin and Speaker soils. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 116 on the Sanhedrin soil and 106 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 121 on the Sanhedrin soil and 107 on the Speaker soil. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees.

Some concerns for the harvesting of timber are steepness of slope, seasonal soil wetness, and the hazard of erosion. 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 harvesting systems. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads generally is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Sanhedrin and Speaker soils. Revegetation of cut and fill slopes is difficult on the Neuns soil because of the high content of rock fragments and restricted available water capacity. Rock and loose soil material may slide down roadcuts on the Neuns soil, increasing the need for maintenance.

Seedling establishment is a concern in the production of timber on the Neuns soil. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Reforestation can be accomplished by planting Douglas-fir seedlings on cool aspects and ponderosa pine in other areas. On the Sanhedrin and Speaker soils, plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can delay the establishment of seedlings. Reforestation of the Sanhedrin and Speaker soils can be accomplished by planting Douglas-fir and ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by Douglas-fir frequently occurs on this unit.

Among the common forest understory plants are wild pea, mountain brome, California fescue, and manzanita.

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

189—Neuns-Sheetiron-Deadwood complex, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers, hardwoods, and shrubs. Elevation is 3,200 to 5,000 feet. The average

annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 53 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 30 percent Neuns gravelly loam, 25 percent Sheetiron gravelly sandy loam, and 15 percent Deadwood 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 Bamtush, Freezeout, Marpa, Shortyork Variant, and Yollabolly soils and Rock outcrop. Also included are small areas of Deadwood, Sheetiron, and Neuns soils that have slopes of less than 30 percent and soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone and metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 1.5 inches thick. The surface layer is brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sheetiron soil is moderately deep and well drained. It formed in material weathered from mica-quartz schist. The surface layer is brown gravelly sandy loam 3 inches thick over pale brown very gravelly sandy loam 5 inches thick. The upper 9 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 12 inches is very pale brown extremely gravelly sandy loam. Fractured mica-quartz schist is at a depth of 29 inches.

Permeability of the Sheetiron soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, interior live oak, and California black oak are the main tree species on this unit. Interior live oak is the dominant tree on the Deadwood soil. Among the trees of limited extent are incense-cedar, white fir, and sugar pine. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil, 105 on the Sheetiron soil, and 84 on the Deadwood soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 113 on the Neuns soil, 105 on the Sheetiron soil, and 83 on the Deadwood soil. The potential annual production from a fully stocked stand of ponderosa pine is 425 board feet per acre on the Neuns soil and 415 board feet per acre on the Sheetiron soil. Estimates of the potential annual production on the Deadwood soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber on this unit is steepness of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Revegetation of cut and fill slopes is difficult on this unit because of the high content of rock fragments in the soils and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts in this unit, necessitating increased maintenance on roads. Rock for construction of roads is available, but it is frequently of low quality. The Sheetiron soil is dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Even when seed trees are present, natural reforestation of cutover areas by Douglas-fir, ponderosa pine, white fir, and incense-cedar occurs infrequently on this unit. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir. Planting on the Deadwood soil is not practical because of the high content of rock and restricted available water capacity of the soil.

Among the common forest understory plants are bedstraw, perennial fescue, poison-oak, and nutmeg.

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

190—Neuns-Sheetiron-Deadwood complex, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers, hardwoods, and some shrubs. Elevation is 3,200 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 47 to 53 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 30 percent Neuns gravelly loam, 20 percent Sheetiron gravelly sandy loam, and 20 percent Deadwood 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 areas of Bamtush, Freezeout, Marpa, and Yollabolly soils and Rock outcrop. Also included are small areas of Neuns soils that have slopes of more than 75 percent, soils that are similar to the Deadwood and Sheetiron soils but have slopes of more than 75 percent, and soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone and metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 1.5 inches thick. The surface layer is brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Sheetiron soil is moderately deep and well drained. It formed in material weathered from mica-quartz schist. The surface layer is brown gravelly sandy loam 3 inches thick over pale brown very gravelly sandy loam 5 inches thick. The upper 9 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 12 inches is very pale brown extremely gravelly sandy loam. Fractured mica-quartz schist is at a depth of 29 inches.

Permeability of the Sheetiron soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, interior live oak, and California black oak are the main tree species on this unit. Interior live oak is the dominant tree on the Deadwood soil. Among the trees of limited extent are incense-cedar, white fir, and sugar pine. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil, 105 on the Sheetiron soil, and 84 on the Deadwood soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 113 on the Neuns soil, 105 on the Sheetiron soil, and 83 on the Deadwood soil. The potential annual production from a fully stocked stand of ponderosa pine is 425 board feet per acre on the Neuns soil and 415 board feet per acre on the Sheetiron soil. Estimates of the potential annual production on the Deadwood soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber is steepness of slope. Cable yarding systems generally are used on this unit. Revegetation of cut and fill slopes is difficult on this unit because of the high amount of rocks in the soil and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts on this unit and thus increase the need for maintenance on roads. Rock for construction of roads is available on this unit but generally is of poor quality. The Sheetiron soil is dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Movement of loose surface material can reduce seedling survival on the steeper slopes. Even with seed trees present, natural reforestation of cutover areas by Douglas-fir, ponderosa pine, white fir, and incense-cedar occurs infrequently on the soils in this unit. Reforestation can be accomplished by planting ponderosa pine and Douglas-fir seedlings. Planting on the Deadwood soil is not practical because of the high content of rock fragments and the restricted available water capacity of the soil.

Among the common forest understory plants are bedstraw, perennial fescue, poison-oak, and nutmeg.

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

191—Neuns-Speaker gravelly loams, 15 to 30 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods and some brush. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 35 percent Neuns gravelly loam and 30 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 Deadwood, Marpa, Maymen, and Sanhedrin soils and Rock outcrop. Also included are small areas of soils that are similar to the Speaker soil but do not have an argillic horizon and soils that are similar to the Neuns soil but have more clay in the subsoil. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 1.5 inches thick. The surface layer is brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

Douglas-fir and ponderosa pine 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 113 on the Neuns soil and 107 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Neuns soil and 106 on the Speaker soil. The potential annual production of ponderosa pine on the Neuns and Speaker soils is 425 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are white fir, sugar pine, California black oak, and Oregon white oak.

A concern for the harvesting of timber is seasonal wetness on the Speaker soil. 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 on the Speaker soil are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads generally is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Speaker soil. Revegetation of cut and fill slopes is difficult on the Neuns soil because of the high content of rock fragments and restricted available water capacity.

Seedling survival is a concern in the production of timber. The droughtiness of the surface layer reduces the survival rate of seedlings, especially in areas of the Neuns soil on south- and southwest-facing slopes. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings on the Speaker soil. 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 seedlings on the hotter aspects and Douglas-fir on the cooler, north aspects. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir occurs periodically.

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

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

192—Okiota-Henneke complex, 5 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush with an understory of sparse annual grasses. Elevation is 1,100 to 3,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 45 percent Okiota very gravelly clay loam and 35 percent Henneke 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 soils in swales. Also included are small areas of Okiota and Henneke soils that have slopes of less than 5 percent or more than 30 percent, soils that are similar to the Okiota and Henneke soils but are 20 to 40 inches deep to bedrock, and eroded soils that are less than 10 inches deep. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Okiota soil is shallow and well drained. It formed in material weathered from serpentinitic rock. Typically, 35 percent of the surface is covered with rock fragments, of which 5 percent is cobbles and 30 percent is pebbles. The upper part of the surface layer is dark reddish brown very gravelly clay loam 1 inch thick, and the lower part is reddish brown clay loam 2 inches thick. The subsoil is dark reddish brown clay 11 inches thick. Hard, fractured serpentinite is at a depth of 14 inches. In some areas the surface layer is gravelly clay loam or clay loam. In a few areas 15 to 30 percent of the surface is covered with cobbles and stones.

Permeability of the Okiota soil is slow. Available water capacity is 1.5 to 3.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate. Calcium to magnesium ratio is less than 1. The shrink-swell potential is high.

The Henneke soil is shallow and somewhat excessively drained. It formed in material weathered from serpentinitic rock. Typically, the surface has a pavement that is 15 percent cobbles and stones and 40 percent pebbles. The surface layer is reddish brown gravelly loam 3 inches thick. The upper 8 inches of the subsoil is reddish brown gravelly clay loam, and the lower 8 inches

is dark reddish brown very gravelly clay. Hard, fractured serpentinite is at a depth of 19 inches. In some areas the surface layer is very cobbly clay loam.

Permeability of the Henneke soil is moderately slow. Available water capacity is 1 inch to 2 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate. Calcium to magnesium ratio is less than 1.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush because of the limited soil depth, restricted available water capacity, nutrient imbalances, and climate. The vegetation in most areas is mainly chamise, manzanita, and scrub oak. Properly planned and prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

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

193—Okiota-Henneke-Dubakella association, 15 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush on the Okiota and Henneke soils and brush with a few scattered conifers on the Dubakella soil. Rock outcroppings and stones 6 inches to 25 feet in diameter occur randomly throughout the unit. Elevation is 1,100 to 3,500 feet. The average annual precipitation is 25 to 45 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 30 percent Okiota very gravelly clay loam, 25 percent Henneke gravelly loam, and 25 percent Dubakella very gravelly loam. The Dubakella soil is on north-facing slopes, and the Okiota and Henneke soils are on south-facing slopes. Areas of this map unit near Mount St. Helens are dominated by the Dubakella soil. Other areas, especially in the eastern part of the county, are dominated by the Okiota and Henneke soils, with only small areas of the Dubakella soil.

Included in this unit are small areas of Etsel, Mayacama, Maymen, and Montara soils. Also included are small areas of colluvial slopes composed mainly of cobbles, stones, and boulders, Dubakella and Henneke soils and soils that are similar to the Okiota soil but are at elevations of more than 3,500 feet, soils that are similar to the Dubakella soil but are eroded, and Dubakella soils that are in areas that have a warmer average annual temperature. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Okiota soil is shallow and well drained. It formed in material weathered from serpentinitic rock. Typically, there is a surface pavement consisting of 15 percent cobbles and 30 percent pebbles. The upper part of the surface layer is reddish brown very gravelly clay loam 1 inch thick and the lower part is reddish brown clay loam 2 inches thick. The subsoil to a depth of 14 inches is dark reddish brown clay. Hard, fractured serpentinite is at a depth of 14 inches. In some areas the surface layer has been lost through erosion, and the clay subsoil is exposed.

Permeability of the Okiota soil is slow. Available water capacity is 1.5 to 3.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate. Calcium to magnesium ratio is less than 1. The shrink-swell potential is high.

The Henneke soil is shallow and somewhat excessively drained. It formed in material weathered from serpentinitic rock. Typically, there is a surface pavement consisting of about 35 percent stones, cobbles, and pebbles. The surface layer is reddish brown gravelly loam 3 inches thick. The upper 8 inches of the subsoil is reddish brown gravelly clay loam, and the lower 8 inches is dark reddish brown and reddish brown very gravelly clay. Fractured serpentinite is at a depth of 19 inches.

Permeability of the Henneke soil is moderately slow. Available water capacity is 1 inch to 2 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe. Calcium to magnesium ratio is less than 1.

The Dubakella soil is moderately deep and well drained. It formed in material weathered from serpentinite and peridotite. Typically, the surface layer is dark reddish brown very gravelly loam 7 inches thick. The upper 6 inches of the subsoil is reddish brown very gravelly clay loam, and the lower 17 inches is reddish brown very gravelly clay loam. Fractured serpentinite is at a depth of 30 inches.

Permeability of the Dubakella soil is slow. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe. Calcium to magnesium ratio is less than 1:1.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush because of limited soil depth, restricted available water capacity, nutrient imbalances, and climate. The vegetation in most areas is mainly chamise, manzanita, and scrub oak. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

The Okiota soil is in capability subclass VIIe (15), nonirrigated; the Henneke soil is in capability subclass VIIs (15), nonirrigated; and the Dubakella soil is in capability subclass VIIs (5), nonirrigated.

194—Oxalis Variant silt loam. This very deep, poorly drained soil is on alluvial plains. It formed in alluvium derived dominantly from volcanic rock. Slope is 0 to 2 percent. The vegetation is mainly annual grasses and forbs. Elevation is 1,300 to 2,600 feet. The average

annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is light brownish gray and gray silt loam 8 inches thick. The subsoil is light gray silty clay loam 9 inches thick. Below this is a buried surface layer of gray silty clay 6 inches thick. The next layer is a buried subsoil of light gray silty clay 47 inches thick. The substratum to a depth of 84 inches or more is white silt loam.

Included in this unit are small areas of Asbill soils and soils that are similar to this Oxalis Variant soil but are well drained because of the deep entrenchment of gullies or are redder in color. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Oxalis Variant soil is slow. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of erosion is slight. The shrink-swell potential is high in the subsoil.

This unit is used mainly for livestock grazing.

The production of forage is limited by the susceptibility of the soil in this unit to compaction when it is moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. The soil responds well to fertilizing, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess and other annual grasses.

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

195—Phipps complex, 5 to 15 percent slopes. This map unit is on uplifted and dissected hills. These soils are susceptible to slumping and gullying. The vegetation is mainly annual grasses, oaks, and brush. Elevation is 1,400 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 40 percent Phipps clay loam and 40 percent Phipps 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 Forbesville soils, Phipps soils that have slopes of more than 15 percent, and soils that are similar to these Phipps soils but have a gravelly surface layer. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Phipps clay loam is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is pale brown clay loam about 7 inches thick. The upper 11 inches of the subsoil is pale brown and light yellowish brown clay loam, and the lower 24 inches is light yellowish brown clay. The substratum to a depth of 60 inches or more is light yellowish brown clay loam.

Permeability of the Phipps clay loam is slow. Available water capacity is 8 to 12 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential is high.

The Phipps loam is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is brown loam 6 inches thick. The subsoil is brown gravelly clay loam about 15 inches thick. The substratum to a depth of 73 inches is brown and yellowish brown gravelly and very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability of the Phipps loam is slow. Available water capacity is 6.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate. The shrink-swell potential is high.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover in some areas. Where oaks are present, forage production can be increased by managing the harvesting of trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 5 to 15 cords of wood per acre have been measured on the Phipps soils. This unit reponds well to fertilizing, rangeland seeding, and proper grazing use. The main limitation for seeding is the woody canopy cover. Among the common understory plants are wild oat, soft chess, and filaree.

If this unit is used for homesite development, the main limitations are slow permeability, high shrink-swell potential, and low load bearing capacity. If the unit is used for septic tank absorption fields, the limitation of slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed septic system. The shrink-swell potential and low load bearing capacity of the Phipps clay loam should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the Phipps clay loam is used as a base for roads or streets, it can be mixed with sand and gravel to increase its strength and stability.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

196—Phipps complex, 15 to 30 percent slopes. This map unit is on uplifted, dissected hills. These soils are susceptible to slumping and gullying. The vegetation is mainly oak and annual grasses. Elevation is 1,100 to

2,000 feet. The average annual precipitation is about 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is about 160 to 200 days.

This unit is about 60 percent Phipps clay loam, loamy substratum, and 15 percent Phipps 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 Bally and Forbesville soils. Also included are small areas of olive gray clayey soils that form deep, wide cracks when dry and are 20 to 40 inches deep over unconsolidated sediment; soils on north-facing slopes that are similar to these Phipps soils but are cooler; highly eroded or gullied soils in steep ravines; and soils that are similar to these Phipps soils but have a thick, dark-colored surface layer, have more clay throughout the profile, or have less clay in the subsoil. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Phipps clay loam is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is pale brown clay loam about 7 inches thick. The upper 11 inches of subsoil is pale brown and light yellowish brown clay loam, and the lower 24 inches of the subsoil is yellowish brown clay. The substratum to a depth of 60 inches or more is light yellowish brown clay loam.

Permeability of this Phipps soil is slow. Available water capacity is 8 to 12 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high in the subsoil.

The Phipps loam is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is brown loam about 6 inches thick. The subsoil is brown gravelly clay loam about 15 inches thick. The substratum to a depth of 73 inches is brown and yellowish brown gravelly and very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability of this Phipps soil is slow. Available water capacity is 6.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

This unit is used mainly for livestock grazing, firewood production, wildlife habitat, and watershed.

The production of forage is limited by a dense canopy cover in some areas. Where oaks are present, forage production can be increased by managed harvesting of trees. Vegetation in the drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 5 to 15 cords of wood per acre have been measured on the Phipps soils. This unit responds well to fertilizing, rangeland seeding, and proper grazing use. The main limitation for seeding is the woody canopy cover. Among the common understory plants are wild oat, soft chess, and filaree.

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

197—Phipps complex, 30 to 50 percent slopes. This map unit is on uplifted, dissected hills. These soils are susceptible to slumping and gullying. The vegetation is mainly oak and annual grasses. Elevation is 1,100 to 2,000 feet. The average annual precipitation is about 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is about 160 to 200 days.

This unit is about 50 percent Phipps clay loam, loamy substratum, and 15 percent Phipps 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 Bally and Forbesville soils. Also included are small areas of olive gray clayey soils that form deep, wide cracks when dry and are 20 to 40 inches deep over unconsolidated sediment; highly eroded or gullied soils in steep ravines; soils on north-facing slopes that are similar to these Phipps soils but are cooler or have slopes of 50 to 75 percent; and soils that are similar to these Phipps soils but have a thick, dark-colored surface layer, have more clay throughout the profile, or have less clay in the subsoil. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

The Phipps clay loam is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is pale brown clay loam about 7 inches thick. The upper 11 inches of the subsoil is pale brown and light yellowish brown clay loam, and the lower 24 inches is yellowish brown clay. The substratum to a depth of 60 inches or more is light yellowish brown clay loam.

Permeability of this Phipps soil is slow. Available water capacity is 8 to 12 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high in the subsoil.

The Phipps loam is very deep and well drained. It formed in alluvium derived from mixed rock sources. Typically, the surface layer is brown loam about 6 inches thick. The subsoil is brown gravelly clay loam about 15 inches thick. The substratum to a depth of 73 inches is brown and yellowish brown gravelly and very gravelly sandy clay loam. In some areas the surface layer is sandy clay loam.

Permeability of this Phipps soil is slow. Available water capacity is 6.0 to 7.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

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

The production of forage is limited by a dense canopy cover in some areas and steepness of slope. Because of the instability of the soils, trees should be retained on this unit. This unit responds well to fertilizing, rangeland seeding, and proper grazing use. The main limitations for seeding are steepness of slope and the woody canopy cover. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities 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 potential of the unit to produce plants suitable for grazing. Among the common understory plants are wild oat, soft chess, and filaree.

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

198—Pomo-Bressa loams, 15 to 50 percent slopes. This map unit is on hills. The Pomo soils are susceptible to slumping. The vegetation is mainly annual grasses and forbs and scattered stands of oak. Elevation is 1,400 to 3,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 60 percent Pomo loam and 15 percent Bressa loam. The components of this unit are so intricately intermingled that is was not practical to map them separately at the scale used.

Included in this unit are small areas of Marpa, Millsholm, and Yorkville soils. Also included are small areas of Bressa soils, soils that are similar to the Pomo soil but have slopes of less than 15 percent, and soils that are similar to the Bressa and Pomo soils but are at elevations of more than 3,000 feet. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Pomo soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is yellowish brown loam 11 inches thick. The subsoil is yellowish brown and dark yellowish brown gravelly loam 29 inches thick. The substratum is dark yellowish brown very gravelly clay loam 18 inches thick. Fractured, weathered sandstone is at a depth of 58 inches.

Permeability of the Pomo soil is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Bressa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is light brownish gray and pale brown loam 12 inches thick. The subsoil is light yellowish brown clay loam 14 inches thick. Fractured sandstone is at a depth of 26 inches.

Permeability of the Bressa soil is moderately slow. Available water capacity is 3.0 to 7.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for firewood production.

The production of forage is limited on the Pomo soil by the susceptibility to compaction when wet and on the Bressa soil by a dense canopy cover in some areas. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. Where oaks are present and slopes are less than 40 percent, forage production can be increased by managing the harvesting of trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 13 to 36 cords of wood per acre have been measured on this unit. This unit responds well to fertilizing, rangeland seeding, and 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 uniform distribution of livestock grazing. Springs and seeps are common on this unit. They can be developed as watering facilities for wildlife and to achieve better livestock distribution. 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 suitable for grazing. The characteristic plant community on the Pomo soil is mainly soft chess, purple needlegrass, and filaree. Among the common understory plants on the Bressa soil are wild oat, soft chess, and blue wildrye.

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

199—Riverwash. This map unit is in active stream channels. Slope is 0 to 5 percent. The vegetation is mainly very sparse annual grasses and forbs and some brush, commonly on banks or sand bars. Elevation is 620 to 2,000 feet. This unit is inundated during periods of waterflow and is subject to constant deposition and removal of material.

Riverwash consists of erratically stratified layers of water deposited sand, gravel, and cobbles. Layers of sandy loam and loamy sand are deposited for short periods but are subject to intermittent scouring and removal. Thickness of the layers varies from 2 to 40 inches. Reaction is neutral or mildly alkaline.

Runoff is very slow to rapid, and the hazard of erosion is slight to very severe, depending on water velocity.

Riverwash is used mainly as wildlife habitat and as a source of sand and gravel. Because it is nearly devoid of vegetation, it is not used for agriculture.

The removal of aggregates can lower the level of the streambeds and widen stream channels. This can undermine structures, lower the water table adjacent to the stream channel, and erode streambanks, thereby increasing sedimentation downstream. Streambanks can be protected against water erosion by use of a suitable structure, riprap, or vegetation. Check dams or buried sills can be used to control the lowering of streambeds. Shallow recharge ponds can be located in areas of adjacent soils to minimize the effects of a lowering ground water table.

This map unit is in capability class VIII (14), nonirrigated.

200—Rock outcrop-Etsel-Snook complex, 50 to 80 percent slopes. This map unit is on hills and mountains. The vegetation is mainly brush and sparse annual grasses. Elevation is 1,400 to 4,000 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 56 to 57 degrees F, and the average frost-free period is 135 to 190 days.

This unit is about 60 percent Rock outcrop, 15 percent Etsel gravelly loam, and 15 percent Snook loam. Areas of the Snook soil at elevations of more than 3,500 feet are on south-facing 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 Mayacama, Maymen, and Neuns soils. Also included are small areas of Etsel soils that have slopes of less than 50 percent or are neutral in reaction and small areas of soils that are at an elevation of more than 4,000 feet. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Rock outcrop consists of exposed areas of hard, unweathered sandstone. It occurs on ridgetops and side slopes as intruding bedrock or as detached masses of rock. Outcroppings are 100 feet in diameter to 5 acres in diameter.

The Etsel soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the soil is light yellowish brown gravelly loam 3 inches thick over light yellowish brown very gravelly loam 5 inches thick. Sandstone is at a depth of 8 inches.

Permeability of the Etsel soil is moderate. Available water capacity is 0.5 inch to 1.5 inches. Effective rooting depth is 6 to 12 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Snook soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone or shale. Typically, the soil is light yellowish brown loam 5 inches thick. Fractured sandstone is at a depth of 5 inches.

Permeability of the Snook soil is moderate. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 4 to 10 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed.

The natural vegetation on this unit is mainly brush. Because of the instability of the Etsel soil, vegetation should be retained for erosion control and to provide wildlife habitat.

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

201—Sanhedrin-Kekawaka-Speaker complex, 15 to 30 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 2,200 to 4,800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 49 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 35 percent Sanhedrin gravelly loam, 30 percent Kekawaka 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 Bamtush and Marpa soils and small areas of Kekawaka, Sanhedrin, and Speaker soils that have slopes of more than 30 percent. Also included, on Long Ridge in the Mendocino National Forest, are areas of Sanhedrin and Kekawaka soils that are severely eroded; small areas of soils that are similar to the Sanhedrin soil but are more than 60 inches deep; and small areas of soils that are similar to the Speaker soil but have a clay subsoil. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Kekawaka soil is very deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface is covered with a mat of partially decomposed needles, leaves, bark, and twigs 3 inches thick. The surface layer is yellowish brown loam 2 inches thick over light yellowish brown loam 7 inches thick. The upper 19 inches of the subsoil is strong brown and

reddish yellow clay loam, the next 14 inches is reddish yellow and strong brown clay, and the lower 26 inches is reddish yellow gravelly clay.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir, sugar pine, 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 121 on the Sanhedrin soil, 154 on the Kekawaka soil, and 107 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 116 on the Sanhedrin soil, 147 on the Kekawaka soil, and 106 on the Speaker soil. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Kekawaka soil is 945 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. In many areas, the Kekawaka soil has a rather abrupt boundary between the surface layer and the clay subsoil. In those areas, productivity is much lower; the average site index is 106 for Douglas-fir and 113 for ponderosa pine.

A concern 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. They may be impassable during rainy periods. Roads are dusty when dry. If the road is to be used heavily, the surface should be treated. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on this unit.

Plant competition is a concern in the reforestation and production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of seedlings. Reforestation can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers frequently occurs.

Among the common forest understory plants are bedstraw, rose, manzanita, and annual forbs.

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

202—Sanhedrin-Kekawaka-Speaker complex, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 2,200 to 4,800 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 49 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 35 percent Sanhedrin gravelly loam, 30 percent Kekawaka 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 Bamtush, Marpa, and Maymen soils. The Maymen soil is on some south-facing, brush-covered slopes. Also included are small areas of Kekawaka, Sanhedrin, and Speaker soils that have slopes of less than 30 percent; soils that are similar to the Speaker soil but have a clay subsoil; soils that are similar to the Sanhedrin soil but are 60 to 80 inches deep; and on Long Ridge in the Mendocino National Forest, Sanhedrin and Kekawaka soils that are severely eroded. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Kekawaka soil is very deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 2 inches thick. The surface layer is yellowish brown loam 2 inches thick over light yellowish brown loam 7 inches thick. The upper 19 inches of the subsoil is strong brown and reddish yellow clay loam, the next 14 inches is reddish yellow and strong brown clay, and the lower 26 inches is reddish yellow gravelly clay.

Permeability of the Kekawaka soil is moderately slow. Available water capacity is 8 to 10 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed conifer needles, leaves, twigs, and bark 1 inch thick. The surface layer is brown gravelly loam about 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, sugar 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 121 on the Sanhedrin soil, 154 on the Kekawaka soil, and 107 on the Speaker soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 116 on the Sanhedrin soil, 147 on the Kekawaka soil, and 106 on the Speaker soil. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Kekawaka soil is 945 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. In some areas, the Kekawaka soil has a rather abrupt boundary between the surface layer and the clay subsoil. In those areas, productivity is much lower; the average site index is 106 for Douglas-fir and 113 for ponderosa pine. Among the trees of limited extent are canyon live oak, Oregon white oak, and white fir.

Some concerns for the harvesting of timber are steepness of slope, the hazard of erosion, and seasonal wetness. The Kekawaka soil has a tendency to slump in some areas; however, this is not a consistent trait. It happens more frequently where there is an abrupt boundary between the surface layer and the clay subsoil. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and can damage the tree roots. 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 harvesting systems. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Roads on this unit are dusty when dry. If the road is to be used heavily, its surface should be treated. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on this unit.

Plant competition is a concern in the reforestation and production of timber on this unit. When openings are made in the canopy, invading brushy plants that are not controlled can prevent the establishment of conifer seedlings. Reforestation can be accomplished by planting Douglas-fir, ponderosa pine, and sugar pine seedlings. If seed trees are present, natural reforestation of cutover areas by conifers frequently occurs.

Among the common forest understory plants are bedstraw, wild rose, manzanita, and annual forbs.

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

203—San Joaquin Variant fine sandy loam, 0 to 5 percent slopes. This moderately deep, well drained soil is on alluvial plains and stream terraces. It formed in alluvium derived dominantly from volcanic rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 1,300 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 155 to 205 days.

Typically, the surface layer is light gray fine sandy loam 21 inches thick. The subsoil is light brownish gray clay loam 4 inches thick. The next layer is a silica-cemented hardpan 5 inches thick. The upper 21 inches of the substratum is pale brown sandy loam, and the lower part to a depth of 65 inches is pale brown fine sandy loam. In some areas the surface layer is loam or silty clay loam. Depth to the hardpan is 20 to 40 inches. The hardpan commonly is 3 to 8 inches thick.

Included in this unit are small areas of Wolfcreek soils. Also included are small areas of a yellower soil with hard, brittle calcium carbonate concretions that is saturated with water for long periods of time and small areas of soils that are similar to this San Joaquin Variant soil but are calcareous throughout. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the San Joaquin Variant soil is very slow. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very slow, and the hazard of erosion is slight.

This unit is used mainly for hay and pasture and homesite development.

If this unit is used for hay and pasture, the main limitations are the hardpan, which restricts rooting depth, and restricted available water capacity. Ripping and shattering the hardpan increases the effective rooting depth. Frequent applications of irrigation water are needed because of the restricted available water capacity.

If this unit is used for homesite development, the main limitations are the hardpan and slow permeability. The hardpan is rippable and therefore is not a serious limitation for most engineering uses. Suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability. Increasing the size of the absorption field or using a specially designed disposal system can help to compensate for the slow permeability.

This map unit is in capability unit IVe-8 (14), irrigated and nonirrigated.

204—Sheetiron-Deadwood association, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods and some shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 47 to 52 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 50 percent Sheetiron gravelly sandy loam and 30 percent Deadwood very gravelly sandy loam. The Sheetiron soil is on north- and east-facing slopes and on benches. The Deadwood soil is on ridgetops, on south- and west-facing slopes, and in drainageways.

Included in this unit are small areas of Bamtush, Freezeout, Neuns, Sanhedrin, and Yollabolly soils and Rock outcrop. Also included are small areas of Deadwood and Sheetiron soils that have slopes of more than 50 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sheetiron soil is moderately deep and well drained. It formed in material weathered from mica-quartz schist. The surface layer is brown gravelly sandy loam 3 inches thick over pale brown very gravelly sandy loam 5 inches thick. The upper 9 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 12 inches is very pale brown extremely gravelly sandy loam. Fractured mica-quartz schist is at a depth of 29 inches.

Permeability of the Sheetiron soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, and California black oak are the main tree species on the Sheetiron soil. Canyon live oak, incense-cedar, and scattered Douglas-fir and ponderosa pine are the main tree species on the Deadwood soil. Among the trees of limited extent are white fir on some north aspects and sugar pine. On the basis of a 100-year site curve, the mean site index is estimated to be 105 for both Douglas-fir and ponderosa pine on the Sheetiron soil. On the basis of a 100-year site curve, the mean site index is 83 for Douglas-fir and 84 for ponderosa pine on the Deadwood soil. The potential annual production of ponderosa pine on the Sheetiron soil is 425 board feet per acre from a fully stocked stand of trees. Estimates of the potential annual production on the Deadwood soil have not been made because the vegetation is mostly brush.

A concern for the harvesting of timber on this unit is steepness of slope. Wheeled and tracked equipment can be used in the more gently sloping areas, but cable yarding systems generally disturb the soil less in the steeper areas. Revegetation of cut and fill slopes is difficult on the Sheetiron and Deadwood soils because of the high amount of rocks in the soil and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts in this unit, necessitating increased maintenance on roads. Rock for construction of roads is available on this unit but is frequently of low quality. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Even with seed trees present, natural reforestation of cutover areas by conifers occurs infrequently on this unit. Reforestation can be accomplished by planting large seedlings. Planting on the Deadwood soil is not practical because of the high content of rock fragements and the restricted available water capacity of the soil.

Among the common forest understory plants are California nutmeg and greenleaf mananita.

The Sheetiron soil is in capability subclass VIs (5), nonirrigated, and the Deadwood soil is in capability subclass VIIs (5), nonirrigated.

205—Sheetiron-Deadwood association, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods and some shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is 45 to 60 inches, the average annual air temperature is 47 to 52 degrees F, and the average frost-free period is 110 to 160 days.

This unit is about 50 percent Sheetiron gravelly sandy loam and 30 percent Deadwood very gravelly sandy

loam. The Sheetiron soil is on north- and east-facing slopes and on benches. The Deadwood soil is on ridgetops, on south- and west-facing slopes, and in drainageways.

Included in this unit are small areas of Bamtush, Freezeout, Neuns, Sanhedrin, and Yollabolly soils and Rock outcrop. Also included are small areas of Deadwood and Sheetiron soils that have slopes of less than 50 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sheetiron soil is moderately deep and well drained. It formed in material weathered from mica-quartz schist. The surface layer is brown gravelly sandy loam 3 inches thick over pale brown very gravelly sandy loam 5 inches thick. The upper 9 inches of the subsoil is pale brown very gravelly sandy loam, and the lower 12 inches is very pale brown extremely gravelly sandy loam. Fractured mica-quartz schist is at a depth of 29 inches.

Permeability of the Sheetiron soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Deadwood soil is shallow and somewhat excessively drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and bark 1 inch thick. The surface layer is brown very gravelly sandy loam 4 inches thick. The upper 5 inches of the subsoil is light yellowish brown very gravelly sandy loam, and the lower 4 inches is brownish yellow extremely gravelly sandy loam. Hard sandstone is at a depth of 13 inches.

Permeability of the Deadwood soil is moderately rapid. Available water capacity is 0.5 to 1.0 inch. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, sugar pine, and California black oak are the main tree species on the Sheetiron soil. Canyon live oak, incense-cedar, and scattered Douglas-fir and ponderosa pine are the main tree species on the Deadwood soil. Among the trees of limited extent are white fir on some north aspects and sugar pine. On the basis of a 100-year site curve, the mean site index is estimated to be 105 for both Douglas-fir and ponderosa pine on the Sheetiron soil. On the basis of a 100-year site curve, the mean site index is 84 for ponderosa pine and 83 for Douglas-fir on the Deadwood soil. The potential annual production of ponderosa pine on the Sheetiron soil is 425 board feet per acre from a fully stocked stand of trees. Estimates of the potential annual production of the Deadwood soil have not been made because the vegetation is mostly brush.

The main limitation for the harvesting of timber is steepness of slope. Cable yarding systems generally are used on this unit. Revegetation of cut and fill slopes is difficult on the Sheetiron and Deadwood soils because of the high amount of rock in the soils and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts on the Sheetiron and Deadwood soils, necessitating increased maintenance on roads. Rock for construction of roads is available on this unit but is frequently of low quality. The soils in this unit are dusty when subjected to vehicular use. If the road is to be used heavily, its surface should be treated.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. Movement of loose surface material can reduce seedling survival on the steeper slopes. Even with seed trees present, natural reforestation of cutover areas by conifers occurs infrequently on these soils. Reforestation can be accomplished by planting large seedlings. Planting on the Deadwood soil is not practical because of the high percentage of rock and the very low available water capacity of the soil.

Among the common forest understory plants are California nutmeg and greenleaf manzanita.

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

206—Shortyork Variant-Yorkville-Squawrock association, 15 to 50 percent slopes. This map unit is on mountains. Mass soil movement is common on this unit and occurs as slumps and slides; it usually is associated with springs and seeps or undercutting of a lower portion of the mountain slope. The vegetation is mainly annual grasses and forbs with scattered oaks. Elevation is 2,000 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 130 to 180 days.

This unit is about 35 percent Shortyork Variant gravelly loam, 30 percent Yorkville clay loam, and 15 percent Squawrock gravelly loam. The Shortyork soil is on unstable, convex, grass-covered side slopes; the Yorkville soil is on unstable, concave, grass-covered side slopes; and the Squawrock soil is on stable, convex, grass-covered spur ridges, in drainageways, and in areas surrounding rock outcroppings.

Included in this unit are small areas of Dubakella, Henneke, Neuns, and Yorktree soils and Rock outcrop. Areas of serpentinitic Rock outcrop are near ridges. Also included are small areas of Shortyork, Squawrock, and Yorkville soils that have slopes of less than 15 percent; soils that are similar to the Shortyork Variant, Squawrock, and Yorkville soils but are at elevations of more than 4,000 feet; and areas of wet Shortyork and Yorkville soils that are in depressional areas and swales. Included areas make up about 20 percent of the total

acreage. The percentage varies from one area to another.

The Shortyork Variant soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone and greenstone. Typically, the surface layer is dark grayish brown gravelly loam 9 inches thick. The upper 3 inches of the subsoil is grayish brown very gravelly clay loam, and the lower 20 inches is variegated, brown and light olive brown very gravelly clay. Hard, fractured greenstone and metamorphosed sandstone are at a depth of 32 inches.

Permeability of the Shortyork Variant soil is very slow. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, schist, or shale. Typically, the surface layer is dark gray clay loam 3 inches thick. The upper 30 inches of the subsoil is dark gray and gray clay, and the lower 31 inches is gray gravelly clay loam. Hard, fractured schist is at a depth of 64 inches.

Permeability of the Yorkville soil is very slow. Available water capacity is 8.5 to 13.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is grayish brown gravelly loam 8 inches thick. The subsoil is light brownish gray very gravelly clay loam 29 inches thick. Hard, fractured sandstone is at a depth of 37 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The production of forage is limited by the susceptibility of the Shortyork and Yorkville soils to compaction when wet and by the restricted available water capacity of the Squawrock soil. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. This unit responds well to fertilizing, rangeland seeding, and 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 located salt and livestock watering facilities promote uniform distribution of livestock grazing. Springs and seeps are common on the Yorkville soil. They can be developed as a source of water for wildlife and to achieve better distribution of livestock. The characteristic plant community on this unit is mainly soft chess and wild oat.

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

207—Skyhigh-Asbill complex, 8 to 15 percent slopes. This map unit is on hills. The vegetation is mainly annual grasses and oaks with scattered shrubs. Elevation is 1,450 to 2,100 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 55 percent Skyhigh loam and 25 percent Asbill 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 Millsholm and Sleeper soils. Also included are small areas of soils that are similar to the Skyhigh soil but are cooler and soils that have a light-colored surface layer. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Skyhigh soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 2 inches thick. The upper 6 inches of the subsoil is brown clay loam, and the lower 30 inches is brown, yellowish brown, and strong brown clay. Hard, fractured sandstone is at a depth of 38 inches. In some areas the surface layer is clay loam.

Permeability of the Skyhigh soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential is high.

The Asbill soil is moderately deep and well drained. It formed in material weathered from shale or siltstone. Typically, the surface layer is olive gray clay loam 13 inches thick. The underlying material to a depth of 39 inches is olive gray and light olive gray clay. Soft siltstone is at a depth of 39 inches.

Permeability of this Asbill soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential is high.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for firewood production and homesite development.

The production of forage is limited by a dense canopy cover in some areas of the Skyhigh soil and by the susceptibility of the Asbill soil to compaction when moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. In areas where oak trees grow, forage production can be increased by harvesting the trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 40 cords of wood per acre have been measured on the Skyhigh soil. This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The main

limitation for seeding is the woody canopy cover on the Skyhigh soil. Among the common understory plants on the Skyhigh soil are soft chess, wild oat, and purple needlegrass. The characteristic plant community on the Asbill soil is wild oat, soft chess, and ripgut brome.

If this unit is used for homesite development, the main limitations are the slow permeability, depth to bedrock, high shrink-swell potential, and low load bearing capacity. The main limitations for septic tank absorption fields are the moderate soil depth and slow permeability, which can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The high shrink-swell potential and low load bearing capacity of the soils in this unit should be considered when designing and constructing foundations, concrete buildings, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soils in this unit are used as a base for roads and streets, they can be mixed with sand and gravel to increase their strength and stability.

The Skyhigh soil is in capability unit IIIe-3 (15), nonirrigated, and the Asbill soil is in capability unit IIIe-5 (15), nonirrigated.

208—Skyhigh-Asbill complex, 15 to 50 percent slopes. This map unit is on hills. The vegetation is mainly annual grasses and oaks with scattered shrubs. Elevation is 1,450 to 2,100 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 50 percent Skyhigh loam and 30 percent Asbill 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 Sleeper soils. Also included are small areas of soils that are similar to the Skyhigh soil but are in areas that have a cooler average annual air temperature and soils that have a light-colored surface layer. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Skyhigh soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 2 inches thick. The upper 6 inches of the subsoil is brown clay loam, and the lower 30 inches is brown, yellowish brown, and strong brown clay. Hard, fractured sandstone is at a depth of 38 inches. In some areas the surface layer is clay loam.

Permeability of the Skyhigh soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Asbill soil is moderately deep and well drained. It formed in material weathered from shale or siltstone. Typically, the surface layer is olive gray clay loam 13 inches thick. The underlying material to a depth of 39 inches is olive gray and light olive gray clay. Soft siltstone is at a depth of 39 inches.

Permeability of the Asbill soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It can be used for firewood production.

The production of forage is limited by a dense canopy cover in some areas of the Skyhigh soil and by the susceptibility of the Asbill soil to compaction when moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Where oaks are present, forage production can be increased by managing the harvesting of trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 40 cords of wood per acre have been measured on the Skyhigh soil.

This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The main limitations for seeding are steepness of slope and the woody canopy cover. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities 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 potential of the unit to produce vegetation suitable for grazing. Among the common understory plants on the Skyhigh soil are soft chess, wild oat, and purple needlegrass. The characteristic plant community on the Asbill soil is wild oat, soft chess, and ripgut brome.

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

209—Skyhigh-Millsholm loams, 15 to 50 percent slopes. This map unit is on hills. The vegetation is mainly oaks and annual grasses. Elevation is 620 to 2,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Skyhigh loam and 25 percent Millsholm 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 is about 10 percent Bressa soils. Also included are small areas of Asbill, Etsel, Hopland, Maymen, and Sleeper soils; isolated areas of soils that have lower base saturation than do the Skyhill and

Millsholm soils; some areas of stony soils that have 5 to 25 percent of the surface covered with stones and cobbles; small areas of reddish brown soils that are 20 to 40 inches deep and have a loam surface layer and a clay loam or gravelly clay subsoil over sandstone and shale; small areas of Millsholm and Skyhigh soils that have slopes of 50 to 75 percent; soils that are similar to the Millsholm soil but have fine texture or are less than 10 inches deep over bedrock; and soils that are similar to the Skyhigh soil but have a light-colored surface layer. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Skyhigh soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 2 inches thick. The upper 6 inches of the subsoil is brown clay loam, and the lower 30 inches is brown, yellowish brown, and strong brown clay. Hard, fractured sandstone is at a depth of 38 inches.

Permeability of the Skyhigh soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high in the subsoil.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is light yellowish brown loam 6 inches thick. The subsoil is light yellowish brown clay loam 10 inches thick. Fractured sandstone is at a depth of 16 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover in some areas and by the restricted available water capacity and shallow depth of the Millsholm soil. Where oaks are present, the amount of forage can be increased by harvesting trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 40 cords of wood per acre have been measured on the Skyhigh soil. The Skyhigh soil responds well to fertilizer, rangeland seeding, and proper grazing use. The main limitations for seeding are steepness of slope and the woody canopy cover 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 promote uniform distribution of livestock grazing. Livestock grazing should be managed to protect this 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 suitable for grazing. Among the common understory plants are soft chess, wild oat, purple needlegrass, and filaree.

If this unit is used for homesite development, the main limitations are steepness of slope, depth to bedrock, and the hazard of erosion on the Millsholm and Skyhigh soils and by slow permeability, low load bearing capacity, and high shrink-swell potential of the Skyhigh soil. Preferred building sites are limited to knolls and the less sloping areas. Extensive cutting and filling generally are required. Deep cuts made during construction can expose bedrock or the clayey subsoil. Cut slopes are susceptible to excessive erosion, and intensive runoff control measures are needed on them. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. Shallow depth to bedrock in the Millsholm soil is a major limitation for septic tank absorption fields. The limitations of moderate depth and slow permeability of the Skyhigh soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The high shrink-swell potential and low load bearing capacity of the Skyhigh soil should be considered when designing and constructing foundations, concrete structures, and roads. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the Skyhigh soil in this unit is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

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

210—Skyhigh-Sleeper-Millsholm association, 8 to 15 percent slopes. This map unit is on hills. The vegetation is mainly oaks and annual grasses. Elevation is 1,250 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 35 percent Skyhigh loam, 30 percent Sleeper loam, and 20 percent Millsholm loam. The Skyhigh and Sleeper soils are on intermediate and lower side slopes. The Millsholm soil is on upper side slopes and hilltops.

Included in this unit are small areas of Asbill and Bressa soils. Also included are small areas of soils on ridgetops that are less than 10 inches deep to bedrock, soils in drainageways that have 20 to 45 percent gravel, and soils that are similar to the Skyhigh soil but have a light-colored surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Skyhigh soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 2 inches thick. The upper 6 inches of the subsoil is brown clay loam, and the lower 30 inches is brown, yellowish brown, and strong brown clay. Hard, fractured sandstone is at a depth of 38 inches.

Permeability of the Skyhigh soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential is high.

The Sleeper soil is deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of oak leaf litter 1 inch thick. The surface layer is brown loam 4 inches thick. The upper 16 inches of the subsoil is pinkish gray loam and clay loam, and the lower 25 inches is pale brown clay. Hard, fractured sandstone is at a depth of 45 inches.

Permeability of the Sleeper soil is slow. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential is high.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is light yellowish brown loam 6 inches thick. The subsoil is light yellowish brown clay loam 10 inches thick. Fractured sandstone is at a depth of 16 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for firewood production and homesite development.

The production of forage is limited by a dense canopy cover, particularly on the north-facing slopes, and by the restricted available water capacity and shallow depth of the Millsholm soil. Where oaks are present, forage production can be increased by harvesting trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 40 cords of wood per acre have been measured on the Skyhigh soil. The Skyhigh and Sleeper soils respond well to fertilizer, to rangeland seeding, and to proper grazing use. Among the common understory plants on the Skyhigh and Millsholm soils are soft chess, wild oat, and filaree. The characteristic plant community on the Sleeper soil is soft chess, ripgut brome, and wild oat.

If this unit is used for homesite development, the main limitations are depth to bedrock in the Millsholm and Skyhigh soils and the slow permeability, high shrink-swell potential, and low load bearing capacity of the Skyhigh and Sleeper soils. Shallow depth to bedrock in the Millsholm soil is a major limitation for septic tank absorption fields. The limitations of moderate depth to bedrock in the Skyhigh soil and slow permeability of the Skyhigh and Sleeper soils can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The high shrink-swell potential and low load bearing capacity of the Skyhigh and Sleeper soils should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation area or by backfilling with material that has low shrink-swell potential. If the soils in this unit are used as a base for roads and streets, they can be mixed with sand and gravel to increase their strength and stability.

The Skyhigh and Sleeper soils are in capability subclass IIIe (15), nonirrigated. The Millsholm soil is in capability subclass VIe (15), nonirrigated.

211—Skyhigh-Sleeper-Millsholm association, 15 to 30 percent slopes. This map unit is on hills. The Skyhigh and Sleeper soils are susceptible to slumping and gullying. The vegetation is mainly oaks and annual grasses. Elevation is 1,250 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 40 percent Skyhigh loam, 30 percent Sleeper loam, and 15 percent Millsholm loam. The Skyhigh and Sleeper soils are on intermediate and lower side slopes. The Millsholm soil is on upper side slopes and hilltops.

Included in this unit are small areas of Bressa, Pomo, and Sleeper soils. Also included are small areas of soils on toe slopes that are clayey throughout and have wide cracks at the surface when dry; Millsholm, Skyhigh, and Sleeper soils that have slopes of 30 to 50 percent; soils on hilltops that are similar to the Millsholm soil but are less than 10 inches deep to bedrock; and soils that are similar to the Skyhigh soil but have a light-colored surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Skyhigh soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 2 inches thick. The upper 6 inches of the subsoil is brown clay loam, and the lower 30 inches is brown, yellowish brown, and strong brown clay. Hard, fractured sandstone is at a depth of 38 inches. In some areas the surface layer is clay loam.

Permeability of the Skyhigh soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high in the subsoil.

The Sleeper soil is deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of oak leaf litter 1 inch thick. The surface layer is brown loam 4 inches thick. Below this is brown clay loam 5 inches thick. The subsoil is brown and yellowish brown clay loam 39 inches thick. Hard, fractured sandstone is at a depth of 48 inches. In some areas the surface layer is clay loam.

Permeability of the Sleeper soil is slow. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is pale brown loam 9 inches thick. Below this is pale brown clay loam 6 inches thick. The subsoil is very pale brown clay loam 3 inches thick. Fractured sandstone is at a depth of 18 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover, particularly on the north-facing slopes, and by the restricted available water capacity and shallow depth of the Millsholm soil. Where oaks are present, forage production can be increased by harvesting trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 40 cords of wood per acre have been measured on the Skyhigh soil.

The Skyhigh and Sleeper soils respond well to fertilizer, rangeland seeding, and proper grazing use. Among the common understory plants on the Skyhigh and Millsholm soils are soft chess, wild oat, and filaree. The characteristic plant community on the Sleeper soil is soft chess, ripgut brome, and wild oat.

If this unit is used for homesite development, the main limitations are steepness of slope and the hazard of erosion. Other limitations are depth to bedrock in the Skyhigh and Millsholm soils and slow permeability, high shrink-swell potential, and low load bearing capacity of the Skyhigh and Sleeper soils. Extensive cutting and filling generally are required. Deep cuts made during construction can expose bedrock in the Skyhigh and Millsholm soils or the clayey subsoil in the Skyhigh and Sleeper soils. Roads may fail and landslips may occur following deep soil disturbance resulting from excavation. Cut slopes are susceptible to erosion, and intensive runoff control measures are needed on them. The risk of erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion.

Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. Shallow depth to bedrock in the Millsholm soil is a major limitation for septic tank absorption fields. The limitations of moderate depth of the Skyhigh soil and slow permeability of the Skyhigh and Sleeper soils can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The high shrink-swell potential and low load bearing capacity of the Skyhigh and Sleeper soils should be considered when designing and constructing foundations, concrete structures, and roads. Diverting runoff away from buildings helps to prevent structural damage as a result of shrinking and swelling and to reduce the risk of landslips. If the soils in this unit are used as a base for roads and streets, they can be mixed with sand and gravel to increase their strength and stability.

The Skyhigh and Sleeper soils are in capability subclass IVe (15), nonirrigated. The Millsholm soil is in capability subclass VIe (15), nonirrigated.

212—Skyhigh-Sleeper-Millsholm association, 30 to 50 percent slopes. This map unit is on hills. The Skyhigh and Sleeper soils are susceptible to slumping and gullying. The vegetation is mainly oaks and annual grasses. Elevation is 1,250 to 2,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Skyhigh loam, 20 percent Sleeper loam, and 20 percent Millsholm loam. The Skyhigh and Sleeper soils are on intermediate and lower side slopes. The Millsholm soil is on upper side slopes and hilltops.

Included in this unit are small areas of Bressa and Pomo soils. Also included are small areas of soils on toe slopes that are clay loam and clay throughout the profile and have wide cracks at the surface when dry; Skyhigh, Sleeper, and Millsholm soils that have slopes of less than 30 percent; soils that are similar to the Skyhigh soil but have a light-colored surface layer; soils that are similar to the Millsholm soil but are less than 10 inches deep to bedrock and are on hilltops; and soils that are similar to the Sleeper soil but are more than 60 inches deep. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Skyhigh soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 2 inches thick. The upper 6 inches of the subsoil is brown clay loam, and the lower 30 inches is brown, yellowish brown, and strong brown clay. Hard, fractured sandstone is at a

depth of 38 inches. In some areas the surface layer is clay loam.

Permeability of the Skyhigh soil is slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Sleeper soil is deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of oak leaf litter 1 inch thick. The surface layer is brown loam 4 inches thick. Below this is brown clay loam 5 inches thick. The subsoil is brown and yellowish brown clay loam 39 inches thick. Hard, fractured sandstone is at a depth of 48 inches. In some areas the surface layer is clay loam.

Permeability of the Sleeper soil is slow. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is pale brown loam 9 inches thick. Below this is pale brown clay loam 6 inches thick. The subsoil is very pale brown clay loam 3 inches thick. Fractured sandstone is at a depth of 18 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for firewood production.

The production of forage is limited by a dense canopy cover, particularly on north-facing slopes, and by the restricted available water capacity and shallow depth of the Millsholm soil. Where oaks are present and slopes are less than 40 percent, forage production can be increased by harvesting trees. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 40 cords of wood per acre have been measured on the Skyhigh soil.

The Skyhigh and Sleeper soils respond well to fertilizer, rangeland seeding, and proper grazing use. The main limitations for seeding are steepness of slope and the woody canopy cover. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities 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 potential of the unit to produce vegetation suitable for grazing. Among the common understory plants on the Skyhigh and Millsholm soils are soft chess, wild oat, and filaree. The characteristic plant community on the Sleeper soil is soft chess, ripgut brome, and wild oat.

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

213—Sleeper Variant-Sleeper loams, 5 to 15 percent slopes. This map unit is on hills. These soils are susceptible to slumping. The vegetation is mainly annual grasses and oaks. Elevation is 1,350 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Sleeper Variant loam and 30 percent Sleeper loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. The Sleeper Variant soil is of minor extent in areas of this unit that are in the eastern part of the county.

Included in this unit is about 10 percent Skyhigh soils. Also included are small areas of Millsholm and Still soils, Rock outcrop, and soils that are similar to the Sleeper soil but are 10 to 20 inches deep to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sleeper Variant soil is very deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface layer is light brownish gray loam 12 inches thick. The upper 25 inches of the subsoil is dark grayish brown and olive clay loam, and the lower 19 inches is olive gray clay. Below this to a depth of 75 inches is olive gray clay loam.

Permeability of the Sleeper Variant soil is slow. Available water capacity is 6.0 to 9.5 inches. Rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

The Sleeper soil is deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of oak leaf litter 1 inch thick. The surface layer is brown loam 4 inches thick. The upper 16 inches of the subsoil is pinkish gray loam and clay loam, and the lower 25 inches is pale brown clay. Hard, fractured sandstone is at a depth of 45 inches.

Permeability of the Sleeper soil is slow. Available water capacity is 6 to 10 inches. Rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential is high.

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

The production of forage is limited by the susceptibility of the soils to compaction when moist and by the presence of a dense canopy cover, particularly in draws and on north-facing slopes. Grazing should be delayed until the soils have drained sufficiently and are firm enough to withstand trampling by livestock. Because of the instability of the soil, trees and brush should be retained on this unit.

This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree. Where there is a canopy cover of oaks, the common understory plants include soft chess, ripgut brome, and wild oat.

If this unit is used for homesite development, the main limitations are slow permeability, high shrink-swell potential, and low load bearing capacity. If the unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field or by using specially designed sewage disposal systems. The high shrink-swell potential and low load bearing capacity should be considered when designing and constructing foundations, concrete structures, and paved areas. Cutbanks are not stable and are subject to slumping. Diverting runoff away from buildings can help to prevent structural damage as a result of shrinking and swelling. If the soils in this unit are used as a base for roads and streets, they can be mixed with sand and gravel to increase their strength and stability.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

214—Sleeper Variant-Sleeper loams, 15 to 30 percent slopes. This map unit is on hills. These soils are susceptible to slumping. The vegetation is mainly annual grasses and oaks. Elevation is 1,350 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Sleeper Variant loam and 35 percent Sleeper loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. The Sleeper Variant soil is of minor extent in areas of this unit that are in the eastern part of the county.

Included in this unit are small areas of Millsholm soils and Rock outcrop and stones. Also included are small areas of soils that are similar to the Sleeper soil but are 10 to 20 inches deep to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sleeper Variant soil is very deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface layer is light brownish gray and grayish brown loam 12 inches thick. The upper 25 inches of the subsoil is dark grayish brown light olive brown and olive clay loam, and the lower 19 inches is olive gray clay. Below this to a depth of 75 inches is olive gray clay loam.

Permeability of the Sleeper Variant soil is slow. Available water capacity is 6.0 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Sleeper soil is deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface is covered with a mat of oak leaf litter 1 inch thick. The surface layer is brown loam 4 inches thick. The upper 16 inches of the subsoil is pinkish gray loam and clay loam, and the lower 25 inches is pale brown clay. Hard, fractured sandstone is at a depth of 45 inches.

Permeability of the Sleeper soil is slow. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

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

The production of forage is limited by the susceptibility of the soils in this unit to compaction when they are moist and by a dense canopy cover, particularly in draws and on north-facing slopes. Grazing should be delayed until the soils have drained sufficiently and are firm enough to withstand trampling by livestock. Because of the instability of the soils, trees and brush should be retained on this unit.

This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree. Where there is a canopy cover of oaks, the common understory plants include soft chess, ripgut brome, and wild oat.

If this unit is used for homesite development, the main limitations are steepness of slope, the instability of the soil, the hazard of erosion, high shrink-swell potential, low load bearing capacity, and slow permeability. Extensive cutting and filling generally are required. Cut and fill slopes are not stable and are subject to slumping. Roads may fail and landslips may occur on the soils in this unit following deep soil disturbance as a result of excavation. The high shrink-swell potential and low load bearing capacity of the subsoil should be considered when designing and constructing foundations, concrete structures, and paved areas. Diverting runoff away from buildings helps to prevent structural damage as a result of shrinking and swelling and helps to overcome the concerns of soil instability and slumping. If the soils in this unit are used as a base for roads and streets, they can be mixed with sand and gravel to increase their strength and stability. The hazard of sheet and rill erosion is increased if the soil surface is left exposed during site development. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. The limitation of slow permeability can be minimized 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 (15), nonirrigated.

215—Sleeper Variant-Sleeper loams, 30 to 50 percent slopes. This map unit is on hills. These soils are susceptible to slumping. The vegetation is mainly annual grasses and oaks. Elevation is 1,350 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 45 percent Sleeper Variant loam and 35 percent Sleeper loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. The Sleeper Variant soil is of minor extent in areas of this unit that are in the eastern part of the county.

Included in this unit are small areas of Millsholm and Skyhigh soils, Rock outcrop, and stones. Also included are small areas of soils that have slopes of less than 30 percent; soils that are darker colored and have a clay loam over gravelly clay profile that is more than 40 inches deep to weathered basalt or metasedimentary rock; and soils that are similar to the Sleeper soil but are 10 to 20 inches deep to bedrock. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sleeper Variant soil is very deep and well drained. It formed in material weathered from sandstone, shale, or siltstone. Typically, the surface layer is light brownish gray loam 12 inches thick. The upper 25 inches of the subsoil is dark grayish brown and olive clay loam, the next 19 inches is olive gray clay, and the lower part to a depth of 75 inches is olive gray clay loam.

Permeability of the Sleeper Variant soil is slow. Available water capacity is 6.0 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Sleeper 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 leaf litter 1 inch thick. The surface layer is brown loam 4 inches thick. The upper 16 inches of the subsoil is pinkish gray loam and clay loam, and the lower 25 inches is pale brown clay. Hard, fractured sandstone is at a depth of 45 inches.

Permeability of the Sleeper soil is slow. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

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

The production of forage is limited by the susceptibility of the soils in this unit to compaction when moist and by a dense canopy cover of woody plants, particularly in draws and on north-facing slopes. Grazing should be delayed until the soils have drained sufficiently and are firm enough to withstand trampling by livestock. Because of the instability of the soils, trees and brush should be retained on this unit. This unit responds well to fertilizer, rangeland seeding, and 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 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 vegetation suitable for grazing. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree. Where there is a canopy cover of oaks, the common understory plants include soft chess, ripgut brome, and wild oat.

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

216—Sobrante-Collayomi-Whispering association, 15 to 30 percent slopes. This map unit is on hills and mountains. The vegetation is mainly annual grasses and oaks on the Sobrante soil and conifers and oaks with an understory of brush on the Collayomi and Whispering soils. Elevation is 1,200 to 3,500 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 140 to 185 days.

This unit is about 40 percent Sobrante loam, 25 percent Collayomi very gravelly loam, and 20 percent Whispering loam. The Sobrante soil is on south- and west-facing slopes. The Collayomi and Whispering soils are on north- and east-facing slopes.

Included in this unit are small areas of Aiken and Hambright soils and Rock outcrop. Also included are small areas of Colloyomi, Sobrante, and Whispering soils that have slopes of 5 to 15 percent or 30 to 50 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, about 10 percent of the surface is covered with stones and boulders 1 to 5 feet in diameter. The surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard, fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Collayomi soil is very deep and well drained. It formed in material weathered from basalt. Typically, about 5 percent of the surface is covered with stones and boulders 2 to 10 feet in diameter. The surface layer

is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam. In some areas the surface layer is cobbly loam or stony loam.

Permeability of the Collayomi soil is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Whispering soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, about 5 percent of the surface is covered with stones and boulders and a mat of pine needles, leaves, and twigs 1 inch thick. The surface layer is brown loam 5 inches thick. The upper 10 inches of the subsoil is reddish yellow gravelly loam, and the lower 11 inches is yellowish red very cobbly clay loam. Hard, fractured basalt is at a depth of 26 inches.

Permeability of the Whispering soil is moderate. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, timber production, wildlife habitat, and watershed.

The production of forage on the Sobrante soil is limited by a dense canopy cover in some areas. The Collayomi and Whispering soils support very sparse stands of plants that are suitable for grazing. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 9 cords of wood per acre have been measured on the Sobrante soil.

The Sobrante soil responds well to fertilizer, rangeland seeding, and proper grazing use. The main limitation for seeding is the dense woody canopy. Livestock grazing should be managed to protect the soil from erosion. Among the common understory plants on the Sobrante soil are soft chess, ripgut brome, and wild oat.

California black oak, ponderosa pine, and Pacific madrone are the main tree species on the Collayomi and Whispering soils. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 122 on the Collayomi soil and 109 on the Whispering soil. The potential annual production of ponderosa pine on the Collayomi soil is 600 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Whispering soil is 450 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for California black oak and Pacific madrone have not been made.

A concern for the harvesting of timber or firewood is seasonal wetness. Use of wheeled and tracked equipment when the soils are moist produces ruts, compacts the soils, 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.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine frequently occurs. The high soil temperature and low content of soil moisture during the growing season cause mortality of seedlings, especially on south- and southwest-facing slopes.

Among the common forest understory plants are annual grasses, brackenfern, poison-oak, and manzanita.

The Sobrante soil is in capability unit IVe-1 (15), nonirrigated. The Collayomi and Whispering soils are in capability unit IVs-1 (5), nonirrigated.

217—Sobrante-Collayomi-Whispering association, 30 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly annual grasses and oaks on the Sobrante soil and conifers and oaks with an understory of brush on the Whispering and Collayomi soils. Elevation is 1,200 to 3,500 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 140 to 185 days.

This unit is about 35 percent Sobrante loam, 25 percent Collayomi very gravelly loam, and 15 percent Whispering loam. The Sobrante soil is on south- and west-facing slopes. The Collayomi and Whispering soils are on north- and east-facing slopes.

Included in this unit is about 10 percent Hambright soils. Also included are small areas of Aiken soils, Rock outcrop, and Sobrante soils that have slopes of less than 30 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, about 10 percent of the surface is covered with stones and boulders 1 to 5 feet in diameter. The surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard, fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Collayomi soil is very deep and well drained. It formed in material weathered from basalt. Typically, about 5 percent of the surface is covered with stones and boulders 2 to 10 feet in diameter. The surface layer is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam. In some areas the surface layer is cobbly loam or stony loam.

Permeability of the Collayomi soil is moderate. Available water capacity is 2.5 to 4.5 inches. Effective

rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is moderate.

The Whispering soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, about 5 percent of the surface is covered with stones and boulders. There is a mat of pine needles, leaves, and twigs 1 inch thick on the surface. The surface layer is brown loam 5 inches thick. The upper 10 inches of the subsoil is reddish yellow gravelly loam, and the lower 11 inches is yellowish red very cobbly clay loam. Hard, fractured basalt is at a depth of 26 inches.

Permeability of the Whispering soil is moderate. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, timber production, wildlife habitat, and watershed.

The production of forage on the Sobrante soil is limited by a dense canopy in some areas. The Collayomi and Whispering soils support very sparse stands of 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 uniform distribution of livestock grazing. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing. Among the common understory plants on the Sobrante soil are soft chess, ripgut brome, and wild oat.

California black oak, ponderosa pine, and Pacific madrone are the main tree species on the Collayomi and Whispering soils. On the basis of a 100-year site curve, the mean site index for ponderosa pine is estimated to be 122 on the Collayomi soil and 109 on the Whispering soil. The potential annual production of ponderosa pina on the Collayomi soil is 600 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Whispering soil is 450 board feet per acre from a fully stocked stand of trees.

Some concerns for the harvesting of timber or firewood are steepness of slope and the hazard of erosion. 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 by cable yarding systems. Rock for construction of roads generally is available on this unit.

Seedling survival is a concern in the production of timber. Proper site preparation on the Collayomi and Whispering soils might make it possible to replace stands of brush and hardwoods with conifers. Reforestation can be accomplished by planting ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occasionally occurs. Hardwoods can regenerate by sprouting after cutting. The high soil temperature and low content of soil moisture during the growing season cause mortality of seedlings, especially in areas of the Whispering soil on the south- and southwest-facing slopes.

Among the common forest understory plants are manzanita, poison-oak, brackenfern, and annual and perennial grasses.

The Sobrante soil is in capability subclass VIe (15), nonirrigated, and the Collayomi and Whispering soils are in capability subclass VIe (5), nonirrigated.

218—Sobrante-Guenoc-Hambright complex, 2 to 15 percent slopes. This map unit is on hills. The vegetation is mainly brush, oaks, and annual grasses. Elevation is 800 to 2,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 35 percent Sobrante loam, 30 percent Guenoc clay loam, and 20 percent Hambright 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 Neice soils and Rock outcrop. The Neice soils are on the steeper slopes. The areas of Rock outcrop occur as escarpments. Also included are small areas of soils that are similar to the Hambright and Sobrante soils but have 10 to 50 percent of the surface covered with stones and boulders or are clay loam and soils on north-facing slopes and in ravines that are similar to the Sobrante soil but have average annual soil temperatures of less than 59 degrees F. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, about 10 percent of the surface is covered with stones and boulders as much as 3 feet in diameter. The surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard, fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

The Guenoc soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown clay loam 3 inches thick. The upper 5 inches of the subsoil is dark red clay, and the lower 20 inches is dark red gravelly clay. Hard, fractured basalt is at a depth of 28 inches. In some areas the surface layer is loam.

Permeability of the Guenoc soil is moderately slow. Available water capacity is 2.0 to 6.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is medium, and the hazard of erosion is moderate.

The Hambright soil is shallow and well drained. It formed in material derived from basalt. Typically, the surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Fractured basalt is at a depth of 16 inches.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is medium, and the hazard of erosion is slight.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover in some areas and by the restricted available water capacity and shallow depth of the Hambright soil. Where oaks and brush are present, forage production can be increased by managing the harvesting of trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 9 cords of wood per acre have been measured on the Sobrante and Hambright soils.

The Sobrante and Guenoc soils respond well to fertilizer, rangeland seeding, and proper grazing use. The main limitation for seeding on the Sobrante and Guenoc soils is the woody canopy cover. Seeding generally is not practical on the Hambright soil. Among the common understory plants are soft chess, wild oat, and filaree on the Sobrante and Guenoc soils and soft chess, filaree, manzanita, and chamise on the Hambright soil.

If this unit is used for homesite development, the main limitation is depth to bedrock. Other limitations are the low load bearing capacity and moderately slow permeability of the Guenoc soil. Cuts needed to provide building sites in the steeper areas of this unit can expose bedrock. Shallow depth to bedrock in the Hambright soil is a major limitation for septic tank absorption fields. The limitations of moderate depth to bedrock and moderately slow permeability of the Guenoc soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the limited ability of the Guenoc soil to support a load. If the Guenoc soil is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

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

219—Sobrante-Guenoc-Hambright complex, 15 to 30 percent slopes. This map unit is on hills. Rock outcroppings and stones 1 to 15 feet in diameter occur randomly throughout the unit. The vegetation is mainly brush, oaks, and annual grasses (fig. 4). Elevation is 800 to 2,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 35 percent Sobrante loam, 25 percent Guenoc clay loam, and 20 percent Hambright 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 Aiken and Collayomi soils and Rock outcrop. The areas of Rock outcrop occur as escarpments. Also included are small areas of soils that are similar to the Hambright soil but are clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, about 10 percent of the surface is covered with stones and boulders 1 to 5 feet in diameter. The surface layer is reddish brown loam about 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard, fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Guenoc soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown clay loam 3 inches thick. The upper 5 inches of the subsoil is dark red clay, and the lower 20 inches is dark red gravelly clay. Hard, fractured basalt is at a depth of 28 inches. In some areas the surface layer is loam.

Permeability of the Guenoc soil is moderately slow. Available water capacity is 2.0 to 6.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Fractured basalt is at a depth of 16 inches. In some areas the surface layer is clay loam.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It is also used for homesite development and firewood production.

The production of forage is limited by a dense canopy cover in some areas and by restricted available water capacity and shallow depth of the Hambright soil. Where

Figure 4.—Typical oak-grassland vegetation in an area of Sobrante-Guenoc-Hambright complex, 15 to 30 percent slopes.

oaks and brush are present, forage production can be increased by managing the harvesting of trees and controlling brush. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 9 cords of wood per acre have been measured on the Sobrante and Hambright soils.

The Sobrante and Guenoc soils respond well to fertilizer, rangeland seeding, and proper grazing use. The main limitation for seeding on the Sobrante and Guenoc soils is the woody canopy cover. Seeding generally is not practical on the Hambright soil. Among the common understory plants are soft chess, wild oat, and filaree on the Sobrante and Guenoc soils and soft chess, filaree, manzanita, and chamise on the Hambright soil.

If this unit is used for homesite development, the main limitations are depth to bedrock, the hazard of erosion, and steepness of slope. Other limitations are the low load bearing capacity and moderately slow permeability of the Guenoc soils. Extensive cutting and filling generally are required. Cut slopes are susceptible to excessive erosion. Intensive runoff control measures are needed. Cuts needed to provide building sites can expose bedrock. The risk of erosion is increased if the soil is left exposed during construction. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour.

Shallow depth of the Hambright soil is a major limitation for septic tank absorption fields. The limitations of moderate depth of the Guenoc and Sobrante soils and moderately slow permeability of the Guenoc soil can be minimized by increasing the size of the septic tank absorptions fields or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the limited ability of the Guenoc soil to support a load. If the Guenoc soil is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

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

220—Sobrante-Hambright-Guenoc complex, 30 to 50 percent slopes. This map unit is on hills. Rock outcrop and stones 1 to 15 feet in diameter occur randomly throughout the unit. The vegetation is mainly brush, oaks, and annual grasses. Elevation is 800 to 2,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 30 percent Sobrante loam, 25 percent Hambright very gravelly loam, and 20 percent Guenoc 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 Collayomi and Konocti Variant soils and Rock outcrop. The areas of Rock outcrop occur as escarpments. Also included are small areas of soils that are similar to the Sobrante soil but are 40 to 70 inches deep. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Sobrante soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown loam 10 inches thick. The upper 11 inches of the subsoil is reddish brown loam, and the lower 17 inches is reddish brown clay loam. Hard, fractured basalt is at a depth of 38 inches.

Permeability of the Sobrante soil is moderate. Available water capacity is 2.5 to 7.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Hambright soil is shallow and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown very gravelly loam 4 inches thick. The subsoil is reddish brown very gravelly loam 12 inches thick. Fractured basalt is at a depth of 16 inches. In some areas the surface layer is clay loam.

Permeability of the Hambright soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Guenoc soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown clay loam 3 inches thick. The upper 5 inches of the subsoil is dark red clay, and the lower 20 inches is dark red gravelly clay. Hard, fractured basalt is at a depth of 28 inches. In some areas the surface layer is loam.

Permeability of the Guenoc soil is moderately slow. Available water capacity is 2.0 to 6.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The production of forage is limited by a dense canopy cover in some areas and by the restricted available water capacity and shallow depth of the Hambright soil. Vegetation in drainageways should be left for erosion control, wildlife habitat, and esthetic purposes. Volumes of 9 cords of wood per acre have been measured on the Sobrante and Hambright soils. Rangeland seeding and fertilizing generally are not practical because of steepness of slope and the woody canopy cover. Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote uniform distribution of livestock grazing. Livestock grazing should be managed to protect the unit from excessive erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. Among the common understory plants are soft chess, wild oat, and filaree on the Sobrante and Guenoc soils and soft chess, filaree, manzanita, and chamise on the Hambright soil.

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

221—Sodabay loam, 5 to 15 percent slopes. This very deep, well drained soil is on hills. It formed in material weathered from dacite, tuff, breccia, or volcanic ash. The vegetation is brush with some oaks and sparse annual grasses. Elevation is 1,350 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is light reddish brown loam 6 inches thick. The upper 46 inches of the subsoil is light reddish brown clay loam, and the lower 11 inches is light reddish brown gravelly clay loam. Weathered pyroclastic tuff is at a depth of 63 inches.

Included in this unit are small areas of Benridge and Konocti soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Sodabay soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for homesite development, orchards, wildlife habitat, and watershed.

If this unit is used for homesite development, the main limitation is the moderately slow permeability. This limitation can be minimized by increasing the size of the absorption field or by installing a specially designed sewage disposal system.

The main crop grown on this unit is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. The main limitations are the hazard of erosion and steepness of slope. Use of a cover crop between rows of trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

Woody shrubs are the most extensive plants in areas of this unit that are not cleared. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

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

222—Sodabay loam, 15 to 30 percent slopes. This very deep, well drained soil is on hills. It formed in material weathered from dacite, tuff, breccia, or volcanic ash. The vegetation is mainly brush with some oaks and sparse annual grasses. Elevation is 1,350 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is light reddish brown loam 6 inches thick. The upper 46 inches of the subsoil is light reddish brown clay loam, and the lower 11 inches is light reddish brown gravelly clay loam. Weathered pyroclastic tuff is at a depth of 63 inches.

Included in this unit are small areas of Benridge and Konocti soils. Also included are small areas of Sodabay soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Sodabay soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for homesite development, wildlife habitat, and watershed.

If this unit is used for homesite development, the main limitations are steepness of slope and moderately slow permeability. Extensive cutting and filling generally are required to provide roadbeds and building sites. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. The limitation of moderately slow permeability can be minimized by increasing the size of the absorption fields or by using a specially designed sewage disposal system.

Woody shrubs are the most extensive plants on this unit. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

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

223—Sodabay-Konocti association, 5 to 30 percent slopes. This map unit is on hills and mountains. Rock outcroppings and stones 1 to 25 feet in diameter are present, dominantly on the Konocti soil. The vegetation is mainly brush, oaks, and annual grasses. Elevation is 1,350 to 2,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 50 percent Sodabay loam, 20 percent Konocti cobbly loam, and 15 percent Konocti stony loam. The Konocti soils are on upper side slopes and ridgetops and in drainageways. The Sodabay soil is on side slopes and toe slopes.

Included in this unit are small areas of Benridge soils. Also included are small areas of Konocti and Sodabay soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sodabay soil is very deep and well drained. It formed in material weathered from dacite, tuff, breccia, or volcanic ash. Typically, the surface layer is light reddish brown loam 6 inches thick. The upper 46 inches of the subsoil is light reddish brown clay loam, and the lower 11 inches is light reddish brown gravelly clay loam. Weathered pyroclastic tuff is at a depth of 63 inches.

Permeability of the Sodabay soil is moderately slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is rapid, and the hazard of erosion is severe.

The Konocti cobbly loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown cobbly loam 8 inches thick. The upper 8 inches of the subsoil is brown stony clay loam, and the lower 16 inches is light reddish brown very stony loam. The substratum to a depth of 39 inches is reddish yellow very stony loam. Slightly weathered dacite is at a depth of 39 inches.

Permeability of Konocti cobbly loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Konocti stony loam is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, the surface layer is brown stony loam 4 inches thick. The upper 5 inches of the subsoil is brown stony loam, and the lower 19 inches is light reddish brown very stony clay loam. Slightly weathered dacite is at a depth of 28 inches.

Permeability of the Konocti stony loam is moderately slow. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It is also used for homesite development and orchards.

Woody shrubs are the most extensive plants on this unit. The characteristic vegetation is mainly California scrub oak, manzanita, and soft chess. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, improve access, and reduce the risk of fire.

If this unit is used for homesite development, the main limitations are steepness of slope, the hazard of erosion, and moderately slow permeability. Other limitations are depth to bedrock in the Konocti soils and large stones in the Konocti stony loam. Extensive cutting and filling generally are required to provide roadbeds and building sites. Cutting can expose bedrock and large stones in the Konocti soils. Cut and fill slopes are susceptible to erosion. The risk of erosion is increased if the soil surface is left exposed during construction. Preserving existing vegetation or revegetating disturbed areas around construction sites helps to control erosion. Slope limits installation of septic tank absorption fields. Absorption lines should be installed on the contour. The limitations of moderately slow permeability of the Sodabay and Konocti soils and moderate depth of the Konocti soils can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Large stones in the Konocti stony loam may interfere with building site preparation.

The main crop grown on this unit is walnuts. Irrigation commonly is not used because an adequate irrigation water supply has not been developed. Walnut orchards are primarily on the Sodabay soil in areas where slopes are 5 to 15 percent. The main limitations are the hazard of erosion and steepness of slope. The Konocti soils are poorly suited to orchards. The main limitations are depth to bedrock, available water capacity, and stones on the surface. Areas of this unit where slopes are 15 to 30 percent are poorly suited to orchards. Use of a cover crop between rows of trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum. Adding organic matter to the soil increases the available water capacity and fertility. Stones on the surface limit the use of most equipment on the Konocti stony loam. Rock deflectors should be used on all mowing equipment.

The Sodabay soil is in capability unit IVe-1 (15), nonirrigated. The Konocti soils are in capability unit IVs-1 (15), nonirrigated.

224—Speaker-Marpa-Sanhedrin gravelly loams, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods. Elevation is 1,800 to 3,800 feet. The average annual precipitation is 40 to 55 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 30 percent Speaker gravelly loam, 25 percent Marpa gravelly loam, and 15 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 Etsel, Maymen, and Neuns soils. Also included are small areas of Marpa, Sanhedrin, and Speaker soils that have slopes of more than 50 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Marpa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is light brown gravelly loam 10 inches thick. The upper 5 inches of the subsoil is brown gravelly loam, and the lower 10 inches is strong brown very gravelly clay loam. Sandstone is at a depth of 25 inches.

Permeability of the Marpa soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine and Douglas-fir are the main tree species on the Speaker and Sanhedrin soils. California black oak, interior live oak, and scattered ponderosa pine are the main trees species on the Marpa soil. On the basis of a 100-year site curve, the mean site index is 107 for Douglas-fir and 106 for ponderosa pine on the Speaker soil. On the basis of a 100-year site curve, the mean site index is 103 for Douglas-fir and 105 for ponderosa pine on the Marpa soil. On the basis of a 100-year site curve, the mean site index is 121 for Douglas-fir and 116 for ponderosa pine on the Sanhedrin soil. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Marpa soil is 415

board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees.

Some concerns for the harvesting of timber are steepness of slope, seasonal soil wetness, and the hazard of erosion. 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 harvesting systems. Unsurfaced roads and skid trails on the Speaker and Sanhedrin soils are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on the Speaker and Sanhedrin soils. Revegetation of cut and fill slopes is difficult on the Marpa soil because of the high content of rock fragments and restricted available water capacity.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine seedlings on the Marpa soil and on south-facing aspects. Douglas-fir can be planted on the cooler, north-facing aspects and in most areas of the Sanhedrin soil. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir occurs periodically. When openings are made in the canopy, invading brushy plants that are not controlled can delay the establishment of seedlings.

Among the common forest understory plants are manzanita, snowberry, rose, and perennial grasses.

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

225—Speaker-Maymen-Marpa association, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and hardwoods on the Speaker and Marpa soils and brush and hardwoods on the Maymen soil. Elevation is 1,500 to 4,000 feet. The average annual precipitation is about 35 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 30 percent Speaker gravelly loam, 25 percent Maymen gravelly loam, and 25 percent Marpa gravelly loam. The Speaker and Marpa soils are on north- and east-facing slopes, and the Maymen soil is on south- and west-facing slopes and on ridges.

Included in this unit are small areas of Bamtush, Etsel, Mayacama, Neuns, and Sanhedrin soils and Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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 gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Marpa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is light brown gravelly loam 10 inches thick. The upper 5 inches of the subsoil is brown gravelly loam, and the lower 10 inches is strong brown very gravelly clay loam. Hard, fractured sandstone is at a depth of 25 inches.

Permeability of the Marpa soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, and California black oak are the main tree species on the Speaker and Marpa soils. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 107 on the Speaker soil and 103 on the Marpa soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker soil and 105 on the Marpa soil. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Marpa soil is 415 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are Pacific madrone, sugar pine, and interior live oak. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

Some concerns for the harvesting of timber are the hazard of erosion, seasonal wetness, 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. Rock for construction of roads generally is available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion. Revegetation of cut and fill slopes is difficult on the Maymen and Marpa soils because of the restricted available water capacity and high content of rock fragments.

Seedling survival is a concern in the production of timber on this unit. The high soil temperature and low content of soil moisture during the growing season cause mortality of seedlings, especially in areas of the Marpa soil on south- and southwest-facing slopes. Reforestation of the Speaker and Marpa soils can be accomplished by planting ponderosa pine seedlings. Survival of Douglas-fir seedlings is higher if they are planted on north-facing slopes. If seed trees are present, natural reforestation of cutover areas by conifers occasionally occurs. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations.

Among the common forest understory plants are mountain brome, California fescue, wild pea, and hoary manzanita.

The natural vegetation on the Maymen soil is mainly brush. This soil is used mainly as watershed, wildlife habitat, and recreation areas. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

The Speaker and Marpa soils are in capability subclass VIe (5), nonirrigated. The Maymen soil is in capability subclass VIIe (15), nonirrigated.

226—Speaker-Maymen-Marpa association, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and hardwoods on the Speaker and Marpa soils and brush and hardwoods on the Maymen soil. Elevation is 1,500 to 4,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 130 to 180 days.

This unit is about 30 percent Speaker gravelly loam, 25 percent Maymen gravelly loam, and 20 percent Marpa gravelly loam. The Speaker and Marpa soils are on north- and east-facing slopes, and the Maymen soil is on south- and west-facing slopes and on ridges.

Included in this unit are small areas of Bamtush, Etsel, Mayacama, Neuns, and Sanhedrin soils and Rock outcrop. The areas of Rock outcrop are on ridges or side slopes. Included areas make up about 25 percent of the unit. The percentage varies from one areas to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Marpa soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is light brown gravelly loam 10 inches thick. The upper 5 inches of the subsoil is brown gravelly loam, and the lower 10 inches is strong brown very gravelly clay loam. Hard, fractured sandstone is at a depth of 25 inches.

Permeability of the Marpa soil is moderate. Available water capacity is 1.5 to 4.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Ponderosa pine, Douglas-fir, California black oak, and interior live oak are the main tree species on the Speaker and Marpa soils. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker soil and 105 on the Marpa soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 107 on the Speaker soil and 103 on the Marpa soil. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Marpa soil is 415 board feet per acre from a fully stocked stand of trees. Estimates of the site index and yield for California black oak and interior live oak have not been made.

The main limitations for the harvesting of timber are steepness of slope and the hazard of erosion. Cable

yarding systems generally should be used on this unit. 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. They may be impassable during rainy periods. Rock for construction of roads generally is available on this unit. Roads may fail and landslides may occur if deep road cuts are made.

Seedling mortality is a concern in the production of timber. The high soil temperature and low content of soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes. Reforestation can be accomplished by planting Douglas-fir seedlings on the cooler aspects and ponderosa pine on the hotter, south aspects. Natural reforestation of cutover areas by Douglas-fir seldom occurs. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit.

Among the common forest understory plants are mountain brome, California fescue, wild pea, and hoary manzanita.

The natural vegetation on the Maymen soil is mainly brush. This soil is used mainly as watershed, wildlife habitat, and recreation areas. Properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

The Speaker and Marpa soils are in capability subclass VIIe (5), nonirrigated. The Maymen soil is in capability subclass VIIe (15), nonirrigated.

227—Speaker-Maymen-Millsholm association, 30 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly mixed conifers and hardwoods on the Speaker soil, brush on the Maymen soil, and oaks and annual grasses on the Millsholm soil. Elevation is 1,400 to 3,000 feet. The average annual precipitation is 30 to 40 inches. The average annual air temperature of the Maymen and Speaker soils is 53 to 56 degrees F, and the average frost-free period is 155 to 190 days. The average annual air temperature of the Millsholm soil is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

This unit is about 40 percent Speaker loam, 25 percent Maymen gravelly loam, and 15 percent Millsholm loam. The Speaker soil is on east- and north-facing slopes, and the Maymen and Millsholm soils are on west- and south-facing slopes.

Included in this unit are small areas of Bressa, Etsel, Marpa, and Sanhedrin soils. Also included are small areas of Maymen, Millsholm, and Speaker soils that have slopes of less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is reddish brown loam 9 inches thick. The upper 6 inches of the subsoil is light reddish brown loam, and the lower 24 inches is reddish yellow cobbly clay loam. Soft sandstone is at a depth of 39 inches. In some areas the surface layer is gravelly sandy loam.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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 gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Millsholm soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is pale brown loam 9 inches thick. The next layer is pale brown clay loam 6 inches thick. The subsoil is very pale brown clay loam 3 inches thick. Fractured sandstone is at a depth of 18 inches.

Permeability of the Millsholm soil is moderate. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Douglas-fir and ponderosa pine are the main tree species on the Speaker soil. On the basis of a 100-year site curve, the mean site index is 107 for Douglas-fir and 106 for ponderosa pine. The potential annual production of ponderosa pine is 425 board feet per acre from a fully stocked stand of trees. Conifer stands commonly are small and widely scattered, making them generally noncommercial. Among the trees of limited extent are knobcone pine, California black oak, and Pacific madrone.

Some concerns for the harvesting of timber are steepness of slope, seasonal wetness, and the hazard of erosion. 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. They may be

impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Seedling mortality is a concern in the production of timber. The high soil temperature and low content of soil moisture during the growing season cause mortality of seedlings, especially on the south- and southwest-facing slopes. Reforestation can be accomplished by planting Douglas-fir seedlings on the cooler aspects and ponderosa pine on the hotter, south aspects. If seed trees are present, natural reforestation of cutover areas by Douglas-fir seldom occurs. Proper site preparation is necessary to replace stands of brush and hardwoods with conifers on the Speaker soil. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations on this unit.

The production of forage is limited by a dense canopy cover in some areas and by the restricted available water capacity and shallow depth of the Millsholm soil. The Speaker and Maymen soils support very sparse stands of vegetation suitable for grazing. Where oaks are present on the Millsholm soil, forage production can be increased by managing the harvesting of trees. Because of the instability of the Millsholm soil, trees should be retained. In areas dominated by brush, properly planned and applied prescribed burning or chemical or mechanical treatment can be used in small areas to improve habitat for wildlife, increase access, and reduce the risk of fire.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote uniform distribution of livestock grazing. Livestock grazing should be managed to protect the unit from erosion.

Among the common forest understory plants on the Speaker soil are mountain brome, California fescue, wild pea, and hoary manzanita. The characteristic plant community on the Maymen soil is mainly chamise and ceanothus. Among the common understory plants on the Millsholm soil are soft chess, filaree, and manzanita.

The Speaker soil is in capability subclass VIe (5), nonirrigated; the Maymen soil is capability subclass VIIe (15), nonirrigated, and the Millsholm soil is in capability subclass VIe (15), nonirrigated.

228—Speaker-Sanhedrin gravelly loams, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods with some shrubs. Elevation is 1,600 to 3,500 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 130 to 190 days.

This unit is about 35 percent Speaker gravelly 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 Bamtush, Etsel, Marpa, and Maymen soils. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat partially decomposed needles, leaves, and twigs 1 inch thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly clay loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Douglas-fir, ponderosa pine, and California black oak are the main tree species in some areas of this unit. In many areas knobcone pine, California black oak, California-laurel, and Pacific madrone are dominant because of past fires. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 107 on the Speaker soil and 121 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker soil and 116 on the Sanhedrin soil. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees.

The main limitations for the harvesting of timber are steepness of slope and the hazard of erosion. Cable yarding systems are suited to this unit. 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. A concern for the harvesting of timber is seasonal

wetness. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Roads may fail and landslides may occur if deep road cuts are made.

Plant competition is a concern in the reforestation and production of timber. Proper site preparation on this unit is necessary to replace stands of brush, knobcone pine, and hardwoods with commercial conifers. Reforestation can be accomplished by planting Douglas-fir and ponderosa pine seedlings. Because of the high risk of fire on the surrounding brush-covered soils, firebreaks are needed to protect plantations and other improvements on this unit.

Among the common forest understory plants are bedstraw, wild pea, annual grasses, and forbs.

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

229—Speaker-Sanhedrin-Maymen association, 30 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly mixed conifers and hardwoods and some brush on the Speaker and Sanhedrin soils and brush with some annual grasses on the Maymen soil. Elevation is 2,100 to 4,000 feet. The average annual precipitation is 40 to 60 inches. The average annual air temperature in areas of the Speaker and Sanhedrin soils is 50 to 55 degrees F, and the average frost-free period is 120 to 180 days. The average annual air temperature in areas of the Maymen soil is 52 to 56 degrees, and the average frost-free period is 130 to 180 days.

This unit is about 30 percent Speaker gravelly loam, 30 percent Sanhedrin gravelly loam, and 20 percent Maymen gravelly loam. The Maymen soil is on west- and south-facing, brush-covered side slopes and ridgetops, and the Speaker and Sanhedrin soils are on east- and north-facing slopes.

Included in this unit are small areas of Bamtush, Etsel, and Neuns soils. Also included are small areas of soils that are at an elevation of more than 4,000 feet. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone and shale. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone or shale. Typically, the upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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 gravelly loam 4 inches thick. The subsoil is light yellowish brown gravelly loam 8 inches thick. Hard, fractured sandstone is at a depth of 12 inches.

Permeability of the Maymen soil is moderate. Available water capacity is 1 to 3 inches. Effective rooting depth is 12 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

Ponderosa pine and Douglas-fir are the main tree species on the Speaker and Sanhedrin soils. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker soil and 116 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 107 on the Speaker soil and 121 on the Sanhedrin soil. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are California black oak, Pacific madrone, and sugar pine.

Some concerns for the harvesting of timber are steepness of slope, the hazard of erosion, 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. 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 harvesting systems. Unsurfaced roads and skid trails are slippery when wet. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion on these soils.

Plant competition is a concern in the production of timber. When openings are made in the canopy, invading brushy plants that are not controlled can delay the establishment of seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings on

the hotter aspects and Douglas-fir on the cooler, north aspects. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and Douglas-fir occurs periodically.

Among the common forest understory plants are wild pea, bedstraw, snowberry, rose, and annual forbs.

The natural vegetation on Maymen soil is mainly brush. The species in most areas are mainly chamise, manzanita, and buckbrush.

The Speaker and Sanhedrin soils are in capability subclass VIe (5), nonirrigated. The Maymen soil is in capability subclass VIIe (15), nonirrigated.

230—Speaker-Speaker Variant-Sanhedrin association, 5 to 30 percent slopes. This map unit is on broad ridgetops on mountains. The vegetation is mainly mixed conifers and hardwoods and some brush. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 120 to 180 days.

This unit is about 30 percent Speaker gravelly loam, 25 percent Speaker Variant loam, and 20 percent Sanhedrin gravelly loam. The Speaker Variant soil is on broad ridgetops, and the Speaker and Sanhedrin soils are on shoulder slopes and side slopes.

Included in this unit are small areas of Marpa and Maymen soils. Also included are small areas of soils that are similar to the Speaker soil but have a loam subsoil. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Speaker soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The surface layer is brown gravelly loam 2 inches thick. The upper 6 inches of the subsoil is reddish yellow gravelly loam, and the lower 19 inches is reddish yellow clay loam. Soft sandstone is at a depth of 27 inches.

Permeability of the Speaker soil is moderately slow. Available water capacity is 2 to 6 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Speaker Variant soil is shallow and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is light yellowish brown loam 4 inches thick. The upper 6 inches of the subsoil is light yellowish brown clay loam, and the lower 7 inches is reddish yellow gravelly clay loam. Soft sandstone is at a depth of 17 inches.

Permeability of the Speaker Variant soil is moderately slow. Available water capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Sanhedrin soil is deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 2 inches thick. The upper part of the surface layer is brown gravelly loam 4 inches thick, and the lower part is pale brown gravelly loam 4 inches thick. The upper 33 inches of the subsoil is light yellowish brown and reddish yellow gravelly loam, and the lower 16 inches is reddish yellow gravelly clay loam. Weathered sandstone is at a depth of 57 inches.

Permeability of the Sanhedrin soil is moderately slow. Available water capacity is 4 to 8 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

Douglas-fir and ponderosa pine 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 107 on the Speaker soil, 80 on the Speaker Variant soil, and 121 on the Sanhedrin soil. On the basis of a 100-year site curve, the mean site index for ponderosa pine is 106 on the Speaker soil, 80 on the Speaker Variant soil, and 116 on the Sanhedrin soil. The potential annual production of ponderosa pine on the Speaker soil is 425 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Speaker Variant soil is 225 board feet per acre from a fully stocked stand of trees. The potential annual production of ponderosa pine on the Sanhedrin soil is 530 board feet per acre from a fully stocked stand of trees. Among the trees of limited extent are California black oak, Pacific madrone, and sugar pine.

A concern for the harvesting of timber is seasonal soil 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. They may be impassable during rainy periods. Rock for construction of roads is not readily available on this unit. Establishing plant cover on steep cut and fill slopes reduces erosion.

Seedling survival is a concern in the production of timber. Reforestation can be accomplished by planting Douglas-fir seedlings on the cooler aspects and ponderosa pine on the hotter, south aspects. If seed trees are present, natural reforestation of cutover areas by Douglas-fir and ponderosa pine occurs periodically. The high soil temperature and low content of soil moisture during the growing season cause mortality of seedlings, especially in areas of the Speaker and Speaker Variant soils on south- and southwest-facing slopes.

Among the common forest understory plants are wild pea, mountain brome, California fescue, and manzanita.

The Speaker and Sanhedrin soils are in capability unit IVe-1 (5), nonirrigated, and the Speaker Variant soil is in capability subclass VIe (5), nonirrigated.

231—Squawrock-Shortyork Variant gravelly loams, 15 to 30 percent slopes. This map unit is on mountains. The Shortyork soil is susceptible to slumping. The vegetation is mainly annual grasses and forbs with a few scattered oaks and conifers. Elevation is 2,000 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 130 to 180 days.

This unit is about 40 percent Squawrock gravelly loam and 35 percent Shortyork Variant 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 Deadwood, Neuns, Speaker, and Yorkville soils. Also included are small areas of Shortyork and Squawrock soils that have slopes of less than 15 percent or more than 30 percent and soils that are similar to the Squawrock soil but are less than 20 inches deep to bedrock. Included areas make up about 25 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 weathered from sandstone. Typically, the surface layer is grayish brown gravelly loam 8 inches thick. The subsoil is light brownish gray very gravelly clay loam 29 inches thick. Hard, fractured sandstone is at a depth of 37 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Shortyork Variant soil is moderately deep and well drained. It formed in material weathered from metamorphased sandstone and greenstone. Typically, the surface layer is dark grayish brown gravelly loam 9 inches thick. The upper 3 inches of the subsoil is grayish brown very gravelly clay loam, and the lower 20 inches is variegated brown and light olive brown very gravelly clay. Hard, fractured greenstone and metamorphosed sandstone are at a depth of 32 inches.

Permeability of the Shortyork Variant soil is very slow. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

The production of forage is limited by the restricted available water capacity of the Squawrock soil and by the susceptibility of the Shortyork Variant soil to compaction when wet. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess and wild oat.

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

232—Still loam. This very deep, well drained soil is on alluvial plains. It formed in alluvium derived from mixed rock sources, dominantly sandstone and shale. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered oaks. Elevation is 1,000 to 2,000 feet. The average annual precipitation is 25 to 34 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is brown loam 7 inches thick. The next layer is brown clay loam 25 inches thick. The underlying material to a depth of 70 inches is brown clay loam.

Included in this unit are small areas of Kelsey and Talmage soils. Also included are small areas of clayey soils in depressional areas, soils that are similar to this Still soil but have a seasonal high water table at a depth of 4 to 6 feet, soils that are similar to this Still soil but have a surface layer that has been compacted by livestock or are at an elevation of as much as 2,400 feet, and soils that are similar to this Still soil but are in narrow valleys adjacent to hills and mountains and have a shorter frost-free period because of cold air drainage. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Still soil is moderately slow. Available water capacity is 8.5 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. Some areas adjacent to stream channels are subject to rare periods of flooding. Many areas of this soil are protected by dikes and levees.

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

The main crops grown on this unit are wine grapes, walnuts, and pears. Irrigation commonly is used for maximum production of these crops. The main limitation is the hazard of flooding. In areas with a flooding hazard, capital improvements should be designed to withstand flooding.

This unit is well suited to hay and pasture.

If this unit is used for homesite development, the main limitations are moderately slow permeability and the hazard of flooding. Increasing the size of the septic tank absorption fields or using a specially designed disposal system can help to compensate for the moderately slow permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

This map unit is in capability class I (14), irrigated, and capability unit IIIc-1 (14), nonirrigated.

233—Still loam, stratified substratum. This very deep, well drained soil is on alluvial plains. It formed in alluvium derived from mixed rock sources, dominantly sandstone and shale. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs with scattered oaks. Elevation is 1,000 to 2,000 feet. The average annual precipitation is 25 to 34 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the upper part of the surface layer is brown loam 6 inches thick and the lower part is brown clay loam 30 inches thick. The upper 16 inches of the underlying material is stratified, brown clay loam and loam, and the lower part to a depth of 70 inches is extremely gravelly loamy coarse sand. In some areas the surface layer is gravelly loam.

Included in this unit are small areas of Cole, Cole Variant, Kelsey, Lupoyoma, and Talmage soils and Xerofluvents. Also included are small areas of soils that are similar to this Still soil but have a seasonal high water table at a depth of 2 to 4 feet, soils that have a surface layer that has been compacted by livestock, soils that do not have a gravelly substratum, and soils that are similar to this Still soil but are at elevations of as much as 2,300 feet. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Still soil is moderately slow. Available water capacity is 7.5 to 10.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. Some areas adjacent to stream channels are subject to rare periods of flooding. Many areas of this soil are protected from flooding by dikes and levees.

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

The main crops grown on this unit are walnuts, pears, and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitation is the hazard of flooding in some areas. In areas that are subject to flooding, capital improvements should be designed to withstand flooding.

This unit is well suited to hay and pasture.

If this unit is used for homesite development, the main limitations are the moderately slow permeability, the rapidly permeable underlying material, and the hazard of flooding. Increasing the size of the septic tank absorption fields or using a specially designed sewage disposal system can help to compensate for the moderately slow permeability. The disposal system should be designed so that effluent does not reach the rapidly permeable underlying material. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

This map unit is in capability class I (14), irrigated, and capability unit IIIc-3 (14), nonirrigated.

234—Still gravelly loam. This very deep, well drained soil is on alluvial plains. It formed in alluvium derived from mixed rock sources, dominantly sandstone or shale. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and a few scattered oaks. Elevation is 1,300 to 2,000 feet. The average annual precipitation is 25 to 34 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the upper part of the surface layer is brown gravelly loam 3 inches thick and the lower part to a depth of 36 inches brown gravelly clay loam. The underlying material to a depth of 70 inches is brown clay loam. In some areas the surface layer is very gravelly loam.

Included in this unit are small areas of Cole Variant, Kelsey, Lupoyoma, and Talmage soils and Xerofluvents. Also included are small areas of Still soils, mainly in Scotts Valley, that have slopes of 2 to 5 percent, soils at elevations of as much as 2,400 feet, soils that are similar to this Still soil but are in narrow valleys adjacent to hills and mountains and have a shorter frost-free period because of cold air drainage, and soils that are lighter colored throughout the profile. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Still soil is moderately slow. Available water capacity is 7.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. Some areas adjacent to stream channels are subject to rare periods of flooding. Some areas are protected from flooding by dikes and levees.

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

This unit is well suited to hay and pasture.

This unit is well suited to orchards and vineyards. The main crops grown on this unit are walnuts, pears, and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitation is the hazard of flooding. In areas that are subject to flooding, capital improvements should be designed to withstand flooding.

If this unit is used for homesite development, the main limitations are the moderately slow permeability and the hazard of flooding. Increasing the size of the septic tank absorption fields or using a specially designed sewage disposal system can help to compensate for the moderately slow permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from

flooding. Roads and streets should be located above the expected flood level.

This map unit is in capability units IIs-4 (14), irrigated, and IIIs-4 (14), nonirrigated.

235—Still-Talmage complex, 2 to 8 percent slopes. This map unit is on alluvial fans and flood plains. The vegetation is mainly annual grasses and forbs with scattered oaks. Elevation is 1,300 to 1,800 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

This unit is about 55 percent Still gravelly loam and 30 percent Talmage 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 Cole Variant and Kelsey soils and Xerofluvents. Also included are small areas of soils that are similar to the Still and Talmage soils but are at elevations of as much as 2,900 feet. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Still soil is very deep and well drained. It formed in alluvium derived from mixed rock sources, dominantly sandstone or shale. Typically, the upper part of the surface layer is brown gravelly loam 3 inches thick and the lower part is brown gravelly clay loam 33 inches thick. The underlying material to a depth of 70 inches is brown clay loam. In some areas the surface layer is very gravelly loam.

Permeability of the Still soil is moderately slow. Available water capacity is 7.5 to 9.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is moderate. Areas of this soil near stream channels are subject to rare periods of flooding during prolonged, high-intensity storms.

The Talmage soil is very deep and somewhat excessively drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is grayish brown very gravelly sandy loam 33 inches thick. The underlying material to a depth of 70 inches is stratified, light yellowish brown and grayish brown gravelly sandy loam, very gravelly loam, and gravelly loam. In some areas the surface layer is gravelly sandy loam.

Permeability of the Talmage soil is moderately rapid. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is medium, and the hazard of erosion is slight. Areas of this soil near stream channels are subject to rare periods of flooding during prolonged, high-intensity storms.

This unit is used mainly for livestock grazing and hay and pasture. It is also used for orchards and vineyards.

The production of forage on the Talmage soil is limited by the restricted available water capacity. The Still soil has few limitations and responds well to rangeland seeding and fertilization. Rangeland seeding on the Talmage soil generally is not practical because of the restricted available water capacity and high content of gravel. Livestock should be fenced out of gullies and off streambanks to help control erosion. The characteristic plant community on this unit is mainly soft chess, filaree, and wild oat.

If this unit is used for hay and pasture, the main limitations are the restricted available water capacity and the very gravelly surface layer of the Talmage soil. Frequent irrigations may be needed because of the restricted available water capacity of the Talmage soil. Rock fragments in the surface layer of the Talmage soil cause the rapid wear of tillage equipment.

The main crops grown on this unit are walnuts, pears, and wine grapes. Irrigation commonly is used for maximum production of these crops. The main limitations of this unit are the hazard of flooding in areas adjacent to streams and the restricted available water capacity and the very gravelly surface layer of the Talmage soil. Capital improvements on this unit should be built to withstand flooding. To avoid overirrigating and leaching of plant nutrients, application of irrigation water should be adjusted to the restricted available water capacity of the Talmage soil, the water intake rate, and the crop needs. Rock fragments in the surface layer cause the rapid wear of tillage equipment.

This map unit is in capability unit IVs-4 (14), irrigated and nonirrigated.

236—Stonyford-Guenoc complex, 30 to 50 percent slopes. This map unit is on hills. The vegetation is mainly brush and sparse annual grasses. Elevation is 1,400 to 2,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 57 to 60 degrees F, and the average frost-free period is 160 to 205 days.

This unit is about 40 percent Stonyford gravelly loam and 35 percent Guenoc 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 Guenoc and Stonyford soils that are on flat, rounded knolls and have slopes of 5 to 30 percent. Also included are small areas of soils that are similar to the Guenoc soil but are more than 40 inches deep and soils that are similar to the Stonyford and Guenoc soils but have more than 35 percent rock fragments. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Stonyford soil is shallow and somewhat excessively drained. It formed in material weathered from basalt. Typically, the surface layer is dark reddish brown gravelly loam 2 inches thick. The upper 3 inches of the subsoil is yellowish red gravelly loam, and the lower 5 inches is yellowish red gravelly clay loam. Hard,

fractured, metamorphased basalt is at a depth of 10 inches.

Permeability of the Stonyford soil is moderately slow. Available water capacity is 1 inch to 3 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Guenoc soil is moderately deep and well drained. It formed in material weathered from basalt. Typically, the surface layer is reddish brown clay loam 3 inches thick. The upper 5 inches of the subsoil is dark red clay, and the lower 20 inches is dark red gravelly clay. Hard, fractured basalt is at a depth of 28 inches.

Permeability of the Guenoc soil is moderately slow. Available water capacity is 2.0 to 6.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly as wildlife habitat and watershed. It is also used for homesite development. Areas that are cleared can also be used for livestock grazing.

If this unit is used for homesite development, the main limitations are steepness of slope, depth to bedrock, and the hazard of erosion. Other limitations are the moderately slow permeability and low load bearing capacity of the Guenoc soil. Preferred building sites are limited to knolls and the less sloping areas. Steepness of slope presents many problems when the unit is used for homesite development. Extensive cutting and filling generally are required. Cuts needed to provide building sites can expose bedrock. Cut slopes are susceptible to erosion. Intensive runoff control measures are needed. The risk of erosion is increased if the soil is left exposed during construction. Preserving existing vegetation and revegetating disturbed areas around construction sites help to control erosion. Slope and shallow depth to bedrock in the Stonyford soil are major limitations for septic tank absorption fields. Absorption lines should be installed on the contour. The limitations of moderate depth and slow permeability of the Guenoc soil can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. Buildings and roads should be designed to offset the limited ability of the Guenoc soil to bear a load. If this soil is used as a base for roads and streets, it can be mixed with sand and gravel to increase its strength and stability.

The production of forage is limited by a tendency of this unit to produce woody species and by the restricted available water capacity and shallow depth of the Stonyford soil. If the shrubs are managed to create open areas, this unit can produce a good stand of desirable grasses and forbs. Leaving woody plants in the drainageways and in areas where slopes are more than 40 percent reduces erosion and provides habitat for wildlife. The characteristic plant community is mainly chamise, manzanita, and ceanothus.

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

237—Talmage very gravelly sandy loam. This very deep, somewhat excessively drained soil is on alluvial fans and flood plains and in areas adjacent to drainageways. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation is mainly annual grasses and forbs with scattered oaks. Elevation is 1,300 to 1,800 feet. The average annual precipitation is 25 to 50 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is grayish brown very gravelly sandy loam 33 inches thick. The underlying material to a depth of 70 inches is stratified, light yellowish brown and grayish brown gravelly sandy loam, very gravelly loam, and gravelly loam. In some areas the surface layer is gravelly sandy loam.

Included in this unit are small areas of Kelsey soils, Xerofluvents, and soils that are similar to this Talmage soil but are at elevations of more than 1,800 feet in Gravelly Valley, near Lake Pillsbury, and in Johnson's Glade, south of Pine Mountain. Also included are small areas of soils that are similar to this Talmage soil but have less than 35 percent gravel throughout the profile, have a lighter colored surface layer, or have a subsoil of sandy clay loam or clay loam. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Talmage soil is moderately rapid. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. Areas of this soil near stream channels are subject to rare periods of flooding during prolonged, high-intensity storms.

This unit is used mainly for livestock grazing and for hay and pasture. It is also used for orchards and vineyards.

The production of forage is limited by the high content of gravel in the soil and the restricted available water capacity. Seeding on this unit generally is not practical. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The characteristic plant community on this unit is mainly soft chess and filaree.

This unit is poorly suited to hay and pasture. The main limitations are the restricted available water capacity and the very gravelly surface layer. Frequent irrigations may be needed because of the restricted available water capacity. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. Rock fragments in the surface layer cause the rapid wear of tillage equipment.

This unit is poorly suited to irrigated crops. The main crops grown are walnuts and wine grapes. Irrigation

commonly is used for maximum production of these crops. The restricted available water capacity, the very gravelly surface layer, and the rare periods of flooding are the main limitations. To avoid overirrigating and leaching of plant nutrients, application of irrigation water should be adjusted to the restricted available water capacity, the water intake rate, and the crop needs. Rock fragments in the surface layer cause the rapid wear of tillage equipment. Capital improvements on this unit should be designed to withstand flooding.

This map unit is in capability unit IVs-4 (14), irrigated and nonirrigated.

238—Tulelake silty clay loam, flooded. This very deep, poorly drained soil is in intermittent lake basins. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs and water tolerant plants. Elevation is 1,300 to 1,400 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 170 to 210 days.

Typically, the surface layer is grayish brown silty clay loam 10 inches thick. The underlying material to a depth of 77 inches is stratified, gray and light brownish gray silty clay loam and silty clay.

Included in this unit are small areas of Landlow Variant, Maywood Variant, and Still soils. Also included are small areas of soils that are similar to this Tulelake soil but are loam, silt loam, sandy loam, or silty clay loam and have a thick, dark-colored surface layer that is high in content of organic matter; these soils are mainly at the eastern end of Tule Lake and in Scotts Valley. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Tulelake soil is slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is limited by the presence of a seasonal high water table. This soil is subject to frequent, long to very long periods of flooding during winter and spring. The part of this unit that is in Tule Lake is artificially drained in spring and summer by pumping into Scotts Creek. The water table drops to between 3 and 6 feet by late in summer and fall. Surface runoff is ponded, and the hazard of erosion is slight.

This unit is used for hay and pasture and field crops.

If this unit is used for hay and pasture, the main limitations are the hazard of flooding, the seasonal high water table, and poor drainage. The risk of flooding can be reduced by the use of dikes and levees. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Irrigation commonly is not needed in areas where the water table remains at a shallow depth during most of the growing season.

The main crops grown on this unit are safflower, sunflower, and milo. Some wild rice is also grown. These crops commonly do not need irrigation because of the shallow depth to the seasonal high water table in the early part of the growing season. The main limitations are the hazard of flooding, the seasonal high water table, and poor drainage. Capital improvements should be designed to withstand flooding. Excess water can be removed by installing subsurface drains or drainage ditches, or both.

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

239—Tulelake silty clay loam, protected. This very deep, poorly drained soil is in reclaimed lake basins. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs and water tolerant species. Elevation is 1,300 to 1,400 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 200 days.

Typically, the surface layer is grayish brown silty clay loam 10 inches thick. The underlying material to a depth of 77 inches is stratified, gray and light brownish gray silty clay loam and silty clay.

Included in this unit are small areas of Cole and Landlow Variant soils. Also included are small areas of soils that are similar to this Tulelake soil but are calcareous and have less clay. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of Tulelake soil is slow. Available water capacity is 9.0 to 10.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is slow, and the hazard of water erosion is slight. This soil is within the Westlake Reclamation District. A dam at the lower end of Tule Lake and dikes and levees protect the soil from flooding. Flooding may occur, however, during abnormally wet years. In winter and early in spring, this soil has a water table that fluctuates between depths of 18 and 36 inches. The water table drops to below a depth of 60 inches during the growing season. The shrink-swell potential is high in the subsoil.

This unit is used mainly for hay and pasture.

If this unit is used for hay and pasture, the main limitations are poor drainage and slow permeability. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Because of the slow permeability, the application of irrigation water should be regulated so that water does not stand on the surface for long periods of time. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

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

240—Tyson-Neuns gravelly loams, 30 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly hardwoods, shrubs, and some conifers. Elevation is 3,300 to 5,000 feet. The average annual precipitation is 40 to 60 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free period is 110 to 170 days.

This unit is about 40 percent Tyson gravelly loam and 35 percent Neuns 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 Deadwood, Sheetiron, and Speaker soils. Also included are small areas of soils that are similar to the Tyson soil but have more clay in the subsoil or have less than 35 percent rock fragments, soils that are similar to the Neuns soil but have more clay in the subsoil, and soils that are at elevations of more than 5,000 feet. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Tyson soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone. Typically, the surface is covered with a mat of decomposed and partially decomposed leaves, twigs, and bark 1.5 inches thick. The upper part of the surface layer is dark grayish brown gravelly loam 9 inches thick, and the lower part is brown very gravelly loam 6 inches thick. The subsoil is light yellowish brown very cobbly clay loam 12 inches thick. Hard, fractured, metamorphosed sandstone is at a depth of 27 inches.

Permeability of the Tyson soil is moderate. Available water capacity is 1.5 to 5.0 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Neuns soil is moderately deep and well drained. It formed in material weathered from sandstone and metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed needles, leaves, twigs, and bark 1.5 inches thick. The surface layer is light yellowish brown gravelly loam 4 inches thick. The upper 10 inches of the subsoil is pale brown very gravelly loam, and the lower 17 inches is reddish yellow very gravelly loam. Hard, fractured sandstone is at a depth of 31 inches.

Permeability of the Neuns soil is moderate. Available water capacity is 1.0 inch to 3.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Brewer oak and Oregon white oak are the main tree species on this unit. Volumes of 10 to 20 cords of wood per acre have been measured on the Tyson soil. Among the trees of limited extent are Douglas-fir and California black oak. Conifer stands commonly are small and widely scattered, making them generally noncommercial.

Among the common forest understory plants are blue wildrye, bedstraw, brodiaea, lupine, and annual grasses.

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

241—Vitrandepts-Cinder land complex, 15 to 75 percent slopes. This map unit is on volcanic cinder cones. The native vegetation is mainly brush and scattered oaks and conifers. Elevation is 1,500 to 2,200 feet. The average annual precipitation is 24 to 32 inches, the average annual air temperature is 56 to 60 degrees F, and the average frost-free period is 160 to 210 days.

This unit is 45 percent Vitrandepts and 45 percent Cinderland. 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 Konocti, Konocti Variant, and Sodabay soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

No single profile of Vitrandepts is typical, but one commonly observed in the survey area has a dark brown cindery sandy loam surface layer 7 inches thick. The upper 30 inches of the subsoil is brown and yellowish red very cindery sandy loam, and the lower 16 inches is yellowish red extremely cindery sandy loam. Scoriaceous basalt and scoria are at a depth of 53 inches. Depth to cindery bedrock ranges from 20 inches to more than 60 inches.

Permeability of Vitrandepts is rapid. Available water capacity is very low or low.

Cinderland is composed of loose cinders and other scoriaceous magmatic ejecta. Available water capacity is 1.5 to 2.5 inches.

This unit is used mainly as wildlife habitat and watershed. It is also used as cinder quarries.

In areas where this unit is used as cinder quarries, the topsoil should be stockpiled for use during land reclamation after mining is complete.

This map unit is in capability class VIII (15), nonirrigated.

242—Wappo loam, 2 to 8 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly annual grasses and forbs with scattered oaks. Elevation is 1,400 to 1,600 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is brown loam 10 inches thick. The upper 24 inches of the subsoil is strong brown clay, and the lower 17 inches is reddish yellow clay loam and sandy clay loam. The substratum to a depth of 63 inches is light yellowish brown clay loam. In some areas the surface layer is clay loam.

Included in this unit are small areas of Forbesville and Manzanita soils. Also included are small areas of soils, on convex ridges and side slopes, that are similar to the Wappo soil but are 20 to 40 inches deep over sedimentary rock and small areas of soils that have 15 to 35 percent gravel in the substratum. This unit is dissected by numerous drainageways 1 foot to 10 feet deep. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Wappo soil is very slow. Available water capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. The clay layer in the subsoil may restrict root penetration. Surface runoff is medium, and the hazard of erosion is moderate. The shrink-swell potential in the subsoil is high.

This unit is used mainly for livestock grazing. It is also used for vineyards, hay and pasture, and homesite development.

The production of forage is limited by the susceptibility of the soil to compaction when moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly wild oat, soft chess, and filaree.

The main crop grown on this unit is wine grapes. Irrigation commonly is used for maximum production. The very slow permeability and the hazard of erosion are the main limitations. Because of the very slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of a cover crop between rows of vines and trees helps to control erosion. All tillage should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are very slow permeability and the hazard of erosion. Because of the very slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

If this unit is used for homesite development, the main limitations are very slow permeability, high shrink-swell potential of the subsoil, and low load bearing capacity. If the unit is used for septic tank absorption fields, the limitation of very slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The shrink-swell potential and low load bearing capacity of the soil should be considered when designing and constructing foundations, concrete structures, and paved areas. The effect of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads or streets, it can be mixed with sand and gravel to increase its strength and stability.

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

243—Wappo loam, 8 to 15 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly annual grasses and forbs with scattered blue oaks. Elevation is 1,450 to 1,650 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 57 to 59 degrees F, and the average frost-free period is 160 to 205 days.

Typically, the surface layer is brown loam 10 inches thick. The upper 24 inches of the subsoil is strong brown clay, and the lower 17 inches is reddish yellow clay loam and sandy clay loam. The substratum to a depth of 63 inches is light yellowish brown clay loam. In some areas the surface layer is clay loam.

Included in this unit are small areas of Forbesville and Manzanita soils. Also included are small areas of soils that are similar to this Wappo soil but have slopes of 15 to 30 percent, are 20 to 40 inches deep over sedimentary rock and are on convex ridges and side slopes, have less clay in the subsoil, have redder colors, or have 15 to 35 percent gravel in the substratum. This unit is dissected by numerous drainageways 1 foot to 10 feet deep. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Wappo soil is very slow. Available water capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. The clay layer in the subsoil may restrict root penetration. Surface runoff is rapid, and the hazard of erosion is moderate. The shrink-swell potential in the subsoil is high.

This unit is used mainly for livestock grazing. It is also used for vineyards, hay and pasture, and homesite development.

The production of forage is limited by the susceptibility of the soil to compaction when moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. The soil in this unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly wild oat, soft chess, and filaree.

The main crop grown on this unit is wine grapes. Irrigation commonly is used for maximum production. The hazard of erosion, steepness of slope, and very slow permeability are the main limitations. Because of the very slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of a cover crop between rows of vines helps to control erosion. All tillage

should be on the contour or across the slope. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are the hazard of erosion and very slow permeability. Because of the very slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

If this unit is used for homesite development, the main limitations are very slow permeability, high shrink-swell potential in the subsoil, and low load bearing capacity. If this unit is used for septic tank absorption fields, the limitation of very slow permeability can be minimized by increasing the size of the absorption field or by using a specially designed sewage disposal system. The shrink-swell potential and low load bearing capacity of the soil in this unit should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads or streets, it can be mixed with sand and gravel to increase its strength and stability.

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

244—Wappo Variant clay loam, 2 to 8 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in alluvium derived from mixed rock sources. The vegetation is mainly annual grasses and scattered brush and oaks. Elevation is 1,400 to 1,650 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 200 days.

Typically, the surface layer is yellowish red clay loam 4 inches thick. The upper 11 inches of the subsoil is yellowish red clay, and the lower 69 inches is yellowish red gravelly and very gravelly clay loam. In some areas the surface layer is loam.

Included in this unit are small areas of Forbesville and Neice soils. Also included are small areas of soils that are similar to this Wappo Variant soil but have yellower colors in the subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Wappo Variant soil is very slow. Available water capacity is 4.5 to 5.5 inches. Effective rooting depth is 60 inches or more. The clay layer in the subsoil can restrict root penetration. Surface runoff is medium, and the hazard of erosion is moderate. The shrink-swell potential is high in the subsoil.

This unit is used mainly for livestock grazing and hay and pasture. It is also used for homesite development.

The production of forage is limited by the susceptibility of the soil to compaction by livestock when moist. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess and wild oat.

If this unit is used for hay and pasture, the main limitations are very slow permeability and the hazard of erosion. Because of the very slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

If this unit is used for homesite development, the main limitations are very slow permeability, high shrink-swell potential in the subsoil, and low load bearing capacity. Increasing the size of the absorption field or using a specially designed sewage disposal system can help to compensate for the very slow permeability. The shrink-swell potential and low load bearing capacity of the soil in this unit should be considered when designing and constructing foundations, concrete structures, and paved areas. The effects of shrinking and swelling can be reduced by maintaining a constant soil moisture content around the foundation area and by backfilling with material that has low shrink-swell potential. If the soil in this unit is used as a base for roads or streets, it can be mixed with sand or gravel to increase its strength and stability.

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

245—Whispering-Collayomi complex, 50 to 75 percent slopes. This map unit is on mountains. The vegetation is mainly conifers and oaks with an understory of shrubs. Elevation is 3,000 to 4,600 feet. The average annual precipitation is 50 to 65 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 120 to 160 days.

This unit is about 50 percent Whispering loam, 25 percent Collayomi very gravelly loam, and 15 percent Collayomi stony 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 near ridgetops. Also included are small areas of Collayomi and Whispering soils that have slopes of less than 50 percent and soils that are similar to the Collayomi soil but are less than 60 inches deep or have slopes of more than 75 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Whispering soil is moderately deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 5 percent of the surface is covered with stones and boulders and a mat of pine needles, leaves, and twigs 1 inch thick. The surface layer is brown loam 5 inches thick. The upper 10 inches of the subsoil is reddish yellow gravelly loam, and the lower 11 inches is yellowish red very cobbly clay loam. Hard, fractured andesite is at a depth of 26 inches.

Permeability of the Whispering soil is moderate. Available water capacity is 2 to 5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

The Collayomi very gravelly loam is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 10 percent of the surface is covered with stones and boulders. The surface layer is light brown very gravelly loam 15 inches thick. The upper 35 inches of the subsoil is light brown and reddish yellow very gravelly loam, and the lower 10 inches is light reddish brown extremely gravelly loam.

Permeability of the Collayomi very gravelly loam is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

The Collayomi stony loam is very deep and well drained. It formed in material weathered from andesite, basalt, or dacite. Typically, 20 percent of the surface is covered with stones and boulders. The surface layer is pinkish gray stony loam 12 inches thick. The next layer is pinkish gray stony loam 8 inches thick. The upper 24 inches of the subsoil is light reddish brown very cobbly clay loam, and the lower 24 inches is reddish yellow very cobbly loam. In some areas the surface layer is cobbly loam.

Permeability of the Collayomi stony loam is moderate. Available water capacity is 2.5 to 4.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe.

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

Ponderosa pine, California black oak, and sugar pine 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 122 on the Collayomi soils and 109 on the Whispering soil. The potential annual production of ponderosa pine on the Whispering soil is 455 board feet per acre from a fully stocked, unmanaged stand of trees. The potential annual production of ponderosa pine on the Collayomi soils is 595 board feet per acre from a fully stocked, unmanaged stand of trees. Estimates of the site index and yield for sugar pine and California black oak have not been made.

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. Stones and boulders on the surface hinder harvesting in some areas. Roads may fail and landslides may occur if deep road cuts are made. Revegetation of cut and fill slopes is difficult on this unit because of the high content of rock fragments and the restricted available water capacity. Rock for construction of roads generally is available on this unit.

Seedling establishment is a concern in the production of timber. Reforestation can be accomplished by planting ponderosa pine seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs periodically. Stones and boulders on the surface limit the even distribution of reforestation.

Among the common forest understory plants are squawcarpet, coffeeberry, poison-oak, brackenfern, manzanita, and perennial grasses.

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

246—Wolfcreek gravelly loam. This very deep, well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation is mainly annual grasses and forbs. Elevation is 1,300 to 2,600 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is pale brown gravelly loam 10 inches thick. The underlying material to a depth of 72 inches is stratified, brown clay loam, sandy clay loam, and very gravelly sandy clay loam.

Included in this unit are small areas of Talmage soils. Also included are small areas of soils that are similar to this Wolfcreek soil but are nongravelly, have a darker colored surface layer and more clay, or are in low areas that are subject to occasional flooding. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Wolfcreek soil is moderately slow. Available water capacity is 7.5 to 10.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding during prolonged, high-intensity storms.

This unit is used mainly for livestock grazing and hay and pasture. It is also used for homesite development.

The production of forage is limited by the susceptibility of the soil to compaction when moist. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community on this unit is mainly soft chess, filaree, and burclover.

This unit is well suited to hay and pasture.

If this unit is used for homesite development, the main limitations are moderately slow permeability and the hazard of flooding. Increasing the size of the septic tank absorption fields can help to compensate for the

moderately slow permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

This map unit is in capability units IIs-4 (14), irrigated, and IIIs-4 (14), nonirrigated.

247—Wolfcreek loam. This very deep, well drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation is mainly annual grasses and forbs. Elevation is 1,300 to 2,600 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 150 to 205 days.

Typically, the surface layer is pale brown loam 7 inches thick. The upper 39 inches of the underlying material is brown clay loam and sandy clay loam, and the lower part to a depth of 72 inches is brown very gravelly sandy clay loam.

Included in this unit are small areas of Still soils. Also included are small areas of soils that are gravelly sandy loam throughout the profile. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Wolfcreek soil is moderately slow. Available water capacity is 7.5 to 10.0 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and the hazard of erosion is slight. This soil is subject to rare periods of flooding during prolonged, high-intensity storms.

This unit is used mainly for livestock grazing and hay and pasture. It is also used for homesite development.

The production of forage is limited by the susceptibility of the soil in this unit to compaction when moist. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. This unit responds well to fertilizer, rangeland seeding, and proper grazing use. The characteristic plant community is mainly soft chess, filaree, and burclover.

This unit is well suited to hay and pasture.

If this unit is used for homesite development, the main limitations are moderately slow permeability and the hazard of flooding. Increasing the size of the septic tank absorption fields can help to compensate for the moderately slow permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level.

This map unit is in capability class I (14), irrigated, and capability unit IIIc-1 (14), nonirrigated.

248—Xerofluvents, very gravelly. This map unit consists of very deep, excessively drained soils on narrow flood plains adjacent to stream channels. These soils formed in alluvium derived from mixed rock sources, dominantly sandstone or shale. Slope is 0 to 2 percent. The vegetation is mainly sparse annual grasses and forbs. Elevation is 750 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 145 to 200 days.

No single profile of Xerofluvents is typical, but one commonly observed in the survey area has a surface layer of grayish brown very gravelly sandy loam 5 inches thick. The underlying material to a depth of 84 inches is stratified, light brownish gray very gravelly loamy coarse sand and very gravelly coarse sand. In some areas the surface layer is sandy loam or gravelly sandy loam.

Included in this unit are small areas of Kelsey, Still, and Talmage soils. Also included are small areas of Xerofluvents that have slopes of 2 to 5 percent. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

Permeability of these soils is rapid. Available water capacity is 1.5 to 2.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very slow, and there is no hazard of erosion except in areas along streams that are subject to severe streambank erosion during high-intensity storms. These soils are subject to occasional periods of flooding in winter and spring.

This unit is used mainly for livestock grazing. It is also used as a source of commercial gravel.

This unit is poorly suited to livestock grazing because of the restricted available water capacity. It supports very sparse stands of plants that are suitable for grazing. The herbaceous plant cover readily deteriorates if it is overgrazed. To control erosion and provide wildlife habitat, vegetation should not be removed. The characteristic plant community on this unit is mainly vinegarweed, foxtail fescue, and filaree.

The removal of aggregate can lower the level of streambeds and widen stream channels. This can undermine structures, lower the water table adjacent to the stream channel, and result in the erosion of streambanks, thereby increasing sedimentation downstream. Check dams or buried sills can be used to control the lowering of streambeds. Jetties or other structures can be placed in stream channels to protect banks from erosion.

This map unit is in capability subclass VIIs (14), nonirrigated.

249—Xerofluvents-Riverwash complex. This map unit is on narrow flood plains adjacent to stream channels and in active stream channels. Slope is 0 to 2 percent. The vegetation is mainly sparse annual grasses and forbs. Elevation is 750 to 2,800 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 54 to 59 degrees F, and the average frost-free period is 135 to 200 days.

This unit is about 55 percent Xerofluvents and 30 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 Kelsey, Maywood Variant, and Talmage soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Xerofluvents consist of very deep, excessively drained soils that formed in alluvium derived from mixed rock sources. No single profile of Xerofluvents is typical, but one commonly observed in the survey area has a surface layer of grayish brown very gravelly sandy loam 5 inches thick. The underlying material to a depth of 84 inches is stratified, light brownish gray very gravelly loamy coarse sand and very gravelly coarse sand.

Permeability of these soils is rapid. Available water capacity is 1.5 to 2.5 inches. 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 flooding in winter and spring.

Riverwash is very deep water-deposited sediment consisting of sand, gravel, cobbles, and stones in active stream channels.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for as a source of commercial gravel.

This unit is poorly suited to livestock grazing because of the restricted available water capacity. It supports very sparse stands of plants that are suitable for grazing. The herbaceous plant cover readily deteriorates if overgrazed. Vegetation should be retained on the soil to reduce erosion and provide wildlife habitat. 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 adjacent to the stream channel, and result in the erosion of streambanks, thereby increasing sedimentation downstream. Erosion of streambanks can also result in the loss of valuable agricultural land. Jetties or other structures can be placed in stream channels to prevent the channels from widening. Check dams or sills can be used to control the downcutting of streambeds.

This map unit is in capability class VIII (14), nonirrigated.

250—Yollabolly-Freezeout very gravelly sandy loams, 30 to 50 percent slopes. This map unit is on mountaintops. The vegetation is mainly conifers and shrubs. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 43 to 48 degrees F, and the average frost-free period is 90 to 130 days.

This unit is about 50 percent Yollabolly very gravelly sandy loam and 30 percent Freezeout 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 Deadwood, Neuns, and Sheetiron soils and areas of debris slopes that are associated with Rock outcrop and are devoid of vegetation. Also included are small areas of Freezeout and Yollabolly soils that have slopes of less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Yollabolly soil is shallow and excessively drained. It formed in material weathered from metamorphosed sandstone. The surface layer is brown very gravelly sandy loam about 5 inches thick. The underlying material is pale brown extremely gravelly sandy loam about 9 inches thick. Metamorphosed sandstone is at a depth of 14 inches.

Permeability of the Yollabolly soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

The Freezeout soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed conifer needles, twigs, and bark 1 inch thick. The surface layer is dark grayish brown very gravelly sandy loam 5 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam, and the lower 9 inches is yellowish brown very gravelly sandy loam. Hard metamorphosed sandstone is at a depth of 25 inches.

Permeability of the Freezeout soil is moderately rapid. Available water capacity is 2 to 3 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is moderate.

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

White fir, Jeffrey pine, and California red fir are the main tree species on this unit. Among the trees of limited extent are sugar pine, incense-cedar, and Douglas-fir. On the basis of a 50-year site curve, the mean site index is 53 for white fir on the Freezeout soil. Estimates of the site index and yield for the Yollabolly soil have not been made because the vegetation is mostly brush. The potential annual production of white fir on the Freezeout soil is 565 board feet (International rule, one-eighth inch kerf) per acre from a fully stocked stand of trees. Areas of Rock outcrop reduce the yield substantially. Conifer stands commonly are small and widely scattered, making many areas noncommercial.

A concern for the harvesting of timber is steepness of slope. Snowpack limits the use of equipment and restricts access. Revegetation of cut and fill slopes is difficult on this unit because of the high content of rock

fragments in the soil and the restricted available water capacity. Rock for construction of roads is available on this unit.

Seedling survival is a concern in the production of timber on this unit. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. The mortality rate of seedlings is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Even where seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. Reforestation can be accomplished by planting large seedlings. Areas of Rock outcrop limit the even distribution of reforestation. Planting on the Yollabolly soil is not practical because of the large amount of rock fragments on the surface and in the soil.

Among the common forest understory plants are buckleberry oak, whitethorn, and lupine.

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

251—Yollabolly-Rock outcrop-Freezeout complex, 50 to 75 percent slopes. This map unit is on mountaintops. The vegetation is mainly shrubs with a few conifers. Elevation is 5,000 to 7,050 feet. The average annual precipitation is 50 to 70 inches, the average annual air temperature is 43 to 48 degrees F, and the average frost-free period is 90 to 130 days.

This unit is about 35 percent Yollabolly very gravelly sandy loam, 30 percent Rock outcrop, and 20 percent Freezeout 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 Deadwood, Sheetiron, and Neuns soils. Also included are small areas of debris slopes that are associated with Rock outcrop and are devoid of vegetation and small areas of Freezeout and Yollabolly soils that have slopes of less than 50 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Yollabolly soil is shallow and excessively drained. It formed in material weathered from metamorphosed sandstone. The surface layer is brown very gravelly sandy loam about 5 inches thick. The underlying material is pale brown extremely gravelly sandy loam about 9 inches thick. Metamorphosed sandstone is at a depth of 14 inches.

Permeability of the Yollabolly soil is moderate. Available water capacity is 0.5 inch to 2.0 inches. Effective rooting depth is 10 to 20 inches. Surface runoff is very rapid, and the hazard of erosion is severe.

Rock outcrop consists of hard, unweathered sandstone. It occurs as large solid intrusive masses 1 acre to 20 acres in size. Debris slopes that are devoid of vegetation commonly are associated with the Rock outcrop.

The Freezeout soil is moderately deep and well drained. It formed in material weathered from metamorphosed sandstone. Typically, the surface is covered with a mat of partially decomposed needles, twigs, and bark 1 inch thick. The surface layer is dark grayish brown very gravelly sandy loam 5 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam, and the lower 9 inches is yellowish brown very gravelly sandy loam. Hard metamorphosed sandstone is at a depth of 25 inches.

Permeability of the Freezeout soil is moderately rapid. Available water capacity is 2 to 3 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

White fir, Jeffrey pine, and red fir are the main tree species on this unit. Among the trees of limited extent are sugar pine, incense-cedar, and Douglas-fir. Estimates of the site index and yield for the Yollabolly soil have not been made because the vegetation is mostly brush. On the basis of a 50-year site curve, the mean site index is 53 for white fir on the Freezeout soil. The potential annual production of white fir on the Freezeout soil is 565 board feet (International rule, one-eighth inch kerf) per acre from a fully stocked stand of trees. Areas of Rock outcrop in this unit will reduce the yield substantially. Conifer stands commonly are small and widely scattered, making many areas noncommercial.

The main limitations for the harvesting of timber are steepness of slope and the areas of Rock outcrop. Cable yarding systems generally are used on this unit. Snowpack limits the use of equipment and restricts access. Revegetation of cut and fill slopes is difficult because of the high content of rock fragments in the soil and the restricted available water capacity. Rocks and loose soil material may slide down roadcuts on the Yollabolly and Freezeout soils and thus increase the need for maintenance of roads. Rock for construction of roads is available on this unit.

Seedling survival is a concern in the production and reforestation of timber. The droughtiness of the surface layer reduces the survival rate of seedlings, especially on south- and southwest-facing slopes. The mortality rate of seedlings is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Movement of loose surface material can reduce seedling survival on the Yollabolly soil. Even when seed trees are present, natural reforestation of cutover areas by conifers occurs infrequently. Reforestation can be accomplished by planting large seedlings. Areas of Rock outcrop limit the even distribution of reforestation. Planting on the Yollabolly soil is not practical because of the large number of rocks on the surface and in the soil.

Among the common forest understory plants are huckleberry oak, whitethorn, and lupine.

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

252—Yorktree-Hopland-Squawrock complex, 15 to 50 percent slopes. This map unit is on hills and mountains. The Yorktree soil is unstable and commonly is subject to slumping. The vegetation is mainly oaks and annual grasses on the Yorktree and Hopland soils and annual grasses and forbs with a few scattered oaks on the Squawrock soil. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature 54 to 59 degrees F, and the average frost-free period is 145 to 195 days.

This unit is about 30 percent Yorktree clay loam, 30 percent Hopland loam, and 15 percent Squawrock 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, Mayacama, Maymen, Pomo, and Yorkville soils and Rock outcrop. The areas of Rock outcrop are on ridges. Also included are small areas of soils that are similar to the Yorktree soil but have higher base saturation. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, schist, or shale. Typically, the surface layer is grayish brown clay loam 8 inches thick. The upper 16 inches of the subsoil is grayish brown clay loam, the next 10 inches is olive gray gravelly clay, and the lower 21 inches is very dark gray gravelly clay. Hard, fractured graywacke is at a depth of 55 inches.

Permeability of the Yorktree soil is very slow. Available water capacity is 5.5 to 9.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is very rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Hopland soil is moderately deep and well drained. It formed in material weathered from sandstone or shale. Typically, the surface layer is brown loam 6 inches thick. The upper 9 inches of the subsoil is brown loam, and the lower 19 inches is light brown clay loam. Soft, highly weathered sandstone is at a depth of 34 inches.

Permeability of the Hopland soil is moderately slow. Available water capacity is 3 to 7 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is grayish brown gravelly loam 8 inches thick. The subsoil is light brownish gray very gravelly clay loam 29 inches thick. Hard, fractured sandstone is at a depth of 37 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

This unit is used mainly for livestock grazing, wildlife habitat, and watershed. It can be used for firewood production.

The production of forage is limited by the susceptibility to compaction by livestock when moist and a dense canopy cover on the Yorktree soil and by the restricted available water capacity of the Squawrock soil. The Hopland soil supports sparse stands of plants that are suitable for grazing. Because of the instability of the Yorktree soil, trees should be retained. Grazing should be delayed until the Yorktree soil has drained sufficiently to withstand trampling by livestock.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Fencing and properly locating salt and livestock watering facilities promote uniform distribution of livestock grazing. Springs and seeps are common on the Yorktree soil. They can be developed as watering facilities for wildlife and to achieve better livestock distribution. Livestock grazing should be managed to protect the soil from erosion. The characteristic plant community on the Squawrock soil is mainly wild oat, soft chess, and filaree. Among the common understory plants on the Yorktree soil are melicgrass, blue wildrye, and buttercup.

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

253—Yorkville-Pomo complex, 15 to 50 percent slopes. This map unit is on hills and mountains. The vegetation is mainly annual grasses and forbs with a few scattered oaks. The soils in this unit are unstable and are very susceptible to slumping. Rotational slips and hummocky microrelief are common. Elevation is 1,600 to 3,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 56 to 59 degrees F, and the average frost-free period is 160 to 195 days.

This unit is about 45 percent Yorkville clay loam and 40 percent Pomo 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 Bressa, Millsholm, and Skyhigh soils. Also included are small areas of Pomo and Yorkville soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, schist, or shale. Typically, the surface layer is dark gray clay loam 3 inches thick. The upper 30 inches of the subsoil is dark gray and gray clay, and the lower 31 inches is gray gravelly clay loam. Hard, fractured schist is at a depth of 64 inches.

Permeability of the Yorkville soil is very slow. Available water capacity is 6.0 to 13.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Pomo soil is deep and well drained. It formed in material derived from sandstone. Typically, the surface layer is yellowish brown loam 11 inches thick. The subsoil is yellowish brown and dark yellowish brown gravelly loam 29 inches thick. The substratum to a depth of 58 inches is dark yellowish brown very gravelly clay loam. Fractured, weathered sandstone is at a depth of 58 inches.

Permeability of the Pomo soil is moderately slow. Available water capacity is 4.0 to 8.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The production of forage is limited by the susceptibility of the soil to compaction by livestock when moist. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. This unit responds well to fertilizer, rangeland seeding, and 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 uniform distribution of livestock grazing. Springs and seeps are common on this unit. They can be developed as watering facilities for wildlife and to achieve better livestock distribution. Livestock grazing should be managed to protect the unit from erosion. The characteristic plant community on this unit is mainly soft chess, purple needlegrass, and wild oat.

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

254—Yorkville-Yorktree-Squawrock association, 15 to 50 percent slopes. This map unit is on hills and mountains. The soils in this unit are unstable. Slumps and a hummocky relief are common. The vegetation is mainly annual grasses and forbs with a few scattered oaks on the Yorkville and Squawrock soils and oaks and annual grasses on the Yorktree soil. Elevation is 1,800 to 3,500 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 145 to 195 days.

This unit is about 45 percent Yorkville clay loam, 20 percent Yorktree clay loam, and 15 percent Squawrock gravelly loam. The Yorkville soil is on concave slopes, the Yorktree soil is on convex slopes and in drainageways, and the Squawrock soil is on convex spur ridges surrounding rock outcroppings and in drainageways.

Included in this unit are small areas of Hopland, Mayacama, and Pomo soils and Rock outcrop. Also included are small areas of Yorkville, Squawrock, and Yorktree soils that have slopes of less than 15 percent, soils that are similar to the Yorkville soil but are 20 to 40 inches deep, and soils that are similar to the Yorktree soil but have a higher base saturation. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Yorkville soil is very deep and moderately well drained. It formed in material weathered from graywacke, schist, or shale. Typically, the surface layer is dark gray clay loam 3 inches thick. The upper 30 inches of the subsoil is dark gray and gray clay, and the lower 31 inches is gray gravelly clay loam. Hard, fractured schist is at a depth of 64 inches.

Permeability of the Yorkville soil is very slow. Available water capacity is 8.5 to 13.5 inches. Effective rooting depth is 60 inches or more. Surface runoff is very rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Yorktree soil is deep and well drained. It formed in material weathered from graywacke, schist, or shale. Typically, the surface layer is grayish brown clay loam 8 inches thick. The upper 16 inches of the subsoil is grayish brown clay loam, the next 10 inches is olive gray gravelly clay, and the lower 21 inches is very dark gray gravelly clay. Hard, fractured schist is at a depth of 55 inches.

Permeability of the Yorktree soil is very slow. Available water capacity is 5.5 to 9.5 inches. Effective rooting depth is 40 to 60 inches. Surface runoff is very rapid, and the hazard of erosion is severe. The shrink-swell potential is high.

The Squawrock soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface layer is grayish brown gravelly loam 8 inches thick. The subsoil is light brownish gray very gravelly clay loam 29 inches thick. Hard, fractured sandstone is at a depth of 37 inches.

Permeability of the Squawrock soil is moderate. Available water capacity is 1.5 to 4.5 inches. Effective rooting depth is 20 to 40 inches. Surface runoff is rapid, and the hazard of erosion is severe.

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

The production of forage is limited by the susceptibility of the Yorkville and Yorktree soils to compaction when moist, a dense canopy cover on the Yorktree soil, and the restricted available water capacity of the Squawrock soil. Grazing should be delayed until the soil has drained sufficiently to withstand trampling by livestock. Because of the instability of the Yorktree soil, trees should be retained. The Yorkville and Squawrock soils respond well to fertilizer, rangeland seeding, and 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 uniform distribution of livestock grazing. Springs and seeps are common on this unit. They can be developed as watering facilities for wildlife and to achieve better livestock distribution. The characteristic plant community on the Yorkville and Squawrock soils is mainly soft chess and wild oat. Among the common understory plants on the Yorktree soil are melicgrass, blue wildrye, and buttercup.

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

255—Yorkville Variant clay loam, 2 to 8 percent slopes. This very deep, well drained soil is on alluvial fans, landslips, and toe slopes. It formed in alluvium and colluvium derived dominantly from serpentinitic rock. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 800 to 2,250 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 150 to 200 days.

Typically, the surface layer is reddish brown clay loam 8 inches thick. The upper 23 inches of the subsoil is dark reddish brown gravelly sandy clay, and the lower 31 inches is brown and yellowish red clay. The substratum to a depth of 71 inches is brownish yellow sandy clay loam.

Included in this unit are small areas of Lupoyoma soils. Also included are soils that are similar to this Yorkville Variant soil but have slopes of more than 8 percent or that have more gravel in the subsoil and fine textured, brownish or grayish soils that are on alluvial fans, have slopes of 0 to 5 percent, and are in areas southeast of Detert Reservoir and to the south of Grange Road. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Yorkville Variant soil is slow. Available water capacity is 6.5 to 8.0 inches. Rooting depth is 60 inches or more. Growth of many plants is limited by an unfavorable calcium to magnesium ratio. Surface runoff is medium, and the hazard of erosion is moderate.

This unit is used mainly for livestock grazing. It is also used for hay and pasture and homesite development.

The production of forage is limited by the unfavorable calcium to magnesium ratio and by the susceptibility of the soil to compaction when wet. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Rangeland seeding and fertilization on this unit generally are not practical because of the serpentinitic influence. The characteristic plant community on this unit is mainly soft chess, bottlebrush squirreltail, and danthonia.

This unit is poorly suited to hay and pasture. The main limitations are the unfavorable calcium to magnesium ratio, slow permeability, and the hazard of erosion. Growth of many plants is limited by the low calcium to magnesium ratio. Overcoming this limitation is not economically feasible because of the large amount of calcium needed. Because of the slow permeability, irrigation water needs to be applied slowly to minimize runoff. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Erosion is reduced if tillage and seeding are on the contour or across the slope.

If this unit is used for homesite development, the main limitations are slow permeability. Increasing the size of the septic tank absorption field or using a specially designed disposal system can help to compensate for the slow permeability.

This map unit is in capability unit IIIe-9 (14), irrigated and nonirrigated.